Written Testimony of Professor Michael K. Lindell
U.S. House of Representatives Committee on Science and Technology
Subcommittee on Technology and Innovation

Good morning. My name is Dr. Michael K. Lindell; I am a Professor at Texas A&M University and conduct emergency management research in the Hazard Reduction & Recovery Center. I want to thank you for the opportunity to speak on behalf of the many social scientists who are conducting research supported by NEHRP agencies. My remarks today will be based substantially on the analyses and recommendations of the National Science Foundation's *Second Assessment of Research on Natural Hazards* and the National Academy of Sciences *Committee on Disaster Research in the Social Sciences* (see Attachments 1 and 2).

1 What is the role of social science research in making communities hazard resilient?

One of the committee reports from the NSF's *Second Assessment* concluded that households and businesses typically are unaware of the risks they face, underestimate the risks of which they are aware, and overestimate their ability to cope when disaster strikes. In addition, they have competing demands for their attention, short planning horizons, bounded rationality, and limited economic resources. These limitations increase communities' hazard vulnerability because they lead households and businesses to encroach into high hazard areas, underutilize pre-impact hazard mitigation and preparedness, and rely too much on post-impact emergency response and disaster relief.

Thus, the role of social scientists is threefold. First, we seek to better understand the psychological, social, economic, and political causes of community hazard vulnerability. Second, we want to scientifically test possible ways to increase hazard resilience. Third, we seek opportunities to work with emergency managers, architects, engineers, planners, and public administrators to disseminate administrative and technological innovations that increase community hazard resilience.

2. How has social science been integrated into NEHRP activity and other federal hazards R&D?

The cornerstone of NEHRP support for social science hazards research has been NSF's Engineering Directorate either alone or in collaboration with its Social, Behavioral, and Economic Sciences Directorate. NSF has primarily supported unsolicited proposals submitted by individual investigators and solicitations in response to domestic and international disasters. In addition, USGS has supported social science evaluations of some of its hazard awareness programs (Mileti & Darlington, 1995; Mileti & Fitzpatrick, 1993; Perry, 1990; Perry & Lindell, 2008) and FEMA has supported dissemination of social science research findings through its *Higher Education Initiative* (training.fema.gov/EMIWeb/edu/). Most of the social science projects funded by federal research programs have involved investigators from a single discipline. However, there have also been projects involving collaboration among multiple social science disciplines and, sometimes, social scientists collaborating with engineers and physical scientists. There have also been a few interdisciplinary efforts such as NSF's *Human and Social Dynamics Program* and its *Earthquake Engineering Research Centers*. As yet, these efforts are only beginning to develop the kinds of interdisciplinary cooperation that is needed to increase community hazard resilience.

3. What are the priorities for social science for a reauthorization of NEHRP and other federal hazards R&D programs?

I will discuss priorities in three major areas—hazard and vulnerability analysis, pre-impact actions (hazard mitigation and disaster preparedness) and post-impact actions (emergency response and disaster recovery). I will conclude with a discussion of the utility of an all-hazards approach in social science research.

Hazard/vulnerability analysis

Although it is something of an oversimplification, we can say that physical scientists identify which geographic areas are exposed to hazards and engineers address which structures are most likely to fail. The corresponding social science question is "Which population segments and economic sectors are most vulnerable to disasters, what are their points of vulnerability, and what can government and non-governmental organizations (NGOs) do to reduce this vulnerability?" Of course, we know that ethnic minorities, female-headed households, poorly educated, low income, physically or mentally disabled, and socially isolated citizens are disadvantaged—even under the best of circumstances. Thus, we expect them to be most vulnerable to disasters (e.g., Bolin & Stanford, 1998; Peacock, Morrow & Gladwin, 1997). However, we need to learn more about the *specific* difficulties they have in hazard mitigation, emergency preparedness, and insurance purchase. We also know in broad terms that small businesses are more vulnerable to disasters. However, we need to know more about how businesses' vulnerability varies by economic sector and what specific difficulties they experience (Alesch, Taylor, Ghanty, & Nagy, 1993; Webb, Tierney & Dahlhamer, 2000). For both households and businesses, we need to know more about how government and NGOs can more effectively provide assistance. Answering these questions will require longitudinal studies that track households and businesses over extended periods of time.

Preimpact actions

In general terms, we already know what needs to be done to make communities more disaster resilient. At the household level, pre-impact actions include hazard mitigation (bolting structures to their foundations and strapping water heaters to walls) and disaster preparedness (storing food and water, purchasing first aid kits and learning how to treat minor injuries, and purchasing hazard insurance). For emergency response organizations, pre-impact actions include developing plans, acquiring resources, and conducting training and exercises to support emergency response—as well as engaging in mitigation actions to ensure their buildings and material resources survive a disaster. At the community level, pre-impact actions include land use plans that discourage intensive development of high hazard areas and prohibit the siting of highly vulnerable facilities such as hospitals, nursing homes, and schools in high hazard areas. They also include programs such as building codes and standards to increase buildings' elevation (for flooding) and structural resilience (for wind and earthquakes) if they are built in high hazard areas.

At all levels—households, businesses, and communities—we know that the level of pre-impact action is inadequate. Social scientists have published many small-scale studies that suggest why this is so (Lindell, Arlikatti & Prater, in press; Lindell & Perry, 2000). We know that people *will* voluntarily adopt hazard adjustments that are high in efficacy—ones that protect persons and property and are useful for other purposes. We also know that they will *not* voluntarily adopt hazard adjustments that are high in resource requirements—ones that are expensive, or require substantial time and effort, specialized knowledge and skill, specialized tools and equipment, or substantial amounts of cooperation with others. A major obstacle to improving community hazard resilience is that some of the most promising hazard adjustments—hazard insurance for example—have very low rates of adoption. In some cases, the

problem is that people have erroneous beliefs about these hazard adjustments. That is, people underestimate efficacy or overestimate resource requirements. Worse yet, people often don't know about the existence of many of the hazard adjustments that are available. In such cases, the level of hazard adjustment adoption might be increased by investing in risk communication programs. Although we know much more about risk communication than we did thirty years ago, we still have much to learn about how to persuade people to prepare for low-probability events such as earthquakes (Lindell & Perry, 2004). Especially when people fail to adopt hazard adjustments because the personal cost of a hazard adjustment exceeds the short-term personal benefits, extrinsic inducement programs—incentives and sanctions—may be needed. However, research is needed to determine how to design these inducements so they provide the greatest increase in community resilience for the minimum cost to government and NGOs.

Current research provides an adequate base of small-scale studies for designing comprehensive research on the effects of incentives, sanctions, and risk communication. What we most need to do next is to conduct *large-scale coordinated field experiments*. We know that there are many communities that are willing to undertake—and in many cases have actually implemented—innovative programs to promote hazard resilience. Unfortunately, only a few of these programs are documented and fewer still have been scientifically evaluated. This is a major disappointment because every one of these situations represents a squandered opportunity to learn from experience. As noted earlier, USGS has supported some small studies that begin to address this issue. However, we can do much more if NEHRP will support collaboration between communities that are willing to adopt innovative programs and social scientists who will collect and analyze data from these programs to evaluate their effectiveness.

Post-impact actions

Although household actions are important, some of the most important emergency response and disaster recovery actions are taken by community organizations. Coordination has repeatedly been identified as a major problem in emergency response and the challenges seems to increase with the magnitude of the disaster. This country made a major commitment after 9/11 to adopting the Incident Command System (ICS) as a mechanism for coordinating disaster response. ICS is a major improvement over the multiplicity of idiosyncratic systems that it is displacing, but it deserves systematic evaluation to assess its limitations and identify improvements. In the more than thirty years since its inception, there have been only a handful of empirical studies on ICS effectiveness (see Lutz & Lindell, 2008). A program that the federal government mandates for local governments to qualify for disaster reimbursement should be examined more thoroughly than that.

We have textbooks (Phillips, 2009) and planning guidance (Natural Hazards Center, 2001; Schwab, Topping, Eadie, Deyle & Smith, 1998) that identify problems and recommend solutions for a timely and effective disaster recovery. There is evidence that communities recover more rapidly if they engage in *pre-impact* recovery planning (Wu & Lindell, 2004) but most communities wait until after a disaster strikes to plan their recovery. As a consequence, the pace of recovery is slow, stakeholders (especially vulnerable populations) are frustrated, and hazard mitigation is poorly integrated into disaster recovery plans, causing communities to recreate their pre-existing hazard vulnerability. Thus, systematic social science research is needed on communities of different sizes and different economic bases to determine

what can be done to improve post-disaster recovery planning. This will help all population segments and economic sectors recover more rapidly and completely and reduce the problem of repetitive losses.

All-hazards social science research

Finally, I would like to conclude by presenting some reasons why NEHRP agencies should support social science research on a variety of hazards. A basic premise for hazards researchers is that we have limited opportunities to study earthquake emergency response and recovery in the US because major earthquakes are, thankfully, rare. We can learn much by studying societal response to earthquakes in other countries and numerous Earthquake Engineering Research Institute studies have done so. However, we also need to take advantage of the lessons that can be learned from studying other, more frequent, hazards in this country. Indeed, most environmental hazards are relevant and there are two reasons why this is so. First, earthquakes can themselves generate secondary threats—including tsunami, landslides, dam failures, urban conflagrations, and hazardous materials releases. In fact, earthquakes and their secondary hazards cover most of the spectrum of disaster impacts to which the US is vulnerable.

Second, there appear to be significant similarities in societal responses to different hazards. Specifically, even though a hazard agent might be caused by physical mechanisms that are quite different from those that cause earthquakes, the two hazards can still have critical *impact characteristics* in common (see Lindell, Prater & Perry, 2006, for further discussion of cross-hazard similarities). For example, tornadoes are generated by quite different physical systems than are earthquakes. However, both are rapid onset disasters that provide minimal or no warning. The similarity in the impact characteristics of the two events produces similar societal responses. As a consequence of this principle, hazard mitigation functions (such as land use planning and building codes) and emergency preparedness functions (such as planning, training, and exercising) are similar for most environmental hazards. The same is true for disaster recovery functions such as debris removal, donations management, temporary housing. Even the needs for emergency response functions such as search and rescue, emergency sheltering, interagency coordination, and emergency public information are similar across disasters. It is true that there are some emergency response functions such as pre-impact warning and evacuation that are not possible with current earthquake detection technology. However, earthquakes' secondary hazards such as dam failures and tsunami can be detected far enough in advance to support even these functions. Consequently, what social scientists can learn from mitigation, preparedness, response, and recovery associated with seemingly dissimilar hazards—such as hurricanes, floods, and tornadoes—can be effectively applied to reducing community vulnerability to earthquakes.

REFERENCES

Reports from the National Science Foundation
Second Assessment of Research on Natural Hazards

Burby, R. J. (ed.) (1998). *Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities*. Washington, DC: Joseph Henry Press.

Cutter, S.L. (2001). *American Hazardscapes: The Regionalization of Hazards and Disasters.* Washington, DC: Joseph Henry Press.

Kunreuther, H. & Roth, R.J., Sr. (1998). *Paying the Price: The Status and Role of Insurance Against Natural Disasters in the United States.* Washington DC: Joseph Henry Press.

Lindell, M.K., with Alesch, D., Bolton, P.A., Greene, M.R., Larson, L.A., Lopes, R., May, P.J., Mulilis, J-P., Nathe, S., Nigg, J.M., Palm, R., Pate, P., Perry, R.W., Pine, J., Tubbesing, S.K. & Whitney, D.J. (1997). Adoption and implementation of hazard adjustments. *International Journal of Mass Emergencies and Disasters Special Issue, 15*, 327-453.

Mileti, D.S. (1999). *Disasters by Design: A Reassessment of Natural Hazards in the United States.* Washington DC: Joseph Henry Press.

Sorensen, J.H. (2000). Hazard warning systems: Review of 20 years of progress. *Natural Hazards Review, 1*, 119-125.

Tierney, K.J., Lindell, M.K. & Perry, R.W. (2001). *Facing the Unexpected: Disaster Preparedness and Response in the United States.* Washington DC: Joseph Henry Press.

Report from the National Academy of Sciences
Committee on Disaster Research in the Social Sciences

Committee on Disaster Research in the Social Sciences. (2006). *Facing Hazards and Disasters: Understanding Human Dimensions.* Washington DC: National Academy of Sciences.

Other References

Alesch, D.J., Taylor, C., Ghanty, S. & Nagy, R.A. (1993). Earthquake risk reduction and small business. In Committee on Socioeconomic Impacts (eds.) *1993 National Earthquake Conference Monograph 5: Socioeconomic impacts* (pp. 133-160). Memphis TN: Central United States Earthquake Consortium.

Bolin, R. C. & Stanford, L. (1998). The Northridge earthquake: Vulnerability and disaster. London: Routledge.

Lindell, M.K., Arlikatti, S. & Prater, C.S. (in press). Why people do what they do to protect against earthquake risk: Perceptions of hazard adjustment attributes. *Risk Analysis*.

Lindell, M.K. & Perry, R.W. (2000). Household adjustment to earthquake hazard: A review of research. *Environment & Behavior*, 32, 590-630.

Lindell, M.K. & Perry, R.W. (2004). *Communicating Environmental Risk in Multiethnic Communities.* Thousand Oaks CA: Sage.

Lindell, M.K., Prater, C.S. & Perry, R.W. (2006). *Fundamentals of Emergency Management*. Emmitsburg MD: Federal Emergency Management Agency Emergency Management Institute. Available at www.training.fema.gov/EMIWeb/edu/fem.asp.

Lutz, L.D. & Lindell, M.K. (2008). The Incident Command System as a response model within emergency operation centers during Hurricane Rita. *Journal of Contingencies and Crisis Management*, 16, 122-134.

Mileti, D.S. & Darlington, J.D. (1995). Societal response to revised earthquake probabilities in the San Francisco Bay area. *International Journal of Mass Emergencies and Disasters*, 13, 119-145.

Mileti, D & Fitzpatrick, C. (1993). *The Great Earthquake Experiment: Risk Communication and Public Action*. Boulder CO: Westview Press

Natural Hazards Center. (2001). *Holistic Disaster Recovery: Ideas for Building Local Sustainability After a Natural Disaster*. Boulder CO: University of Colorado Natural Hazards Center.

Peacock, W.G., Morrow, B.H. & Gladwin, H. (1997). *Hurricane Andrew: Ethnicity, Gender and the Sociology of Disaster*. London: Routledge.

Perry, R.W. (1990). Volcanic hazard perceptions at Mt. Shasta. *The Environmental Professional*, 12, 312-318. 1990.

Perry, R.W. & Lindell, M.K. (2008). Volcanic risk perception and adjustment in a multi-hazard environment. *Journal of Volcanology and Geothermal Research*, 172, 170-178.

Phillips, B.D. (2009). *Disaster Recovery*. Boca Raton FL: CRC Press.

Schwab, J., Topping, K.C., Eadie, C.C., Deyle, R.E. & Smith, R.A. (1998). *Planning for Post-Disaster Recovery and Reconstruction*, PAS Report 483/484. Chicago IL: American Planning Association.

Webb, G.R., Tierney, K.J. & Dahlhamer, J.M. (2000). Business and disasters: Empirical patterns and unanswered questions. *Natural Hazards Review*, *1***,** 83-90.

Wu, J.Y. & Lindell, M.K. (2004). Housing reconstruction after two major earthquakes: The 1994 Northridge earthquake in the United States and the 1999 Chi-Chi earthquake in Taiwan. *Disasters*, 28, 63-81.

Attachment 1
Committee on Disaster Research in the Social Sciences
Summary of the Current State of Social Science Research

The [Committee on Disaster Research in the Social Sciences] assessment of the current state of social science research is based on a detailed review of scientific literature in the field. The report's authoring committee also benefited from presentations and discussions that took place during two workshops held in conjunction with committee meetings, one in Washington, DC and the other in Irvine, California. Participants in the first workshop included researchers from the multidisciplinary hazards and disaster research community, practitioners, and representatives from various agencies. All participants in the second workshop were practitioners. Based on this input, the report draws the following conclusions about the current state of social science research:

1. Social science hazards and disaster research has advanced in the United States and internationally.
Under NEHRP social science knowledge has expanded greatly with respect to exposure and vulnerability (physical and social) to natural hazards in the United States, such that the foundation has been established for developing more precise loss estimation models and related decision support tools for hazards and disasters generally. The contribution of NEHRP to social science knowledge on natural hazards is less developed internationally as is its contribution nationally and internationally on exposure and vulnerability to technological and willful threats.

2. Social science knowledge about the responses of U.S. households to natural hazards and disasters is well-developed. There is a solid knowledge base at the household level of analysis on vulnerability assessment, risk communication, evacuation and other forms of protective action, and expedient disaster mitigation activities—for example, how people in earthquake or flood prone regions communicate about risks and warning messages, and how they respond to warning messages. The knowledge base and related explanatory modeling under NEHRP are skewed toward natural hazards (most notably earthquakes) as opposed to technological and willful hazards, and so far they have been confined primarily to national rather than international contexts.

3. Far less is known about how the characteristics of different types of hazards affect disaster preparedness and response. There has been little systematic comparative work on the special characteristics of natural, technological, and willful disasters (e.g., predictability and controllability; length of forewarning, magnitude, scope, and duration of impact) and their relationships with physical and social impacts. For example, how does the variation in warning time—little or no warning for an earthquake, short-term warning for tornados, longer-term warnings for hurricanes, and indeterminate warnings for terrorist attacks—affect preparedness and response? Greater understanding of event/impact relationships would directly facilitate the adoption of more effective disaster preparedness and mitigation practices.

4. More is known about immediate post-disaster responses of groups, organizations, and social networks than about mitigation or disaster recovery policies and practices. While less so than the post-World War II studies that preceded NEHRP's establishment in 1977, NEHRP-sponsored social science research has still tended to focus more on the immediate aftermath of disasters (post-disaster responses) and related emergency preparedness practices than on the affects of pre-disaster mitigation policies and practices, disaster recovery preparedness or longer term recovery from specific events. Research over several decades has contradicted myths that during disasters panic will be widespread, that large percentages of those who are expected to respond will simply abandon disaster roles, that local

institutions will break down, that crime and other forms of anti-social behavior will be rampant, and that psychological impairment of victims and first responders will be a major problem. The more interesting and important research questions have become how and why communities, regions, and societies leverage expected and improvised post-impact responses in coping with the circumstances of disasters. While much of organizational response to disaster is expected and sometimes planned, improvisation is an absolutely essential complement of predetermined activities.

5. The circumstances of terrorist threats could alter societal response to disasters. The possibility exists that some future homeland security emergencies could engender responses that are different from those observed in previous post-disaster investigations of natural and technological disasters. Particular attention is being given post-September 11, 2001 to vulnerability assessment of national energy, transportation, and information systems, terrorist threat detection and interdiction, the special requirements of nuclear, biological, and chemical agents, and the organizational requirements of developing multi-governmental preparedness and response systems. Fortunately these concerns are readily subsumed within the historically mainstream topics of hazards and disaster research depicted in Figure 1 above.

6. NEHRP has made important contributions to understanding longer-term disaster recovery. Prior to NEHRP relatively little was known about disaster recovery processes and outcomes at different levels of analysis (e.g., households, neighborhoods, firms, communities, and regions). While research on disaster recovery remains somewhat underdeveloped, NEHRP funded projects have refined general conceptions of disaster recovery, made important contributions in understanding the recovery of households (primarily) and firms (more recently), and contributed to the development of statistically based community and regional models of post-disaster losses and recovery processes. Moreover, interest in the relationship between disaster recovery and sustainable development has become sufficiently pronounced in this field that the committee has allocated an entire chapter of the report to its consideration.

7. The management and accessibility of data needs immediate attention. Thus far social scientists have not confronted systematically issues related to the management and accessibility of data—from its original collection and analysis, to its longer-term storage and maintenance, and to ensuring its accessibility over time to multiple users. What the committee has termed the "hazards and disaster research informatics problem" is not unique to this research specialty, or to the social sciences, natural sciences, and engineering generally. But the informatics problem demands immediate attention and resolution as a foundation for future research and application of findings.

8. How research is communicated and applied is not well understood. More systematic research is needed on how hazards and disaster information generated by the social sciences and other disciplines is disseminated and applied. Such research will provide clearer understanding of what can be done within hazards and disaster research to further the dissemination of knowledge, thereby advancing sound mitigation, preparedness, response, and recovery practices.

9. A more diverse, interdisciplinary, and technologically sophisticated social science workforce is needed in the future. Given the national and international importance of natural, technological, and willful disasters, the next generation of social scientists studying these events should become larger, more diverse, and more conversant with interdisciplinary perspectives and state-of-the-art research methods and technologies than the previous generation.

Recommended Improvements to Hazards and Disaster Research Grounded in the above conclusions, the report offers 38 separate recommendations for improving how hazards and disasters research in the social sciences is conducted and used to inform policy and decision making. The recommendations, the

majority of which relate to the need for comparative studies of societal responses to natural, technological and willful hazards and disasters, are encapsulated in the following three summary recommendations.

Summary Recommendation 1: Comparative research should be conducted to refine and measure core components of societal vulnerability and resilience to hazards of all types, to address the special requirements of confronting disasters caused by terrorist acts, and to advancing knowledge about mitigation, preparedness, response, and recovery related to disasters having catastrophic physical and social impacts. The recommended comparative research is essential for isolating common from unique aspects of societal response to natural, technological, and willful hazards and disasters. A key contribution of NSF through NEHRP over the years has been that, while necessarily emphasizing earthquakes, since its inception the program has encouraged and supported comparisons of societal responses to earthquakes with other natural as well as technological hazards and even with terrorist induced events, though less so. This historical emphasis within NEHRP dictates that a rigorous approach should prevail in making generalizations to terrorism and that there is a continuing need for systematic comparisons of all societal hazards and disasters using the conceptual and methodological tools summarized in this report. A comparative perspective should be sustained within NSF and also prevail in the new DHS.

Summary Recommendation 2: Strategic planning and institution building are needed to address issues related to the management and sharing of data on hazards and disasters (hazards and disaster informatics), sustain the momentum of interdisciplinary research, advance the utilization of social science findings, and sustain the hazards and disaster research workforce. Of particular importance because of its direct relationship to Summary Recommendation 1 is the call for strategic planning to address issues of data management and data sharing. A Panel on Hazards and Disaster Informatics should be created to guide these efforts. The Panel should be interdisciplinary and include social scientists and engineers from hazards and disaster research as well as experts on informatics issues from cognitive science, computational science, and applied science. The Panel's mission should be, first, to assess problems of data standardization, data management and archiving, and data sharing as they relate to natural, technological, and willful hazards and disasters, and second, to develop a formal plan for resolving these problems to every extent possible within the next five years.

Summary Recommendation 3: NSF and DHS should jointly support the comparative research, strategic planning, and institution building called for in Summary Recommendations 1-2. The proposed leveraging of NSF with DHS support is critical because these two agencies are focal points of federal funding for research on all types of extreme events. The two agencies should take advantage of opportunities to leverage their resources by jointly funding social science hazards and disaster research whenever possible. This could lead to a better understanding of the similarities and differences between natural, technological, and human-induced hazards and disasters. It could also provide the foundation for sound science-based decision making by policy makers and practitioners, whether they are developing measures to counter a major natural disaster like Hurricane Katrina or a terrorist-induced event like the September 11th attacks on the World Trade Center and Pentagon. Social science research on the September 11, 2001 terrorist attacks as well as more limited observations that have been made thus far on Hurricane Katrina indicate, first, that many previous findings about societal response to hazards and disasters remain valid, and second, that there is still much to be learned about responses to truly catastrophic events.

Source: http://dels.nas.edu/dels/rpt_briefs/facing_hazards_brief_final.pdf

Attachment 2
Committee on Disaster Research in the Social Sciences (2006)
Specific Research Recommendations

Number	Recommendation
3.1	Research should be conducted to assess the degree to which hazard event characteristics affect physical and social impacts of disasters and, thus, hazard mitigation and preparedness for disaster response and recovery.
3.2	Research should be conducted to refine the concepts involved in all three components (hazard exposure, physical vulnerability, and social vulnerability) of hazard vulnerability analysis (HVA).
3.3	Research should be conducted to identify better mechanisms for intervening into the dynamics of hazard vulnerability.
3.4	Research should be conducted to identify the factors that promote the adoption of more effective community-level hazard mitigation measures.
3.5	Research should be conducted to assess the effectiveness of hazard mitigation programs.
3.6	Research should be conducted to identify the factors that promote the adoption of more effective emergency response preparedness measures.
3.7	Research should be conducted to assess the extent to which disaster research findings are being implemented in local emergency operations plans, procedures, and training.
3.8	Research is needed to identify the factors that promote the adoption of more effective disaster recovery preparedness measures.
3.9	Research should be conducted to develop better models to guide protective action decision making in emergencies.
3.10	Research is needed on training and exercising for disaster response.
3.11	Research should be conducted to develop better models of hazard adjustment adoption and implementation by community organizations.
3.12	There is a continuing need for further research on hazard insurance.
4.1	Future research should focus on further empirical explorations of societal vulnerability and resilience to natural, technological, and willfully caused hazards and disasters.
4.2	Future research should focus on the special requirements associated with responding to and recovering from willful attacks and disease outbreaks.
4.3	Future research should focus on the societal consequences of changes in government organization and in emergency management legislation, authorities, policies, and plans that have occurred as a result of the terrorist attacks of September 11, 2001, as well as on changes that will almost certainly occur as a result of Hurricane Katrina.
4.4	Research is needed to update current theories and findings on disaster response and recovery in light of changing demographic, economic, technological, and social trends such as those highlighted in Chapter 2 and elsewhere in this report.
4.5	More research is needed on response and recovery for near-catastrophic and catastrophic disaster events.
4.6	More cross-societal research is needed on natural, technological, and willfully caused hazards and disasters.
4.7	Taking into account both existing research and future research needs, sustained efforts should be made with respect to data archiving, sharing, and dissemination.

Committee on Disaster Research in the Social Sciences (2006)
Specific Research Recommendations (continued)

5.1	As NSF funding for the three earthquake engineering research centers (EERCs) draws to a close, NSF should institute mechanisms to sustain the momentum that has been achieved in interdisciplinary hazards and disaster research. Network for Earthquake Engineering Simulation (NEES)
5.2	The hazards and disaster research community should take advantage of current, unique opportunities to study the conditions, conduct, and contributions of interdisciplinary research itself.
5.3	NSF should support the establishment of a National Center for Social Science Research on Hazards and Disasters.
6.1	Priority should be given to international disaster research that emphasizes multiple case research designs, with each case using the same methods and variables to ensure comparability.
6.2	Common indicators of disaster risk and development should be constructed.
6.3	Collaborative international research projects should be the modal form of cross-national research on disasters and development.
7.1	The National Science Foundation and Department of Homeland Security should jointly support the establishment of a nongovernmental Panel on Hazards and Disaster Informatics. The panel should be interdisciplinary and include social scientists and engineers from hazards and disaster research as well as experts on informatics issues from cognitive science, computational science, and applied science. The panel's mission should be (1) to assess issues of data standardization, data management and archiving, and data sharing as they relate to natural, technological, and willful hazards and disasters, and (2) to develop a formal plan for resolving these issues to every extent possible within the next decade.
7.2	The National Science Foundation and Department of Homeland Security should fund a collaborative Center for Modeling, Simulation, and Visualization of Hazards and Disasters. The recommended center would be the locus of advanced computing and communications technologies that are used to support a distributed set of research methods and facilities. The center's capabilities would be accessible on a shared-use basis.
7.3	The hazards and disaster research community should educate university Institutional Review Boards (IRBs) about the unique benefits of, in particular, post-disaster investigations and the unique constraints under which this research community performs research on human subjects.
8.1	Renewed attention should be given by the social science hazards and disaster research community to the need for formal evaluation research on knowledge utilization in the field. New research should be carried out using all of the relevant methodologies and technologies available to the social sciences today.
8.2	Building on earlier practice, social scientists should conduct research utilization studies involving knowledge on hazards and disasters produced by other research disciplines.

Committee on Disaster Research in the Social Sciences (2006)
Specific Research Recommendations (continued)

9.1	Relevant stakeholders should develop an integrated strategy to enhance the capacity of the social science hazards and disaster research community to respond to societal needs, which are expected to grow, for knowledge creation and application. A workshop should be organized to serve as a launching pad for facilitating communication, coordination, and planning among stakeholders from government, academia, professional associations, and the private sector. Representatives from the NSF and DHS should play key roles in the workshop because of their historical (NSF) and more recent (DHS) shared commitment to foster the next generation of hazards and disaster researchers.
9.2	NSF should expand its investments in both undergraduate and graduate education to increase the size of the social science hazards and disaster research workforce and its capacity to conduct needed disciplinary, multidisciplinary, and interdisciplinary research on the core topics discussed in this report. NSF should also give special consideration to investing in innovative ways to further workforce development, especially when they involve partnerships such as NSF's recent joint initiative with the Public Entity Research Institute (PERI) and the Natural Hazards Research and Applications Information Center at the University of Colorado. This initiative, discussed below, exemplifies the collaboration needed across government, academia, professional associations, and the private sector.
9.3	In parallel fashion, DHS should make a conscious effort to increase significantly the number of awards its makes to social science students through its scholarship and fellowship program. Because much that must be investigated about the terrorist threat is related to social and institutional forces, more social scientists need to be recruited to adequately study them. With its broader cross-hazards congressional mandate, DHS should contribute to a larger social science hazards and disaster research workforce, one that complements research in other science and engineering disciplines.
9.4	NSF and DHS should consider ways that they can cooperate programmatically to enhance the social science hazards and disaster research workforce. Jointly sponsored university research and education programs by the two agencies would be of major benefit to the nation.
9.5	As the leader in furthering U.S. science through research and workforce development, NSF should make greater use of its enabling mechanisms, including standard research grants, center grants, grant supplements, and REU programs to attract more minorities to the social science hazards and disaster research workforce.
9.6	The NSF Enabling Project for junior faculty development (discussed below) should be continued if the second pilot proves to be a success.
9.7	Stakeholders in government, academia, professional societies, and the private sector should be open to exploring a variety of innovative approaches for developing the future social science hazards and disaster research workforce.

Source: http://www.nap.edu/openbook.php?record_id=11671&page=R1