

# A Roundtable on a National Framework for Natural Hazard Risk Reduction and Management: Developing a Research Agenda

## Summary Report

November 15, 2006

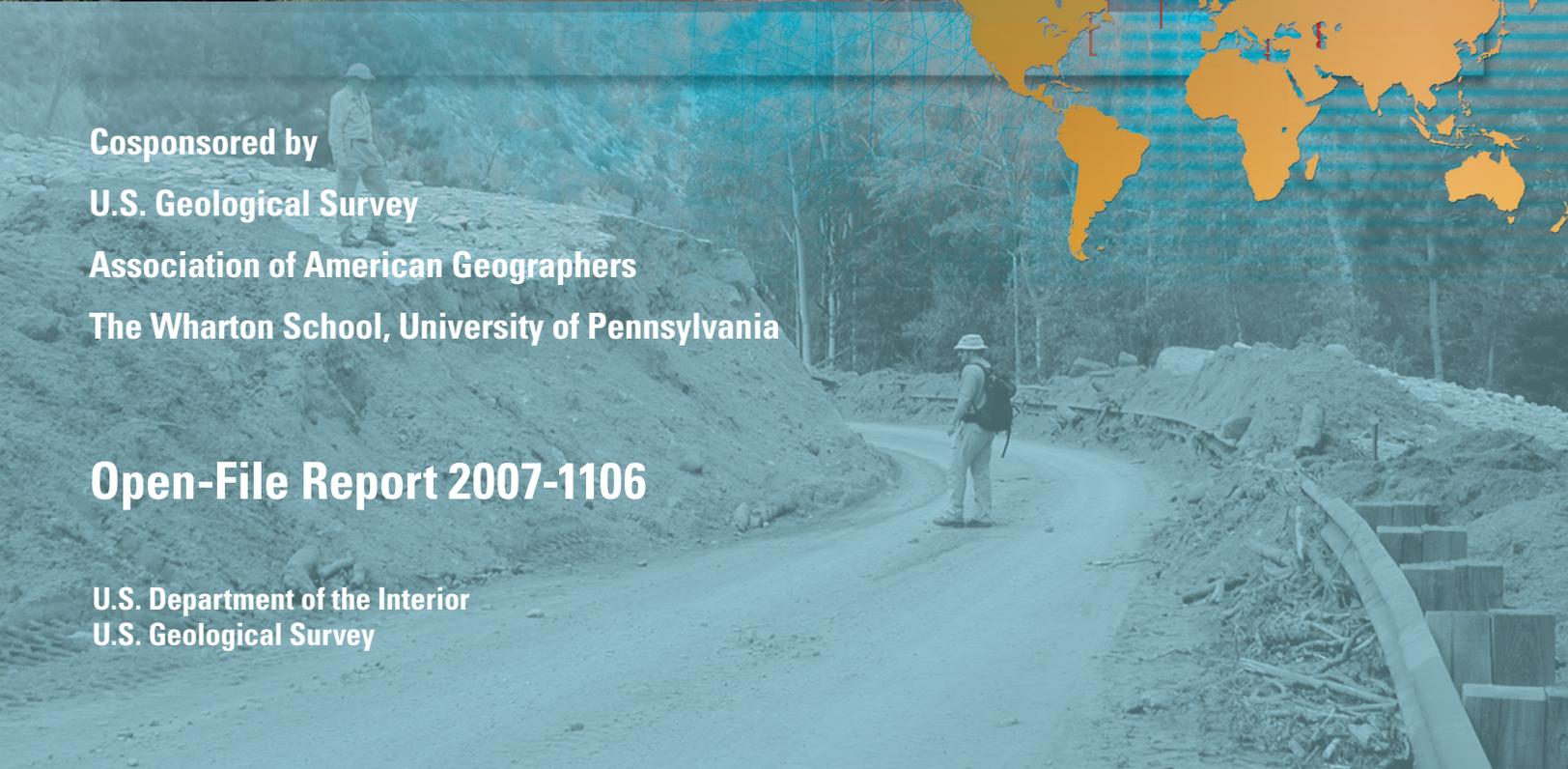
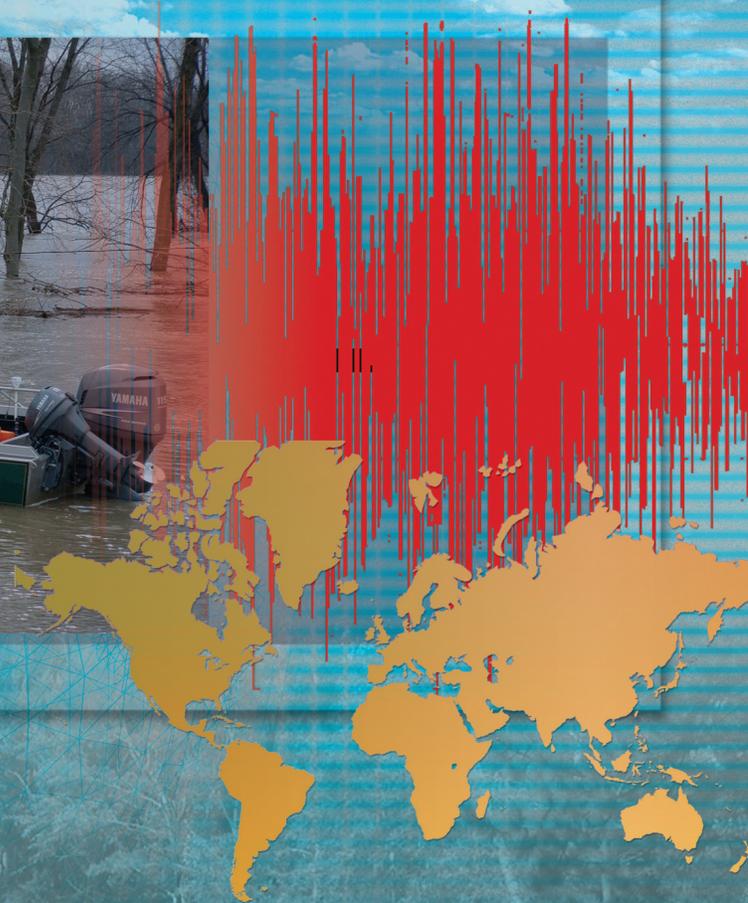
The Cosmos Club, Washington, D.C.



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# **A Roundtable on a National Framework for Natural Hazard Risk Reduction and Management: Developing a Research Agenda**

Summary Report

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**U.S. Department of the Interior  
U.S. Geological Survey**



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# A Roundtable on a National Framework for Natural Hazard Risk Reduction and Management: Developing a Research Agenda

## Summary Report

November 15, 2006 • The Cosmos Club, Washington, D.C.

### Introduction

This report summarizes discussion at the Roundtable on a National Framework for Risk Reduction and Management held on November 15, 2006, at the Cosmos Club in Washington, D.C. The Roundtable was co-sponsored by the U.S. Geological Survey (USGS), the Association of American Geographers (AAG), and The Wharton School, University of Pennsylvania. Comments made by speakers not affiliated with the USGS do not necessarily reflect the positions of the USGS.

The purpose of the day-long Roundtable was to bring together academic, business, and government leaders to advance a research agenda on improving decision-making to reduce and manage the risks of natural hazards. The Roundtable addressed predicted behavior and incentives at both the national and the local levels and sought to develop a research agenda to achieve the following broad goals:

- advancing the use of scientific information to reduce societal vulnerability and risk from hazards; and
- identifying how spatial data can most effectively enable and empower decision-making at the local, state, and national levels.

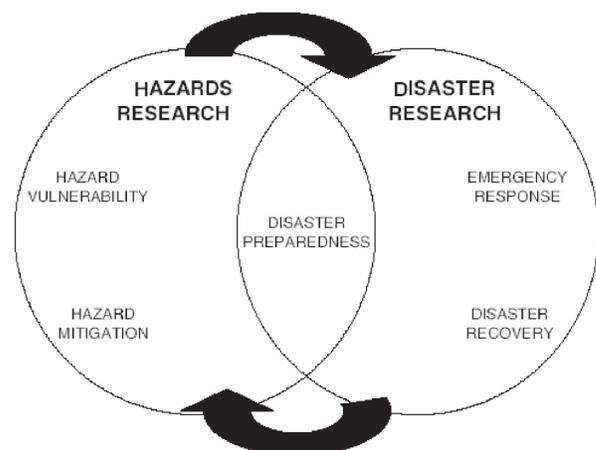
The Roundtable was organized into morning and afternoon sessions with two panels each. The first morning session discussed the overarching issues of natural disasters and the incentives for using science-based data for decision-making. The second session focused on National Flood Insurance and Mapping and the appropriate role of public intervention. After the second panel, the attendees convened for lunch with an address on societal vulnerability given by Susan Cutter, Carolina Distinguished Professor and Director of the Hazards Research Lab at the University of South Carolina. After lunch, the third panel addressed lessons learned from natural disasters while the last panel—Identifying Data, Information, and Modeling Needs—discussed how spatial data and models enable decision-makers.

**Douglas Richardson**, Executive Director of the AAG, welcomed conferees to the Cosmos Club, noting that it has long served as the site of important beginnings, including during the early years of the USGS itself, and now for our current project. He briefly described the long tradition of hazards and

vulnerability research in geography and noted the central role of new geographic technologies as a platform for enabling integrative and interdisciplinary approaches to natural hazards research and management.

**Mark D. Myers**, Director of the USGS, formally opened the Roundtable by calling upon the conferees to address cross-cutting societal issues from multiple perspectives. He emphasized the need for integrative thinking and collaborative approaches to risk management and preparedness. He noted that risk in our society is a multidimensional, multifaceted issue that needs to be broadly considered across multiple hazards, multiple levels of government and the private sector, and across natural and socioeconomic science disciplines. In summary, he stated that we need to expand our efforts to integrate natural science with social and economic information so that society can reduce and manage risk more effectively. Collaboration and partnerships between organizations such as the USGS, the AAG, and the Wharton School are a step in the right direction.

**Susan Wachter**, Richard B. Worley Professor of Financial Management at the Wharton School and Co-Director of the Institute for Urban Research at the University of Pennsylvania, opened the morning sessions, noting that the American population had reached the 300-million mark within the past month and that in 30 years there may be an additional 100 million people. She posed the question of where that growth will occur and to what extent emerging mega-regions will be in the



Source: National Research Council

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path of hazards. She also pointed to the role of local governments in land-use decisions and in mitigating vulnerability to hazards and the societal need for science-based decision-making. Future vulnerability to hazards is a direct consequence of the decisions we make today. While citizens bear the brunt of losses in disasters, it is often because of the difficulty of coordinating effective decision-making across localities, a necessity if consequences extend beyond jurisdictions. Deploying spatial data and spatially-based information are key to informing decisions that by their very nature must incorporate multiple levels of government and many jurisdictions.

Finally, Wachter set the stage for the Roundtable by putting forth the need for a broad strategic approach that encompasses both hazard research and disaster research, as seen in the following figure:

### Breakfast Address: Katrina—One Year Later

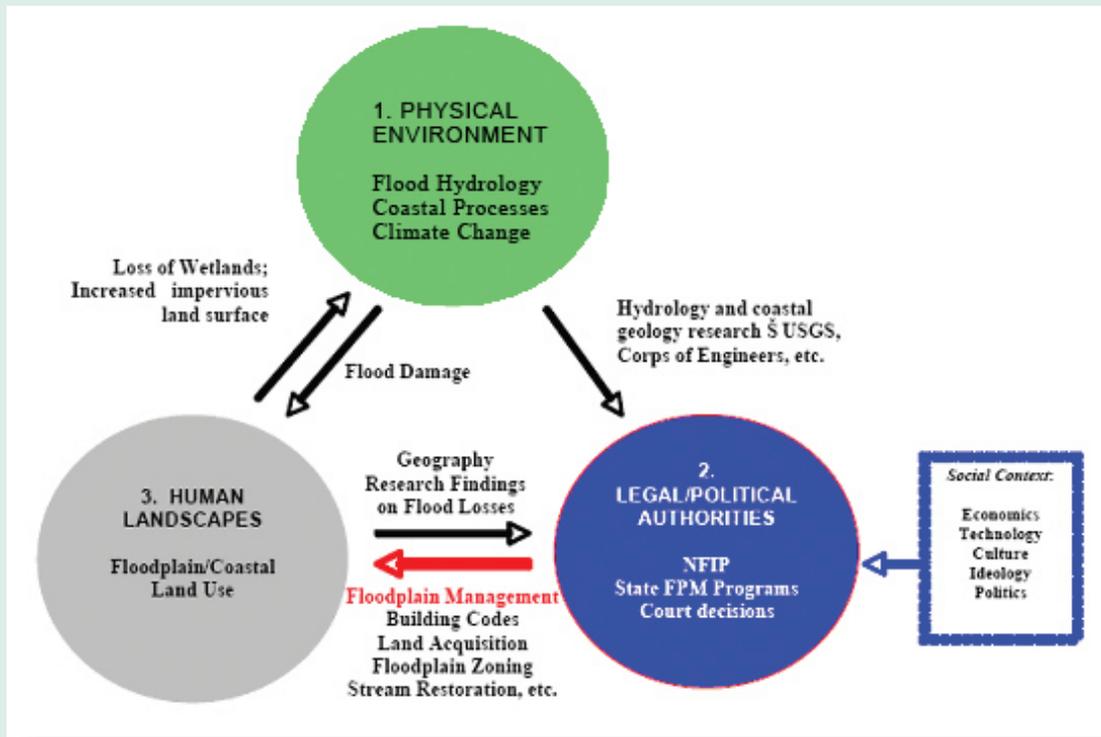
**P. Patrick Leahy**, USGS Associate Director for Geology, discussed the importance of linking science with policy and the challenge of advancing the effective use of scientific information in societal decisions in the context of Katrina. In his chapter in the recently published book, *Rebuilding Urban*

*Places after Disaster*, Leahy emphasized the need for the scientific community to focus on the fundamental issues relating to understanding hazard processes and the spatial and temporal likelihood of hazard events occurring. However, Leahy pointed out that the usefulness of this information depends on our ability to combine physical understanding of the hazard with knowledge and information about our societal vulnerability to the hazard and the resulting risk. To accomplish this, we need to conduct research on combining and integrating physical and socioeconomic investigations and models. Leahy emphasized the need to develop tools and methods to more effectively use physical science with information on societal vulnerability and risk. It is important to bring together, in venues like this Roundtable, experts in different disciplines from academia, government, and the private sector to jointly consider a common research agenda to reduce and manage risk from natural hazards.

### Panel I: Natural Disasters, Land Use, and Incentives

The first panel discussed how federal disaster relief and subsidized insurance affect incentives for land use and what the public and private sector roles are for insurance provision.





Source: Rutherford Platt, Learning From Disasters

The panelists also conferred on how insurance and incentives affect the use of scientific information. The panel consisted of Rutherford Platt, from the University of Massachusetts, Arthur Nelson, from Virginia Tech, Kent Smetters, from the University of Pennsylvania, and Lucile Jones, from the USGS.

**Rutherford Platt** pointed out that 90 percent of disasters are due to floods. He stressed the need for local action and called for revisiting federal disaster assistance programs that contain, he believes, self-defeating components. In his view, summarized in the diagram below, the unintended effects of the National Flood Insurance Plan and disaster relief have encouraged development in flood prone areas. He concluded with the point that the federal government needs to redirect its policies to encouraging better decision-making going forward.

**Kent Smetters** outlined three arguments for government intervention in markets to respond to disasters. Government cannot credibly commit to bailing out citizens in the face of a natural disaster, thus undermining the incentives for communities not to encourage development. He also pointed to the need for government to complement private markets because the harm of natural disasters goes beyond losses to individuals and individual communities. Losses from disasters undermine neighborhoods and have impacts on regional economies. Individuals’ decisions not to ensure themselves have wider societal consequences. Smetters also noted that private markets cannot share risks with future generations. Nonetheless, he observed that the economic answer to these potential market failures is to mandate insurance coverage for all. In

riskier locations, insurance fees would be higher. However, mandatory coverage, by definition would not occur without government mandates. Moreover, there are already regulations in place requiring select homeowners to have insurance, but they are not enforced.

**Arthur C. Nelson** discussed the challenges of disaster planning by local governments. He pointed to the challenges that will continue to grow due to the desirability of living in risky areas near coasts. Local governments need to act either to steer people away from risky areas or to require building standards appropriate to the risk in the building code. Local governments may not be in the best position to carry through on these since their incentives are to encourage development since the benefits of development accrue to them in the form of increases to the local tax base. On the other hand, as it stands today, the costs of development in the path of hazards accrue to others; local governments are not responsible for covering residents’ losses. As a result, it is unlikely that many local governments on their own will strictly enforce a halt to development in disaster prone areas. Devising solutions to this misalignment of incentives, which stands in the way of science-based decisions, would require bringing together the science of natural disasters with the social science of political decision-making.

**Lucile Jones** described her ongoing work with the Earthquake Country Alliance (ECA), an agency that works to educate California communities about earthquake risk and disaster preparedness. She focused on our inability (as a society) to



Source: USGS

prepare for really big disasters. For example, we tend to plan for quakes on the scale of the 1994 Northridge earthquake, which lasted for only 7 seconds. However, an 8.0 magnitude quake, lasting two minutes and spanning a 250-mile fault line, would likely produce devastation across a wide area, affecting multiple counties. A secondary failure, such as the concurrence of intense Santa Ana winds, could make the outcome of such a quake truly catastrophic, on the order of Hurricane Katrina. Jones also discussed the complexity of big disasters, noting that systematic failure is likely, largely due to externalities. For example, a business' mitigation decision affects both that business and the surrounding community. This interdependence is reflected in ECA's motto: "We're all in this together." Jones also discussed deficiencies in our building codes and regulations, which do not attempt to build in resiliency, only to prevent immediate harm. She noted that a new law is likely to be introduced in California that would require a safety rating system for schools, although it is uncertain whether the legislation would be adopted. The pending legislation would likely have the most impact on community colleges, which, in California, are typically not constructed according to the stringent standards applied to elementary and secondary schools.

The ECA is currently preparing simulations of scenarios that would occur in the wake of a big earthquake centered on the southernmost portion of the San Andreas Fault, which is the most likely site of a major quake. In conjunction with ECA's "Dare to Prepare 2007" campaign, the scenarios will be used to educate people about risk and discuss the implications for community preparedness. ECA hopes that the vivid scenarios will help to translate hazard data derived from scientific models into images that people can more easily comprehend and respond to.

## Panel II: National Flood Insurance and Mapping: Private and Public Roles

The second panel of the morning discussed how current and proposed federal legislation relating to flood insurance and flood mapping impact the use of scientific information for private and public decision-making. Participants in this panel included Mark A. Calabria, U.S. Senate Committee on Banking, Housing and Urban Affairs, Robert Hunter, Consumer



Source: USGS

Federation of America, Scott McAfee, Federal Emergency Management Agency (FEMA), David Conrad, National Wildlife Federation (NWF), and Timothy Cohn, USGS. Because much of the panel involved discussion, the major points are reported below, as opposed to specific speaker comments.

The recurring theme of the panel was the failure of the National Flood Insurance Program (NFIP) to live up to its original mandate to provide protection from flood hazards, largely due to administrative and structural problems. The most significant problems identified included a subsidized rate structure that is not based on actuarial risk, and outdated flood plain maps that tend to contribute to more, rather than less, development within high risk floodways.

The devastation caused by the 1993 floods along the Mississippi River prompted groups such as the NWF to lobby the Office of Management and Budget for mitigation grants that would permit the acquisition of properties in the flood plain, a measure that was eventually authorized in the 1994 Flood Insurance Reform Act. The reform measure was a start; however, it did not address the problem of repetitive loss properties. Although only constituting 2 percent of all NFIP claims, these repetitive-loss properties generate roughly 40 percent of losses under the program. Repetitive-loss properties eventually became the target of the 2004 Flood Insurance Reform Act, which authorized \$90 million in funding for buyouts and other non-structural mitigation efforts.

The Gulf Coast hurricanes of 2005 left the NFIP over \$20 billion in debt, highlighting the weaknesses of the program. In

an attempt to both restore solvency to the NFIP and institute reforms that would help to prevent future insolvency, the Senate Banking Committee advanced S. 3589, also known as the Flood Insurance Reform and Modernization Act of 2006. The key reform of the proposed legislation is the elimination of rate subsidies for certain categories of “pre-FIRM” properties, including vacation homes, non-residential structures, and certain repetitive-loss properties. The bill would also fund the costs of mapping the 500-year flood plain, establish a reserve fund of approximately \$2 billion to protect taxpayers from future losses, and raise the minimum deductible for pre-FIRM properties from \$1,000 to \$2,000.

The panel also considered the challenges in estimating flood risk. Despite numerous sources of data, there are significant challenges with modeling flood risk. Two central problems are:

- (1) the problem of change—most models in use assume a stationary process; however rapid urbanization in formerly rural or natural areas can double the 100-year flood peak; and
- (2) the problem of uncertainty, which includes natural variability in flood events and parameter uncertainty.

For example, given the substantial variability in annual peak flows and the relatively wide confidence intervals associated with the data, what is termed a 100-year flood could just as easily be a 95- or 500-year event. To improve scientists’ ability to accurately estimate flood risk, there was a call for more data, including more record sites and longer records.

There is also a need for better statistical models that would capture the dynamic nature of flood hazards.

FEMA is proceeding with its Map Modernization Program, which was funded under the 2004 Flood Insurance Reform Act. This program will both update the existing FIRMs to increase accuracy, especially in the higher risk areas, and improve accessibility by making a number of products available online. FEMA is also seeking to create a National Flood Layer, which will be a vector-based GIS layer that can be used for querying and that localities can link up with their own data. FEMA is hoping that as local agencies and organizations add information to the layer, they can make those data available to FEMA and thereby add value to the basic product. Multi-hazard mapping is another direction that FEMA may be moving toward in the near future.

## Keynote Address: Reducing Societal Vulnerability to Disasters

During the luncheon session, keynote speaker, **Susan Cutter**, Carolina Distinguished Professor and Director of the Hazards Research Lab at the University of South Carolina asked the following topic question:

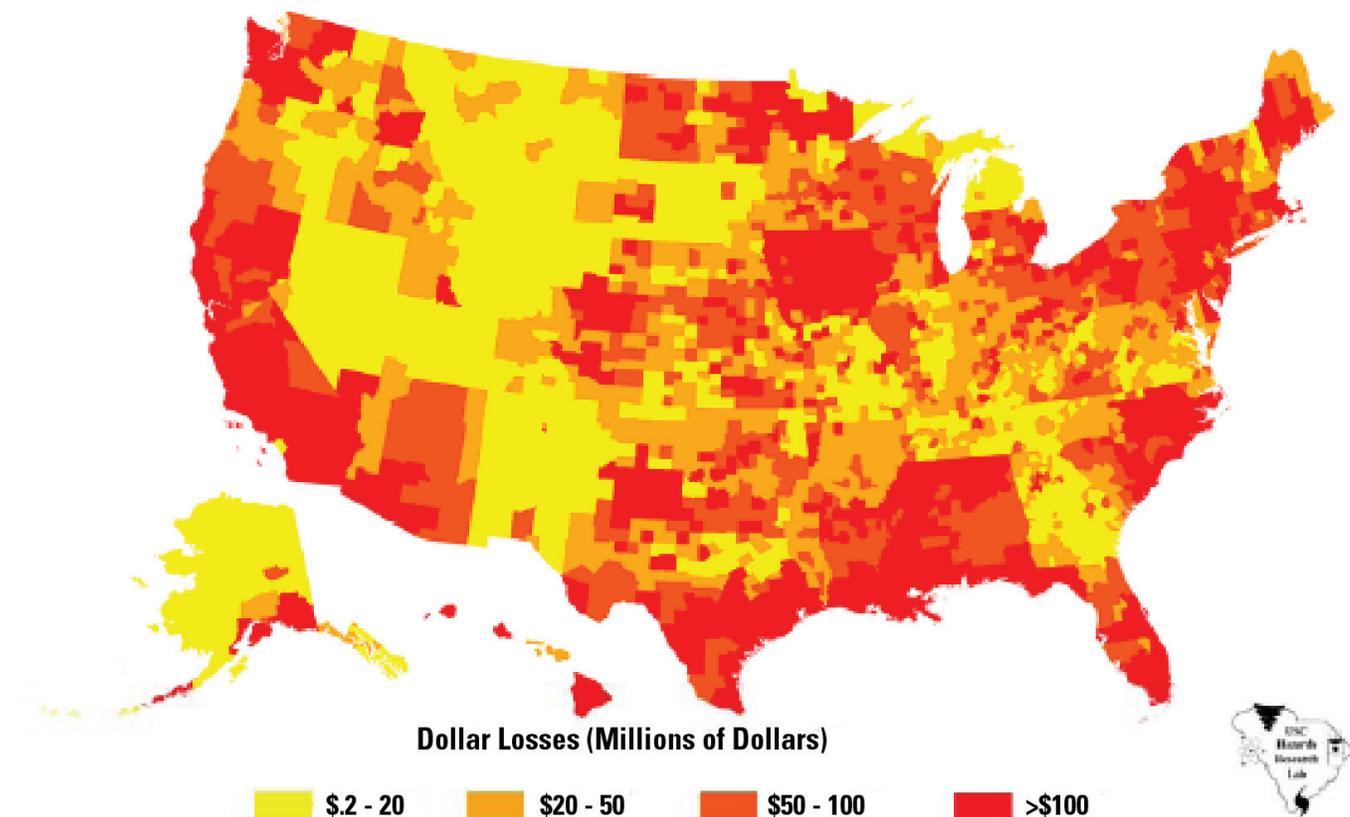
How can we reduce societal vulnerability to disasters when we don't know what that vulnerability is or what causes it?

The key to vulnerability assessment is the understanding of the nexus between social systems, natural systems, and the built environment. One of our greatest challenges in this endeavor is the lack of national standards for collecting disaster data. There are disparities in the way we define disasters, their scale, and geography. In response, The University of South Carolina (USC) and others have devised Sheldus, the beginnings of a national loss inventory for the United States.

Today, Sheldus is a compilation of county-level hazard data sets for 18 different natural hazard events types, including thunderstorms, hurricanes, floods, wildfires, and tornadoes. For each event, the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county. The data were derived from several existing national data sources, including the National Climatic Data Center's monthly Storm Data publications and the National Geophysical Data Center's Tsunami Event Database.

All the data used in the Sheldus application are available online at [www.sheldus.org](http://www.sheldus.org).

Societal factors play an important role in determining the distribution of risk. They can make some communities resilient to disasters, while other communities can be vulnerable. USC and others are addressing these disparities and developing metrics to measure societal risk. The Social Vulnerability



Index (SoVI) enables us to link losses and recovery indicators to social factors.

By understanding the root of disparities in vulnerability, we can think about ways we can assist communities facing risks and prepare them better for disasters. The interplay among social factors, disaster resilience, and recovery needs to be studied further. To do so, we need more integration among physical and social processes, models, and metrics, as well as an inventory of disaster data. Besides knowing hazard geography, we need to work with communities to assist in making decisions related to resiliency and disaster.

## Panel III: Lessons Learned

The afternoon sessions began with a panel using cases to teach lessons learned from local experiences during disastrous events such as Katrina and the Southern California flood, and proposed ways for people and communities to plan for the “next one.” Panelists included Denise Reed, University of New Orleans, Barbara Faga, EDAW, James Devine, USGS, and Jonathan Barnett, University of Pennsylvania.

Denise Reed shared the findings from a 2006 study prepared by a working group of scientists and stakeholders studying the Louisiana coast in light of Hurricane Katrina. The working group operated under two key principles. First, hurricane protection can only be secured with a combination of levees and a sustainable coastal landscape. Second, the coastal area needs stronger inner defenses, such as barrier islands and wetlands, in order to be protected from future storm related damage. A visioning session conducted with a larger group of stakeholders in April 2006 came to the conclusion that a sustainable coastal Louisiana was possible, but bold action would be required. Such action could include (1) rerouting the Mississippi river, (2) abandoning the delta (the claw-like feature at the southernmost end), and (3) capturing up to 120 million tons of sediment just for coastal restoration.

In addition to the working-group study, both the Louisiana Coastal Protection and Restoration Authority and the U.S. Army Corps of Engineers are currently working on plans to save the Louisiana coast. These plans, all of which are expected to call for large scale action, will eventually require local will and federal authorization to move forward.

Barbara Faga presented a demonstration of a computer model that depicts the geographical origins of hurricanes that have made landfall in the United States from 1851–2004. The presentation illustrated the potential GIS-based visualizations to inform local decision-making and the public about the historical geographical patterns of storms and the location of areas most vulnerable to hurricane risk.

Jonathan Barnett offered a longer-run perspective that speculated on the potential impacts of climate change on major population centers along the East Coast, including such densely populated states as New Jersey and New York and cities such as Boston, Philadelphia, and Miami. The disaster sce-

narios that could stem from a 1-foot rise in sea level could be truly catastrophic, largely due to a lack of preparedness, which is typical of low frequency/high consequence events. Long range planning is also lacking with respect to earthquake risk. While some cities that are aware of their risks (such as San Francisco and Memphis) have taken steps, others with lower but non-negligible risks have not. He called for a more systematic way of viewing the risk profile of the nation, through the creation of a national “atlas of risk,” which federal officials could use in disaster planning and local decision-making. The issue of the incentives or the lack thereof was also discussed.

James Devine summed up the main points raised in the panel presentation by posing critical questions that we should take away from the discussion:

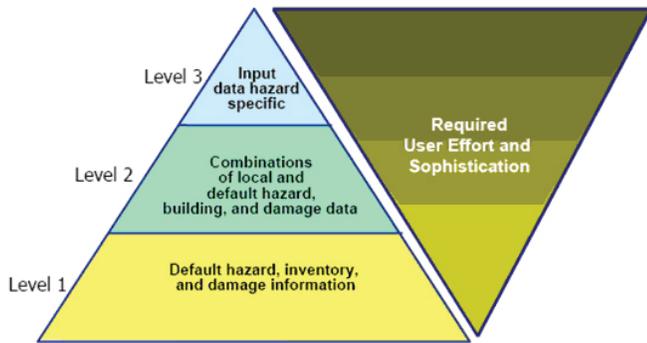
1. What hazards should we be addressing? There is a spectrum of disasters that vary by severity and by probability of occurrence. How much of the spectrum can we as a society accommodate?
2. How does our science get conveyed? Scientists tend to use graphical images ineffectively. They do not do a good job in communicating true risks for the general public.
3. How can we address the issue of vulnerability so that people can understand it? An example is provided in the increased exposure to risk presented by the loss of coastal lands.
4. What does this mean for the future, especially with issues such as global warming that could threaten large sections of the heavily populated Florida coast?
5. Who has the responsibility to do what?

## Panel IV: Identifying Data, Information, and Modeling Needs

The last formal panel spoke to current technology available and the new tools, applications and modeling methods in use to plan for disasters and resiliency. Mark Johnson, University of Central Florida, Adam Rose, University of Southern California, Richard Bernknopf, USGS, Pedro Flores, National Association of Counties, and Hope Seligson, ABS Consulting all addressed the necessity of data and models for decision-makers at all governmental levels.

Mark Johnson described a GIS-based model used by the Florida Department of Community Affairs, known as Mapping for Emergency Management, Parallel Hazard Information System (MEMPHIS). The application features automated reporting functions and can be run at state or county levels. Data layers include historical records, sinkholes, and FEMA FIRM zones. Having worked with MEMPHIS, Johnson stressed that simplicity is important, but that you should not rely on a single

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Source: FEMA HAZUS Training Materials, HAZUS Levels of Analysis

parametric model. Instead, have access to a spectrum of models that can produce alternative scenarios.

Adam Rose presented findings from research employing a computable general equilibrium model for use in loss estimation. The new approach represents an advance over

the earlier input-output style, linear models by allowing for behavioral responses to disaster, both inherent (normal activities) and adaptive (ingenuity in the face of a crisis). Examples include input and import substitution, use of inventories, conservation, relocation, and production rescheduling. These are the kinds of activities that affect economic resilience, which Rose defined in the static context as the ability of a system to maintain function when shocked, and in the dynamic context as the speed of a system to recover from a shock. His work demonstrates that it is possible to both model and measure resilience and that increasing resilience is a low cost means of reducing disaster losses.

Richard Bernknopf spoke to the need to integrate information from the natural sciences and social sciences to evaluate and develop locally relevant, quantitative analyses for natural-hazard risk reduction. He presented examples of hazard mitigation planning in Memphis, TN where the community is considering the implementation of the International Building Code for earthquake hazards and in Squamish, British Columbia, where local officials are contemplating constructing a new downtown area in a floodplain. The case studies illustrated the



Source: Penn IUA

range of spatial data that localities may desire and the kinds of constraints they face (including financial, planning and timing, and data uncertainty) in making decisions to implement loss-reduction measures.

Monitoring technology can be important for local decision-making. For example, the application of satellite imagery can help in monitoring hazards and assist in planning for loss reduction. Because of the highly technical decisions involved in identifying the appropriate data resolution, the number of satellites employed, and the spectral bands that could be used in making policy choices, further research is necessary in this potentially important area.

Pedro Flores talked about the data needs of local governments and their experiences in accessing and using federal hazard data. Most counties tend to rely on their own data, largely due to scale issues that arise with federally assembled data, because counties utilize a larger scale of data. A survey of county officials revealed that more than 75 percent had natural hazard plans; that most collaboration by counties is regional and done on an informal basis; and that counties are incorporating GIS for hazard planning independently, but mostly reactively, for disaster response. There may be avenues for partnerships with federal agencies; however, often “partnership” to local officials means a one-way exchange, with counties giving away data and getting nothing back in return. Counties need to receive added value or some other compensation in order to improve data sharing and coordination across intergovernmental boundaries.

Hope Seligson provided a discussion of HAZUS-MH (multi-hazard), which is a software application for modeling natural hazard scenarios nationwide, developed by the National Institute of Building Sciences for FEMA. The early versions of the software focused on earthquake risks; however, recent improvements have expanded the software to include floods and hurricane risk. The program can be used to estimate direct and indirect economic losses as well as population impacts, such as casualties and shelter requirements. However, users are advised to bring in their own data to get more meaningful results.

## Going Forward: Developing the Research Agenda

A concluding panel was held to present thoughts on developing the research agenda. This panel provided perspective and synthesis to the day’s discussion. The panel included David Applegate, USGS, Robert Giegengack, University of Pennsylvania, Chris Nelson, Virginia Tech, William Hooke, American Meteorological Society, and Susan Cutter, USC, and was moderated by K. Bruce Jones, USGS.

David Applegate linked the day’s discussion to the grand challenges developed by the National Science and Technology Council Subcommittee on Disaster Reduction (SDR). The grand challenges are: provide hazard and disaster information

where and when it is needed; understand the natural processes that produce hazards; develop hazard mitigation strategies and technologies; recognize and reduce vulnerability of interdependent critical infrastructure; assess disaster resilience using standard methods; and promote risk-wise behavior. Applegate discussed the importance of the challenges in framing the issue of risk reduction and management and in providing an interagency, federal context for developing a research agenda.

Robert Giegengack focused on the breadth of issues and scales to be considered in this effort: scales of space and time in developing a research agenda for natural hazards reduction. Giegengack pointed out that we can address hazards and disasters through a continuum of responses: prediction, prevention, compensation, and rebuilding. As we move through the continuum, action becomes more costly.

Arthur C. Nelson pointed out the scale of economic growth and development that is expected during the next century. Nelson emphasized the magnitude of development ahead, as the U.S. population is expected to reach 600 million people by 2106. Nelson stressed the importance of identifying appropriate pricing mechanisms to send the right signals to developers and consumers in areas subject to natural hazards.

William Hooke provided perspective on a research agenda by considering Mark Myers’ observation that stakeholders view risk reduction and management much differently than do scientists. Hooke also discussed Bob Hunter’s suggestion that research is needed on how to make a difference in policy. Hooke noted that losses from disasters are increasing even with advances in the natural and social sciences and observed that this should provide context for considering a research agenda.

Susan Cutter summed up the symposium by identifying five major research needs that should be considered in developing a research agenda.

1. (1)The need for more basic and applied research in filling some of the knowledge gaps in the natural sciences, economics, engineering, and social sciences, particularly as it relates to the ability to predict disasters.
2. (2)The need for spatially referenced data models and tools and a need for more research on the uncertainty of these models.
3. (3)The need for the integration of social science, natural science, engineering, and economics.
4. (4)The need to communicate to the public and communicate the risk to decision makers.
5. (5)The need for policy evaluation and analysis of the effectiveness of public policy.

For further information on the Roundtable, see the University of Pennsylvania’s, Institute for Urban Research (Penn IUR) web site at <http://www.upenn.edu/penniur/risk.htm>.



## **Appendixes I—IV**



## Appendix 1

# A National Framework for Risk Reduction and Management: Developing the Research Agenda November 15, 2006 The Cosmos Club

### Statement of Purpose

The Roundtable will bring together academic, business, and government leaders to advance a research agenda on improving decision-making to reduce and manage the risks of natural hazards. The Roundtable will address incentives and predicted behavior at both the national and the local levels, and seek to develop a research agenda to achieve the following broad goals:

- advancing the use of scientific information to reduce societal vulnerability and risk from hazards, and
- identifying how spatial data can most effectively enable and empower decision-making at the local, state, and national levels.

The need for greater understanding in the effective use of data to prepare for and respond to natural hazard risk is critical. The past few years have provided a wake-up call to our nation's citizens regarding the world we inhabit. More than 27 major disasters were declared in the United States in the past year alone, ranging from earthquakes, landslides, and fires to hurricanes and floods. Every year, natural hazards that

occur in the United States result in hundreds of lives lost and cost billions of dollars in the form of disaster aid, disrupted commerce, and destroyed public and private properties. Given expected population growth in high risk areas, such losses are likely to increase in the coming decades.

Scientific information is an important component in efforts to manage and reduce risk. Effective use of information depends on the relationship among the hazard, societal vulnerability, and institutional factors that affect incentives and influence outcomes, as well as available risk reduction alternatives (such as mitigation and resilience). It is important that these relationships be understood in order to determine what types, resolution, and formats of information can best be used to reduce risk. A move towards greater local resilience and proactive mitigation will increase the need for spatial information on risk exposure.

The Roundtable will advance research on building a national risk framework that is spatially enabled and empowers decision-making at the local, state, and national levels. It will also review the state of current knowledge to identify critical research directions that are needed to improve the availability and usefulness of spatial data, information, and risk modeling for the public good.



Source: USGS

## Appendix 2

### Roundtable Agenda

- 7:30 to 9:00**      **Breakfast, Katrina: One Year Later, Speaker: P. Patrick Leahy, USGS**
- 9:00 to 9:15**      **Welcome and Roundtable Goals, Mark D. Myers, Director, USGS, Douglas Richardson, Executive Director, AAG, and Susan Wachter, University of Pennsylvania**
- 9:15 to 10:30**      **Panel I: Natural Disasters, Land Use and Incentives**  
 How do federal disaster relief and subsidized insurance impact incentives for land use? What are the public and private sector roles for insurance provision? How do insurance and incentives affect the use of scientific information?  
 Panelists: Rutherford Platt, University of Massachusetts, Amherst • Arthur C. Nelson, Virginia Tech • Kent Smetters, University of Pennsylvania • Lucile Jones, USGS
- 10:30 to 10:45**      **Break**
- 10:45 to 12:00**      **Panel II: National Flood Insurance and Mapping: Private and Public Sector Roles**  
 How does current and proposed legislation relating to flood insurance and flood mapping impact the use of scientific information for private and public decision making?  
 Panelists: David Conrad, National Wildlife Federation • Timothy Cohn, USGS • Scott McAfee, FEMA • Robert Hunter, Consumer Federation of America • Mark A. Calabria, U.S. Senate Committee on Banking, Housing and Urban Affairs
- 12:00 to 1:15**      **Lunch and Keynote Address: Susan Cutter, University of South Carolina**
- 1:15 to 2:15**      **Panel III: Lessons Learned**  
 What are the key research questions that arise from local experience on how we should plan for the “next one”?  
 Panelists: Denise Reed, University of New Orleans • Barbara Faga/James Sipes, EDAW • James Devine, USGS • Jonathan Barnett, University of Pennsylvania
- 2:15 to 3:15**      **Panel IV: Identifying Data, Information and Modeling Needs**  
 How can spatial data and models most effectively enable and empower decision-making at the local, state and national levels?  
 Panelists: Mark Johnson, University of Central Florida • Adam Rose, University of Southern California • Richard Bernknopf, USGS • Pedro Flores, National Association of Counties • Hope Seligson, ABS Consulting
- 3:15 to 3:45**      **Going Forward: Developing the Research Agenda**  
 Panelists: David Applegate, USGS • Robert Giegengack, University of Pennsylvania • Robert Lang, Virginia Tech • William Hooke, American Meteorological Society • Susan Cutter, University of South Carolina • Moderator, K. Bruce Jones, USGS
- 3:45 to 4:00**      **Closing Perspectives: Roundtable Participants • Carl Shapiro**

## Appendix 3

### Roundtable Participants

- David Applegate, Senior Science Advisor for Earthquake & Geologic Hazards, U.S. Geological Survey
- William G. Andresen, Associate Vice President, University of Pennsylvania
- Greg J. Arthaud, Social Geographer U.S. Department of Agriculture Forest Service
- William Banks, Hydrologist, U.S. Geological Survey
- Jonathan Barnett, Professor, University of Pennsylvania
- Susan Benjamin, Chief, Western Geographer Science Center, U.S. Geological Survey
- Richard Bernknopf, Economist, U.S. Geological Survey
- Eugenie Birch, Professor, University of Pennsylvania
- David Brookshire, Professor, University of New Mexico
- Mark Calabria, Staff, Senate Banking Committee Senator Shelby's Office
- Jon Campbell, Geographer, U.S. Geological Survey
- Kathrine Cargo, URISA Board Secretary (Past) Urban and Regional Information Systems Association
- Timothy Cohn, Hydrologist U.S. Geological Survey
- David Conrad, Senior Water Resources Specialist, National Wildlife Federation
- Susan Cutter, Professor, University of South Carolina
- James Devine, Senior Advisor for Science Applications, U.S. Geological Survey
- Barbara Faga, Chair of the Board, EDAW
- Pedro Flores, Geospatial IT Specialist, National Association of Counties
- James Fraser, Professor, University of North Carolina
- Philip Ganderton, Professor, University of New Mexico
- Robert Giegengack, Professor, University of Pennsylvania
- Melinda Glazer, Senior Policy Analyst, National League of Cities
- Paula L. Gori, Associate Coordinator Landslide Hazards Program, U.S. Geological Survey
- Paul Hearn, Senior Scientist, U.S. Geological Survey
- William Hooke, Senior Policy Fellow and Director, American Meteorological Society
- William Huneke, Chief Economist and Associate Director, Surface Transportation Board, DOT
- Robert Hunter, Director, Insurance, Consumer Federation of America
- Mark Johnson, Professor, University of Central Florida
- K. Bruce Jones, Chief Scientist for Geography, U.S. Geological Survey
- Lucile Jones, Multi-Hazards Coordinator for Southern California, U.S. Geological Survey
- Quintus Jones, Professor, Dartmouth College
- Michelle Keeney, Science Advisor, Human Factors Div Science & Technology, Directorate, Department of Homeland Security
- John A. Kelmelis, Senior Science Advisor for International Policy, U.S. Geological Survey, and U.S. Department of State
- Suzette Kimball, Director, Eastern Region, U.S. Geological Survey
- Dave Kirtland, Chief, Eastern Geographic Science Center, U.S. Geological Survey
- Barney Krucoff, GIS Director, District of Columbia Government
- Robert Lang, Professor, Virginia Tech
- Mathew Larsen, Chief Scientist for Hydrology, U.S. Geological Survey
- Jennifer LaVista, Public Affairs Specialist, U.S. Geological Survey
- Patrick Leahy, Associate Director for Geology, U.S. Geological Survey
- Alyssa Lee, Metropolitan Policy Program, The Brookings Institution
- Anthony F. Maciorowski, Associate Director for Science, United States Environmental Protection Agency
- Scott McAfee, Hydraulic Engineer, FEMA
- Jacqueline Meszaros Decision, Risk & Management Sciences Program Officer, National Science Foundation
- Mark Myers, Director, U.S. Geological Survey
- M. Richard Nalbandian, Professor, Temple University
- Chris Nelson, Professor, Virginia Tech
- Lawrence Nussdorf, President, The Clark Enterprises, Inc.
- David Park, Metropolitan Policy Program, The Brookings Institution
- Andrey Pavlov, Visiting Professor, University of Pennsylvania
- Rutherford Platt, Professor, University of Massachusetts at Amherst

- Denise Reed, Professor, University of New Orleans
- Doug Richardson, Executive Director, Association of American Geographers
- Adam Rose, Professor, University of Southern California
- Seema Schappelle, Ecological Science Coordinator, Risk Assessment Forum, Environmental Protection Agency
- Hope Seligson, Technical Manager, ABS Consulting
- Carl Shapiro, Senior Advisor, U.S. Geological Survey
- Bill Shear, Director, Financial Markets and Community Investments, GAO
- Howard Silver, Executive Director, Consortium of Social Science Associations
- James Sipes, Senior Associate, EDAW
- Kent Smetters, Professor, University of Pennsylvania
- Jonathan Smith, Program Coordinator, Geographic Analysis and Monitoring, U.S. Geological Survey
- Larry Stipek, GIS Director, Loudoun County, VA
- Neal Stolleman, Economist, Office of Economic Policy, U.S. Department of the Treasury
- Michael Turner Metropolitan Policy Program, The Brookings Institution
- Susan Wachter, Professor, University of Pennsylvania
- Charles Watson, President, Kinetic Analysis Corporation
- Suzanne Weedman, Senior Advisor to the Director U.S. Geological Survey
- Anne Wein, Operations Research Analyst, U.S. Geological Survey
- Karen Wood, Public Affairs Specialist, U.S. Geological Survey
- Jeff Young, Vice President, SANZ Geospatial Solutions Group STAFF
- Paul Amos, Managing Director, Wharton GIS Lab, University of Pennsylvania
- Carolyn Brown, Ph.D. Candidate, City and Regional Planning University of Pennsylvania
- Kendra Goldbas, Associate Director, Penn IUR, University of Pennsylvania
- Jared Lang, Research Assistant, Wharton GIS Lab, University of Pennsylvania
- Jelani Newton, Staff, Penn IUR, University of Pennsylvania
- Pravin Mathur Research Assistant, Wharton GIS Lab, University of Pennsylvania

## Appendix 4

### Panelists' Biographies

#### David Applegate

David Applegate is the senior science advisor for earthquake and geologic hazards at the U.S. Geological Survey. In that capacity, he leads the Earthquake Hazards, Global Seismographic Network, and Geomagnetism Programs and provides coordination for geologic hazards activities across the USGS. He currently serves as Chair of the National Science and Technology Council's interagency Subcommittee on Disaster Reduction. Dr. Applegate is an adjunct faculty member of the University of Utah's Department of Geology and Geophysics, and teaches in the Environmental Sciences and Policy graduate program at The Johns Hopkins University. Prior to joining the USGS in February 2004, he spent 8 years at the American Geological Institute (AGI) as director of government affairs and, for the last 4 years there, as the editor of *Geotimes*, AGI's newsmagazine of the earth sciences. Before coming to AGI, Dr. Applegate served with the U.S. Senate Committee on Energy and Natural Resources as the American Geophysical Union's Congressional Science Fellow and as a professional staff member. Born and raised in Chambersburg, Penn., Dr. Applegate holds a B.S. in geology from Yale University and a Ph.D., also in geology, from the Massachusetts Institute of Technology.

#### Jonathan Barnett

Jonathan Barnett is an architect and planner, educator, and author of numerous books and articles on the theory and practice of city design. He practices urban design with Wallace Roberts and Todd, LLC in Philadelphia, and has been an advisor to many U.S. cities, including Charleston, S.C., Cleveland, Kansas City, Miami, Nashville, Norfolk, Va., and Pittsburgh. He has also been an advisor to several U.S. Government agencies including the U.S. General Services Administration, the National Park Service, the Department of Housing and Urban Development, the National Endowment for the Arts, and the National Capitol Planning Commission.

Jonathan Barnett is also a professor of city and regional planning, and director of the urban design program, at the University of Pennsylvania. Books about Urban Design written by Jonathan Barnett include *Urban Design as Public Policy*, *Introduction to Urban Design*, *The Elusive City*, *The Fractured Metropolis*, *Planning for a New Century*, and the recently published *Redesigning Cities*. A magna cum laude graduate of Yale, Mr. Barnett also holds an M.A. degree from the University of Cambridge and an M. Arch. from Yale. He is a fellow

of the American Institute of Architects and also a fellow of the American Institute of Certified Planners.

#### Richard Bernknopf

Richard Bernknopf is an economist with the USGS Western Geographic Science Center in Menlo Park, Calif. Dr. Bernknopf's research focuses on the demonstration of the relevance (value to society) of natural science information and the translation of that information into a form compatible with decision making processes. He has published papers and books in the economics, hydrology, geology, geophysics, and planning literatures. His research with the USGS has spanned more than three decades. In addition to his USGS responsibilities, he has been a consulting professor and co director of the Center for Earth Science Information Research at Stanford University. Currently, Dr. Bernknopf is on the editorial board of *The Professional Geographer* and is the co-director of the Spatial Integration Laboratory for Urban Systems (SILUS) at the University of Pennsylvania. Dr. Bernknopf received a B.A. in economics in 1970, and a Ph.D. in economics in 1980 from The George Washington University, Washington, D.C.

#### Mark A. Calabria

Mark A. Calabria, Ph.D. is a member of the Senior Professional Staff of the U.S. Senate Committee on Banking, Housing and Urban Affairs. Dr. Calabria handles issues related to housing, mortgage finance, economics, banking and insurance for Chairman Richard Shelby (R-AL). He also served as Deputy Assistant Secretary for Regulatory Affairs at the U.S. Department of Housing and Urban Development. Dr. Calabria previously served as staff on the Senate Banking Committee under Chairman Phil Gramm (R-TX). Dr. Calabria has also held a variety of positions at Harvard University's Joint Center for Housing Studies, the National Association of Home Builders and the National Association of Realtors. He has also been a Research Associate with the U.S. Census Bureau's Center for Economic Studies. He holds a Ph.D. in economics from George Mason University.

#### Timothy A. Cohn

Tim Cohn is a hydrologist in the USGS Office of Surface Water and has co-authored more than 30 papers on methods for estimating flood risk and related topics. He previously served as USGS Science Advisor for Hazards, where he helped coordinate USGS programs that apply science to the challenge of reducing the nation's vulnerability to natural hazards. As the American Geophysical Union's 1995-96 AAAS Congressional Science Fellow, he served as legislative assistant to Senator Bill Bradley on issues related to energy and the environment. Dr. Cohn holds M.S. and Ph.D. degrees from Cornell University and a B.A. from Swarthmore College.

## David Conrad

David Conrad began his work on water resource issues in 1977. For the past 17 years he has served as water resources specialist, and currently as Senior Water Resources Specialist for the National Wildlife Federation, the nation's largest conservation education and advocacy organization. For the previous 8 years, he was legislative representative and water specialist for Friends of the Earth, also in Washington, D.C. David Conrad's major areas of activity have included the water resources development programs of the Army Corps of Engineers and federal river protection and floodplain management programs. In the floodplains arena he was deeply involved in the formulation and passage of the comprehensive National Flood Insurance Reform Act of 1994.

David Conrad led the National Wildlife Federation's Floodplain Management Project, which in July of 1998 published an award-winning report on the nation's repetitive flood loss problems and the potential for greater use of non-structural approaches to reducing flood risk (*Higher Ground—A Report on Voluntary Buyouts in the Nation's Floodplains—A Common Ground Solution Serving People At Risk, Taxpayers and the Environment*). The report stimulated a nearly 8-year effort in Congress that culminated in the Flood Insurance Reform Act of 2004. In 2000, David Conrad received the Federal Emergency Management Agency's Outstanding Public Service Award, and in May 2003, he received the Goddard-White Award from the Association of State Floodplain Managers for "Vision and Skills in Forging National Policy and Solutions to Reduce Flood Losses."

## James F. Devine

James F. Devine has been the USGS Senior Advisor for Science Applications since 1994, after having served 15 years as Assistant Director for Engineering Geology. Throughout these time periods he has provided Bureau policy and guidance on: natural hazards, nuclear waste siting, critical structures such as hospitals and dams; served as an advisor to the Nuclear Regulatory Commission on the seismic and geologic safety of nuclear power plants; advised the Director on all Survey Alaskan matters and compliance with National Environmental Protection Act requirements; and managed the bureau exploration program on National Petroleum Reserve in Alaska and natural gas production system for Barrow, Alaska, and numerous other science application programs. He provides senior oversight of the USGS use of National Technical Means. He also served with the Secretariat of the United Nations International Decade for Natural Disaster Reduction from 1988-1990 in Geneva, Switzerland. Prior to 1980, he held various scientific positions addressing such problems as earthquake research, seismic and geologic safety of nuclear power plants, blasting safety, and other engineering geologic problems.

Mr. Devine is a graduate of West Virginia University with a B.S. in geology and a retired U.S. Army Colonel (Reserve),

and a graduate of the U.S. Army War College. He is a member of the Association of Engineering Geologists, and a registered Professional Geologist/Geophysicist in Idaho. He has received the DOI Meritorious and Distinguished Service Awards and the Presidential Meritorious Rank (SES) award (1987), the Presidential Meritorious Rank (SL) award (2004), and various Department of Army awards, including the Legion of Merit.

## Barbara Faga

Barbara Faga, FASLA, is Chair of the Board of EDAW—environmental, economic, planning and design consultants with 1,200 employees and 28 offices worldwide. Projects include the Tax Allocation District (TAD) Feasibility Study and Redevelopment Plan for the Atlanta BeltLine; Diagonal Mar Parc, Barcelona; Schuylkill River master plan, Philadelphia, Penn.; and the Wharf District Park Plan of the Rose Fitzgerald Kennedy Greenway, the park over the \$15B Big-Dig in Boston. Ms. Faga was named one of the top 15 women changing the world of architecture by DesignIntelligence in 2005. Her book, *Designing Public Consensus: The Civic Theater of Community Participation for Architects, Planners, and Urban Designers* was released in March 2006. Barbara Faga attended Michigan State University and the Georgia Institute of Technology.

## Pedro Flores

Pedro Flores is on the National Association of Counties (NACo) staff through a partnership with the Institute for the Application of Geospatial Technology (IAGT). He supports the development of geospatial technologies in local government by providing education and technical assistance to county officials and staff. Mr. Flores also represents NACo and the interests of counties in various federal geospatial committees and initiatives such as the Federal Geographic Data Committee (FGDC), Geospatial One-Stop, Fifty States Initiative, Imagery for the Nation as well as other projects working with the Environmental Protection Agency (EPA), the USGS, and the National Oceanic and Atmospheric Administration (NOAA).

Mr. Flores joined the NACo staff in May 2006. From 2000 to 2006, he served as the GIS manager at the City of Rockville, Md. Previously he was the GIS Coordinator at the City of Fort Lauderdale, Florida and a GIS technical support analyst with Miami-Dade County, Fla.

## Robert Giegengack

Robert Giegengack, currently Professor of Earth & Environmental Science in the School of Arts and Sciences, has been on the faculty of the University of Pennsylvania since 1968.

Dr. Giegengack received his B.A. and Ph.D. in geology from Yale University (1960, 1968), and his M.S. in geology from the University of Colorado (1962). Dr. Giegengack established the undergraduate major in Environmental Studies at Penn in 1972 and has been undergraduate advisor for that major and for the Geology major in the years since. Dr. Giegengack is also Faculty Director of the Master of Environmental Studies (MES) program, which currently enrolls ~80 students. He is also Director of Penn's Summer Course in Geologic Field Methods, based at the facility of the Yellowstone-Bighorn Research Association (YBRA) in Red Lodge, Mont. Dr. Giegengack teaches courses in Environmental Analysis, Paleoclimatology, and Environmental Geology. He has also developed a series of Academically Based Community-Service courses in urban environmental public health that focus on the hazard of lead-based paint in residential buildings, teenage smoking, and environmental triggers of asthma attacks. Dr. Giegengack studies geologic archives that enable paleoclimatologists to reconstruct the history of climate change during the very long period of time (~4.5 billion years) that preceded acquisition, during the last ~200 years, of the instrumental meteorological record. That work provides a useful time perspective on environmental processes currently under way.

### William H. Hooke

William H. Hooke is a Senior Policy Fellow and Director of the Policy Program at the American Meteorological Society. Prior to this appointment, Dr. Hooke worked for the National Oceanic and Atmospheric Administration (NOAA) and antecedent agencies for 33 years. At NOAA, he conducted research and then served in a series of management positions of increasing scope, including Director of NOAA's Environmental Sciences Group (now Forecast Systems Lab), Deputy Chief Scientist, and Acting Chief Scientist of NOAA. Dr. Hooke also served on the faculty at the University of Colorado. He currently chairs the steering committee of the National Research Council's Disasters Roundtable, and is a member of the ICSU Planning Group on Natural and Human-Induced Environmental Hazards and Disasters. Dr. Hooke holds a B.S. from Swarthmore College and an S.M. and Ph.D. from the University of Chicago. He was elected a member of the American Philosophical Society in April 2006.

### J. Robert Hunter

J. Robert Hunter is the Director of Insurance with the Consumer Federation of America. Formerly he was the Commissioner of Insurance, State of Texas, and President and Founder of the National Insurance Consumer Organization. He also formerly served at the Federal Insurance Administration, as the Federal Insurance Administrator and Chief Actuary. His private insurance industry experience includes serving as Associate Actuary, Mutual Insurance Advisory Association

and Mutual Insurance Rating Bureau (now AIPSO), Actuarial Supervisor, National Bureau of Casualty Underwriters (now ISO). He received the HUD Secretary's Award for Excellent Service for work performed from 1971 to 1977 and the Esther Peterson Consumer Service Award for lifetime service, CFA, in 2002, and the Schraeder-Nelson Publications Award for the article of the year for Enron's Impact on State Insurance Regulation published in *The Regulator* newsletter of the Insurance Regulatory Examiner's Society in 2002.

### Mark E. Johnson

Mark E. Johnson is Professor of Statistics at the University of Central Florida in Orlando. Previously, he was Professor of Industrial and Systems Engineering at the Georgia Institute of Technology and a staff member at Los Alamos National Laboratory. Professor Johnson is a Fellow of the American Statistical Association, an elected member of the International Statistical Institute, a Chartered Statistician with the Royal Statistical Society, and has received the Jack Youden, T. Saaty, Shewell, and Brumbaugh prizes for his research.

He is the author of the book *Multivariate Statistical Simulation* (1987) and Editor of the book *Simulated Annealing & Optimization: Modern Algorithms with VLSI, Optimal Design & Missile Defense Applications*. In international statistical standards, he is the convenor of the working group to revise ISO 3534/3 Statistics. Dr. Johnson's current and recent consulting clients include the Florida Commission on Hurricane Loss Projection Methodology, Agency for Health Care Administration (State of Florida), the Organization of American States, Motorola, IBM, Kinetic Analysis Corporation, ChepUSA, Coca-Cola Foods, and Lockheed-Martin.

### K. Bruce Jones

K. Bruce Jones is currently Chief Scientist for the Geography Discipline at the U.S. Geological Survey in Reston, Va. Before coming to the USGS, he served as a Senior Scientist in the U.S. Environmental Protection Agency's (EPA) National Exposure Research Laboratory in Las Vegas, with the responsibility of pulling together expertise from across EPA to conduct research and fill critical scientific gaps in the areas of spatial analysis and landscape ecology. He has been or is currently involved in landscape ecology research projects in many areas across the United States, in Northern Mexico, and across extensive areas of Europe and Australia. Dr. Jones also served as the Chief of the Landscape Ecology Branch in the EPA's Laboratory in Las Vegas, and as an Associate Director in the Environmental Monitoring and Assessment Program, or EMAP. Previous to coming to work with the EPA, Dr. Jones worked in the Endangered Species Office in Washington, D.C., working on endangered species status reviews and listings within the United States and abroad.

He has conducted extensive research in the fields of landscape ecology, hydrology, biogeography, molecular evolution, and herpetology, and has over 100 publications. Dr. Jones is currently on the Editorial Board for *Ecological Indicators*, and the Editorial Advisory Board for the *International Journal of Environmental Monitoring and Assessment*. He served as Counselor at Large on the Executive Committee of the U.S. Chapter of the International Association of Landscape Ecologists and is a member of a Heinz Center working group on national landscape pattern indicators. He also served on an AIBS working group for the National Ecological Observatory Network (NEON).

## Lucile M. Jones

Lucile M. Jones has been a seismologist with the U.S. Geological Survey and a Visiting Research Associate at the Seismological Laboratory of Caltech since 1983. She has served in a variety of positions, including heading the seismic network (1992-1996) and Scientist-in-charge of the USGS earthquake program in Southern California (1998-2006). She is a Commissioner of the California Seismic Safety Commission, which advises the governor and legislature on seismic safety, by appointment of Gov. Davis in 2002 and reappointment by Gov. Schwarzenegger in 2005 and serves on the California Earthquake Prediction Evaluation Council. Dr. Jones has authored over 80 papers on research seismology with primary interest in the physics of earthquakes, foreshocks and earthquake hazard assessment, and the seismotectonics (earthquake-producing geologic structures) of Southern California. She is currently developing a new program to integrate hazards science in urban areas with economic analysis and emergency response to increase community resiliency to natural disasters.

Dr. Jones has received numerous awards, including the Alquist Award from the California Earthquake Safety Foundation and Woman of the Year from the Muses of the California Science Museum. Dr. Jones received a B.A. in Chinese language and literature, magna cum laude, from Brown University in 1976 and a Ph. D. in geophysics from the Massachusetts Institute of Technology in 1981. She is a past Secretary of the Seismology Section of the American Geophysical Union, past Director and past Chair of the Publications Committee of the Seismological Society of America. Dr. Jones, a fourth-generation resident of Southern California, currently lives in La Cañada, Calif., with her husband and fellow seismologist, Egill Hauksson.

## Robert Lang

Robert E. Lang is the founding Director of the Metropolitan Institute at Virginia Tech in Alexandria, Va., and an Associate Professor in Virginia Tech's School of Planning and International Affairs. In the spring of 2006, Dr. Lang was a Visiting Distinguished Professor at Arizona State University. He is currently a Fellow of the Urban Land Institute. Dr. Lang

is also a Planning and Development Fellow of the Lincoln Institute of Land Policy and a Visiting Fellow of the University of California. Prior to joining Virginia Tech, Dr. Lang was Director of Urban and Metropolitan Research at the Fannie Mae Foundation in Washington, D.C.

Dr. Lang received a Ph.D. in urban sociology from Rutgers University, where he also taught sociology and urban studies. Dr. Lang's research specialties include suburban studies, demographic and spatial analysis, housing and the built environment, and metropolitan governance. He has authored over 100 academic and professional publications on a wide range of topics, and has developed many new urban planning concepts such as "Boomburbs," "Edgeless Cities," and "Metropolitan Areas." Dr. Lang's latest work includes the book *Edgeless Cities: Exploring the Elusive Metropolis*, which is published by the Brookings Institution Press. He is also co-author of three edited volumes on the census titled *Redefining Urban and Suburban America: Evidence from Census 2000*, also by the Brookings Institution Press. Dr. Lang's just-finished book, titled *Boomburbs: the Rise of America's Accidental Cities*, is due out in the fall of 2006.

## P. Patrick Leahy

P. Patrick Leahy is Associate Director for Geology of the U.S. Geological Survey. He has responsibility for Federal basic earth science programs, which include worldwide earthquake hazards monitoring and research, geologic mapping of land and seafloor resources, volcano and landslide hazards, and assessments of energy and mineral resources. He is also responsible for all international activities conducted by the USGS. He has been with the USGS since 1974, having served in various positions, including Chief of the National Water-Quality Assessment Program. He has authored or co-authored more than 50 publications on a wide array of earth science topics. Dr. Leahy served as Acting Director of the USGS between June 2005 and September 2006.

Dr. Leahy is a Fellow in the Geological Society of America and is a member of the American Geophysical Union, the American Institute of Hydrology (Former President). Dr. Leahy is the past President of the U.S. National Chapter of the International Association of Hydrogeologists. In addition, he was selected by the National Academy of Science to head the U.S. delegation to the 30th International Geological Congress in Beijing, China, in August 1996. He also serves as the Chair of the Federal Advisory Committee for the National Cooperative Geologic Mapping Program. He was a member of the U.S. National Committee on Scientific Hydrology. Dr. Leahy is a Representative on the Atmospheric and Hydrospheric Science Committee of the American Association for the Advancement of Science. He is a member and the past Chairman of the U.S. National Committee for Geological Sciences for the National Academy of Sciences. He has received the Meritorious Service Award from the U.S. Department of the Interior and in 2003 was recognized as a Meritorious Senior Executive by President Bush.

## Scott McAfee

Scott McAfee works in the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security (DHS), and is a GIS coordinator for the Mitigation Division of FEMA in Washington, D.C. Mr. McAfee helps to develop policy and coordinate the geospatial information aspects of a number of FEMA activities and programs, including HazardMaps.gov; Emergency Management Map Symbolology; HAZUS; and Multihazard Flood Map Modernization. Before FEMA he worked for the California Office of Emergency Services, where he utilized GIS for disaster preparedness, response, and recovery. Mr. McAfee sits on the Federal Geographic Data Committee's Coordination and Homeland Security Groups.

## Mark D. Myers

On September 26, 2006, Dr. Mark D. Myers became the 14th Director of the U.S. Geological Survey, U.S. Department of the Interior. Director Myers is an internationally recognized geologist and former State Geologist and head of Alaska's Geological Survey. Dr. Myers, an expert on North Slope sedimentary and petroleum geology, served as survey chief for field programs in the MacKenzie Delta (ARCO, 1985), Cook Inlet (State of Alaska/U.S. Geological Survey, 1997), and North Slope (ARCO, 1999). He also served as sedimentologist for 13 other North Slope field programs.

Dr. Myers is a past president and board member of the Alaska Geological Society; a certified professional geologist with the American Institute of Professional Geologists; a certified petroleum geologist with the American Association of Petroleum Geologists; and a licensed geologist with the State of Alaska. He served as an officer in the U.S. Air Force Reserve from 1977 to 2003, retiring as a Lt. Colonel. Dr. Myers received his Ph.D. in geology from the University of Alaska-Fairbanks in 1994, specializing in sedimentology, clastic depositional environments, surface and subsurface sequence analysis, and sandstone petrography. He earned his B.S. and M.S. degrees in geology from the University of Wisconsin-Madison.

## Arthur C. Nelson

Arthur Christian (Chris) Nelson is Co-Director of the Metropolitan Institute and Professor of Urban Affairs and Planning at Virginia Tech's Alexandria Center. For the past 20 years, Dr. Nelson has conducted pioneering research in land-use planning, growth management, public facility finance, and urban development policy. He has made notable contributions to the areas of development impact fees, farmland and forestland preservation, urban containment, removing barriers to affordable housing, and more recently, the effect of metropolitan governance structures on metropolitan economic develop-

ment. He served HUD for a year as an expert on smart growth during the Clinton and Bush Administrations.

Numerous organizations have sponsored Dr. Nelson's research, such as the National Science Foundation; National Academy of Sciences; U.S. Departments of Housing and Urban Development, Commerce, and Transportation; U.K. Department of the Environment; Lincoln Institute of Land Policy; Fannie Mae Foundation; American Planning Association; National Association of Realtors; and the Brookings Institution. His research and practice has led to the publication of 14 books and more than 200 scholarly and professional publications worldwide.

## Rutherford Platt

Rutherford H. Platt is a professor of geography and planning law in the Department of Geosciences at the University of Massachusetts-Amherst. He holds a B.A. in political science from Yale and both a J.D. (law) and Ph.D. (geography) from the University of Chicago. He specializes in public policy concerning urban land and water resources. Among many books and articles, he is the author of *Land Use and Society: Geography, Law, and Public Policy* (2004) and *Disasters and Democracy: The Politics of Extreme Natural Events* (1999). He was editor of *The Ecological City: Preserving and Restoring Urban Biodiversity* (1994). His latest edited book is *The Humane Metropolis: People and Nature in the 21st Century City* (2006).

He has served on many national panels including the National Research Council Water Science and Technology Board. In 2002, he was honored as a Lifetime National Associate of The National Academies. He directs the Ecological Cities Project, a program of research and outreach based at the University of Massachusetts.

## Douglas Richardson

Douglas Richardson is the Executive Director of the Association of American Geographers.

He previously had founded GeoResearch, Inc., which pioneered the early development of real-time interactive GPS/GIS technologies, and served as the company's president from 1980 to 1998, when he sold the firm and its key GPS/GIS patents. He has worked and published extensively on environmental, natural resources, and geographic technology projects and issues.

## Hope Seligson

Hope A. Seligson is a Technical Manager with ABS Consulting, and has been active in the areas of earthquake engineering, natural hazard risk assessment and loss estimation for over 20 years. Her areas of expertise include regional hazard and damage assessment, building inventory development, vulnerability modeling, application of geographic information

systems (GIS), and software application design and development. She has performed various research projects funded by the National Science Foundation, the Pacific Earthquake Engineering Research Center, the Consortium of Universities for Research in Earthquake Engineering, and the Southern California Earthquake Center. Significant projects include development of a computerized tool to estimate earthquake-induced losses and casualties in near-realtime for southern California (the Early Post-Earthquake Damage Assessment Tool, or EPEDAT), and working with researchers at the UCLA Center for Public Health and Disasters to enhance current earthquake-related injury modeling techniques using data from the Northridge, Kobe, Turkey, Taiwan, and Nisqually earthquakes. In addition, Ms. Seligson is part of an interdisciplinary team developing a nationally applicable flood loss estimation methodology under the HAZUS program for the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS).

Ms. Seligson holds an M.S. in structural engineering from Stanford University, with an emphasis in earthquake engineering.

## Carl Shapiro

Carl Shapiro has been an economist at the USGS for over 25 years. He is currently a senior advisor for science and policy in the Geography Discipline, focusing on improving linkages between natural science and societal decisions. Prior to joining the Geography Discipline in 2005, Dr. Shapiro had been the principal economist in the Office of the Director, where he led and participated in analytical studies on topics ranging from interagency wetland data consistency to institutional issues associated with privatization and outsourcing. While in the Director's Office, Dr. Shapiro also served as the acting Chief of the Office of Strategic Planning and Analysis and most recently as a Senior Advisor to the Director for Science Impact.

Dr. Shapiro is an adjunct faculty member in the School of Public Affairs at American University, where he has taught courses on economics and public management for the past 10 years. He has received the Superior Service Award from the Department of the Interior and the University Faculty Award for Outstanding Teaching in an Adjunct Appointment at American University. Dr. Shapiro received his Ph.D. and M.A. in economics from George Mason University and a B.A. in government from the College of William and Mary.

## Jim Sipes

Jim Sipes is an award-winning landscape architect with more than 25 years of experience encompassing a wide range of planning, design, research, and communication projects. His work is broad-based and multi-faceted and includes environmental planning and design, watershed management, park and recreation design, urban design, natural and cultural

resource management, and community-based design. Mr. Sipes has received national recognition for his writing, has written more than 200 articles for a variety of publications, and recently received the Bradford Williams Medal award for outstanding writing. He is currently a Senior Associate with EDAW.

## Kent Smetters

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## Susan Wachter

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