

SESSION SUMMARIES
27TH ANNUAL HAZARDS RESEARCH AND APPLICATIONS WORKSHOP
JULY 14-17, 2002
BOULDER, COLORADO

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2002 NATURAL HAZARDS WORKSHOP CLOSING REMARKS: DENNIS MILETI
HEALTH CARE RESEARCH AND DISASTERS ROUNDTABLE
GIS FOR NATURAL HAZARDS ROUNDTABLE
GENDER AND DISASTER ROUNDTABLE
HAZARDS CENTER DIRECTORS ROUNDTABLE

SEPTEMBER 11 AND BEYOND: SHIFTING CONCERNS AND CROSS-CUTTING LESSONS

Moderator: Bill Anderson, National Research Council

Recorder: James W. Russell, Institute for Business & Home Safety

Discussants: Kathleen Tierney, University of Delaware

Chris Poland, Earthquake Engineering Research Institute/Degenkolb Engineers

Dave Garratt, FEMA/Office of National Preparedness

September 11, 2001, brought new challenges for cross-disciplinary hazard mitigation. The events of that date demonstrated that there is need for a more clearly identified planning and research effort to attend to the response to multi-hazard events. There is a basic similarity of response to various hazardous events, yet each presents responders with unique demands.

Concepts explored included:

- *Convergence*—resources coming to the locus of the event. In New York City, resources arrived in over-abundance and this presented its own challenge for resource receipt, storage, and distribution.
- *Emergence*—the appearance of new groups with specialized agendas. This was particularly delicate in the aftermath of September 11, because these well-meaning individuals had to be acknowledged; yet not permitted to conflict with established, more conventional groups.
- *Organizational Improvisation*—the accommodation required for meeting unforeseen demands of the event; how to solve problems for which we have not planned or trained. There must be improvisation and rapid adaptive responses for effective response to disasters.

September 11 also called attention to our built environment. The events caused design and infrastructure professionals to consider how to build safer, more resilient structures.

One difficulty in really changing building construction practices is the lack of multi-disciplinary discussion. Those involved in the discussion largely remain within their areas of expertise. The challenge is to get many disciplines together for a conversation, along with people engaged in the building code development process. The latter is required because building construction only changes when required to do so by codes.

We speak of disastrous events as “providing a window of opportunity” for change. To take advantage of this window, there must be cross-disciplinary discussion among responders, scientists, and building designers to foster an integrated program for construction improvement.

Lessons learned from the events of September 11 included a need to:

- Revise planning assumptions
- Improve operational posture
- Train and exercise more (and do so in a smarter way)
- Identify national standards
- Develop provisions for robust mutual aid

Research and work on multi-disciplinary approaches are advocated by many people and are seen as possibly being a significant improvement on present practice. Getting started is difficult. This session identified some considerations that might facilitate multi-disciplinary activity:

- Acquire significant, multi-year funding for collaborations and research
- Work on agreed-upon problems
- Ensure mutual trust and respect
- Involve graduate students in the process

MANAGING THE RESPONSE TO THE SEPTEMBER 11 ATTACKS: OBSERVATIONS FROM RESEARCH AND PRACTICE

Moderator: Jack Harrald, George Washington University
Recorder: Jim Franklin, Mankato (MN) Department of Public Safety
Discussants: Benjamin Barksdale, Arlington County (VA) Fire Department
Jim Kendra, University of Delaware
Claire Rubin, Claire B. Rubin & Associates

Benjamin Barksdale shared his direct response experience to the events of September 11, 2001, at the Pentagon in Arlington, Virginia. Normally, the Arlington County Fire Department is staffed by 70 firefighters, who work a 3-platoon rotation schedule. During the response to the plane crash and ensuing events, the department quickly found this rotation schedule was not suitable for a long-term major incident. The department soon switched to a straight 12-hour work schedule of days and nights.

Arlington County immediately implemented the National Incident Management System (NIMS). This implementation automatically activated mutual aid agreements with neighboring departments. When the military response was activated at the site, all commands merged their command structures into the NIMS system. All of the departments had been participating in Weapons Of Mass Destruction (WMD) training for the past six years. This extensive training, along with the relationships and mutual trust that had developed over time, greatly helped the response to this incident.

The three major problems the first responders had to deal with were: fire, building collapse, and the possibility of plane crash victims. Security at the site quickly became a major problem, and an identification system was developed. Since the incident involved an act of terrorism, responders were unsure if additional attacks were planned. Due to the number of responding agencies, each department stayed on its own communications channel. The Emergency Operations Center (EOC) was set up approximately 3 miles from the incident, and the Arlington County Fire Chief felt it was imperative to periodically go to the site and view the scene. Training and communications systems continue to be two of the major factors that need continued development to ensure future successful response to incidents of terrorism.

Jim Kendra commented on his observations about the response to the World Trade Center (WTC) in New York. His discussion focused on creativity and organizational improvisation and their importance in facilitating an effective response. Kendra pointed out that creativity in disaster planning is needed before the disaster occurs. Once a disaster occurs, a foundation of improvisation will be needed. Kendra defined creativity as a new and effective response, perspective, or way of doing something. Dimensions of creativity might be products, markets, delivery process, or obtaining resources. Time pressure and the overall urgency of an event may cause inter- and intra-organizational tension. Some organizations will require hours, days, or even weeks to make decisions, while others can respond more quickly.

An example of WTC creativity included the re-mapping of the landscape at the site. This task required a creative response to overcome data format problems. Additional examples include spontaneous water-borne evacuations of people to New Jersey, Brooklyn and Staten Island by private citizens, and the need to determine the most effective way to “wash down” vehicles containing debris that was removed from the WTC site. Creativity and the ability to craft situation-specific responses must be emphasized at all levels of planning and training. Factors that impede creativity should be identified and mitigated.

Claire Rubin focused her remarks on the changes that have taken place in FEMA since September 11. Prior to September 11, FEMA’s disaster response policies were developed from after-action report analyses, legislation, regulations, executive orders, and operational agency response plans. In New York, the economic impacts of the event include the loss of 12 million feet of office space, business interruption costs that are estimated at 21 billion dollars, and the loss of human productive value that is estimated at an additional 11 billion dollars. There are also losses to the airline industry, stock market, and the revenue to New York.

In the approximately 100 days since September 11, the federal government has moved forward on a number of programs that, in the past, would have taken 5-10 years of political strategizing. Additionally, the public seems to evince a change in attitude and there is increased evidence of the willingness of people to help others in a time of need. There is a greater appreciation of police, fire, and military, as well as general government workers. Major challenges ahead include the re-organization of a number of federal organizational structures, and designing the Office of Homeland Security.

Jack Harrold summarized the presentations. At both sites, the response system designed mostly for natural hazards worked well to respond to the terrorist events. Objectives and goals were quickly identified, work plans were developed, and many components of the Federal Response Plan were quickly put into play. The NIMS and use of a unified command are critical in the response to a terrorism event. Another key to the successful response is the fact that many of the responding members knew of each other’s respective organizations. The fact that members knew each other on a personal basis was a bonus. Managing public information, the media, and implementing a good security plan are also critical to a successful response to any disaster or terrorist incident.

HURRICANE ANDREW 10 YEARS LATER: IMPLICATIONS FOR DISASTER MITIGATION

Moderator: Betty Hearn Morrow, International Hurricane Center

Recorder: Janet Thornhill, NOAA/Coastal Services Center

Discussants: Walt Peacock, International Hurricane Center

Nicole Dash, International Hurricane Center

Michael O'Brien, International Hurricane Center

Betty Hearn Morrow asked the discussants to address a series of questions regarding the ways that South Miami-Dade County is different today than in 1992, before Hurricane Andrew struck. Specifically, they were asked to elaborate on demographic, economic, and political differences. The discussants answered these questions using a current study that is being conducted that utilizes an analysis of census block data from 1990 to 2000, phone survey interviews, and review of property records.

Walt Peacock described the demographic changes that took place in the aftermath of Hurricane Andrew. The area hardest hit by Hurricane Andrew was South Miami-Dade County, which was in the path of the eye of the hurricane. While the Anglo population had been in a majority prior to Hurricane Andrew, it appears that the hurricane increased trends of Anglo flight. By 2000, Anglos were no longer a majority of South Miami-Dade's population. The non-Hispanic Black population of South Miami-Dade maintained its relative size, when compared to Anglos and Hispanics. However, this population remained principally located in traditionally Black areas. The Hispanic population grew considerably, becoming the majority of South Miami-Dade's population, as it is elsewhere in Miami-Dade County. Overall, the data suggest that Hurricane Andrew may have quickened the pace of Latinization in southern sections of Miami-Dade County.

Michael O'Brien discussed what changed politically after Hurricane Andrew. Before the hurricane, the county government structure was a metropolitan form of government with a weak mayoral system and minimal emergency staff. Ten years later, in 2002, the county government structure has changed and now has a more powerful mayor, centralized authority, better communication, and a stronger emergency management staff. The political culture in 1992 had power concentrated in Anglo populations, with poor communication and a general lack of concern with emergency management. In 2002, the political culture has a new leadership characterized by younger people with a greater percentage of minorities, more inclusive politics, and a culture of community participation. Economically, the loss of the Anglo population and the Air Force Base affected the economic base of the area. However, overall, politics were not a major concern for people. Rather, they were more concerned with rebuilding their homes and maintaining normalcy.

Nicole Dash compared property tax assessments from pre-Andrew to 2000 to determine the economic impact of Hurricane Andrew. The change over time showed that residential property tax had gone up by 67% and commercial property tax had increased by 43%. Overall, property tax had increased by 59%. Although property taxes had risen, there were still abandoned and unsafe structures in some predominantly Black areas like West Perrine. Some areas were abandoned because individuals did not receive enough help to rebuild. In others areas, the buildings were rentals and the owner had simply collected insurance and left. This resulted in unsafe and abandoned structures in communities such as Florida City and Homestead, interspersed with homeowners who were rebuilding. An outcome of this study is that special populations are clearly in need of the most help and future planning needs to be in place for these areas.

In conclusion, the winners were those with good insurance, businesses involved with reconstruction, and some of the minority populations. In addition, more year-round work was available for farmers replanting crops and creating start-up nurseries. New parks were developed along with a newer and stronger tax base in some communities. The losers were those who were already on the margins economically, physically, or psychologically. These people could not take advantage of employment opportunities in the reconstruction business. In addition, people who were insured by marginal or fraudulent companies also did not fair well.

WILDFIRE MITIGATION: MAKING IT HAPPEN IN COMMUNITIES

Moderator: Michele Steinberg, National Fire Protection Association International

Recorder: Jim Douglas, U.S. Department of the Interior

Discussants: Jim Smalley, National Fire Protection Association International
Keith Worley, Perry Park (CO) Metropolitan District
Cheryl Renner, Louisiana State University
Jonathan Taylor, U.S. Geological Survey

This session focused on how communities and homeowners can reduce danger from wildfire. The session began with Jim Smalley's overview of the "wildland-urban interface" (WUI). Broadly defined, the WUI is a set of conditions such as weather, topography, vegetation, construction, development configuration, and infrastructure. Smalley noted that the WUI exists throughout the U.S., and that many of the highest growth areas in the country are the most vulnerable. Smalley discussed the need to use multi-hazard planning strategies to break the cycle of structure loss followed by rebuilding followed by structure loss. Smalley concluded by noting that breaking the cycle includes redefining WUI management as a "land use" issue, not solely a "fire" issue. Breaking the cycle also means redefining the traditional roles of firefighters as protectors and homeowners as victims so that both parties can become active partners in addressing the problem.

Jonathan Taylor spoke from the perspective of a social science researcher. He observed that additional research is needed both about the extent of the WUI problem, and how communities can become more effective partners with land management agencies. Taylor concluded by noting that people do not behave rationally about where and how they live. Understanding this psychology is important for long-term solutions.

Cheryl Renner reported on an ongoing assessment of fire reduction programs in WUI communities. The assessment is available on the U.S. Forest Service web site: <http://www.wildfireprograms.org>. The assessment examines vegetation management programs, and has currently reviewed over 90 programs around the country. The largest component of existing programs is education, followed by risk assessments and mapping, assistance to homeowners, demonstration projects, and regulations. Only two states have laws mandating the creation of defensible space, but many states have issued guidelines about defensible space that have been adopted at the local level. Such ordinances require defensible space provisions under zoning, subdivision review, and growth policy regulations.

Keith Worley concluded the session with a case study of Perry Park, Colorado. Worley emphasized three phases of the community-based effort: planning, which involved a large number of stakeholders, surveys, and GIS analyses; education through local newsletters, classes, and property inspections; and field-based implementations such as creating fuel breaks and disposing of slash. Worley concluded with a discussion of the benefits to homeowners and communities of wildland fire mitigation.

The subsequent discussion was wide-ranging, touching on such issues as local regulations that perpetuate unsafe conditions (e.g. wood shingles), the role of insurers in promoting mitigation, and the role of firefighting strategies and tactics such as placing a high value on structure protection. Considerable discussion took place regarding the role of the news media in accurately covering wildland fire stories. There is a tendency for the media to focus on the towering flames rather than on underlying land use management and homeowner behavior issues.

COORDINATED RESEARCH FOR NATURAL HAZARDS AND HOMELAND SECURITY

Moderator: Tom O'Rourke, Cornell University
Recorder: Susan Tubbesing, Earthquake Engineering Research Institute
Discussants: Chris Poland, Degenkolb Engineers
Kathleen Tierney, University of Delaware
Larry Larson, Association of State Floodplain Managers
Arthur Chiu, University of Hawaii
Paul Gilbert, Parsons Brinckerhoff
Dennis Wenger, National Science Foundation

Panelists from the earthquake, flood, wind, and homeland security fields came together to address challenges and opportunities, and to draw upon their skills and knowledge to identify commonalities between natural hazards and homeland security issues.

The panelists unanimously noted that most of the steps that are required to reduce disaster impacts are similar, regardless of the type of threat. In all hazard situations, one must take steps to mitigate, prepare for, respond to, and recover from the event. Basic research is needed, risks must be assessed, and a determination made regarding prevention or mitigation. Regardless of the agent, options must be developed, plans made, and public education and training be included as critical steps. The panelists generally agreed that there needs to be better data dealing with hazards and their impacts, and that there is a particular need for uniformity of data across hazards. For many hazards, developing and issuing effective warnings is a common need. Community recovery, as well, is largely independent of the cause of the event.

Over time, considerable knowledge has been gained about natural disasters. This knowledge must be applied in terrorist situations to help minimize their social, political, and economic impacts. Natural hazards organizations need to develop broad, multi-hazard coalitions that can successfully integrate their goals and knowledge to assist those working with national security. We need to identify the most salient lessons from natural hazards and apply them to vulnerability reduction for terrorism and other non-natural hazards and events.

Considerable discussion surrounded the difficulties inherent in breaking out of discipline-based boundaries. Some of the panelists suggested that it is easier to approach the challenges of national security from a multi-hazard perspective, rather than one that is genuinely multi-disciplinary, because of the strict discipline-based focus that characterizes university education. Panelists noted the need to think horizontally rather than vertically, in order to break out of narrow, stovepipe perspectives.

During the general discussion, members of the larger group noted that mitigation may differ significantly from one hazard to another. Efforts to reduce some hazards may actually increase vulnerability to others. For example, elevating structures for coastal storm surge is likely to present challenges for structures along the west coast subject to strong shaking in earthquakes. Also, in order to mitigate terrorism, we need to focus on its deep-seated social, cultural, and economic origins, not solely on strengthening buildings and infrastructure. Altering buildings to resemble bunkers can be done, but it will place unacceptable economic burdens on building owners and communities.

Several noted the absence of a national vision, and the fact that the Earthquake Engineering Research Institute (EERI) has begun to develop such a vision for earthquake loss reduction. The group expressed the view that a similar comprehensive vision needs to be created to incorporate natural hazards and issues of homeland security. A number of those present expressed the additional concern that recent terrorist events have caused attention to be refocused from mitigation back to an earlier focus on response. They stated that we must continue to work to incorporate mitigation into a national vision of reduced vulnerability from all hazards. The natural hazards community needs to be part of any program being developed to establish “homeland security” and has a significant role to play in Washington D.C., to ensure that natural hazards are considered during this process.

We need greater knowledge and better tools to help us develop a more accurate understanding of risk and of the increasing vulnerability we face as a technologically dependent nation. This session opened a genuine dialogue and emphasized the need to work together to develop a common agenda to address the compelling challenges inherent in creating a secure, resilient, and sustainable society.

WHAT'S HAPPENING IN HIGHER EDUCATION? STUDENT NEEDS AND UNIVERSITY RESPONSES

Moderator: David McEntire, University of North Texas
Recorder: Wayne Blanchard, FEMA/Emergency Management Institute
Discussants: Chrys Rodrigue, California State University, Long Beach
David Neal, Jacksonville State University
Kyle Rhone, Arkansas Tech University
David Hoover, University of Akron
Greg Shaw, George Washington University

David McEntire noted that the demand for qualified emergency and hazards managers has risen during the past year, and that these managers must now have a broad range of skills and abilities to successfully do their jobs. Education programs need to keep pace. The following questions were posed to the discussants: Have you incorporated new perspectives on emergency management into your program? How has September 11 changed your program? Is a balance between academic education and practical training desirable? What challenges confront emergency management programs and how can they be overcome? What will your program do in the future to address specific knowledge, skills, and abilities?

The consensus was that collegiate emergency management programs must continually evolve. All discussants agreed that September 11 has significantly impacted their programs, most notably in the interest generated among students, faculty, school administrators and public officials. This demand has resulted in the creation of a Center for Emergency Management and Homeland Security at Akron University. Greg Shaw noted that on the night of September 11, eight students from his program and one faculty member were involved in response operations. Shaw said that since September 11, there has been a movement toward consequence management and away from mitigation. He added that corporate America perceived September 11 as an attack on itself and has reacted with an upsurge of interest in crisis management topics, as have the health and medical communities. Shaw mentioned that his program at George Washington University, Crisis, Disaster and Risk Management, could hardly keep up with demand. David Neal noted that his distance learning disaster management program currently has students from 40 states and 5 countries, and he anticipates 300 students enrolled in the fall, mostly emergency services practitioners. His university is looking to hire an additional faculty member.

Kyle Rhone remarked that the majority of his students pursue a degree in emergency management to get a job, and added that the State Office of Emergency Management is very interested in student placement. Neal stated his concern about going too far in attempting to address the student preferences, and gave the example of a school that teaches a course on the incident command system—too much, in his opinion, under the domain of field training. There was unanimous consensus that educational courses should focus on critical thinking skills and nurturing the ability to analyze and synthesize.

Rhone observed that people might be going too far in reacting to September 11 with stand-alone terrorism focal areas as opposed to the integration of terrorism preparedness into an all-hazards framework. Others shared his concern and worry that mitigation may suffer in the balance.

Developing new courses, creating community service projects within emergency management classes, using distance learning methods, and engaging community stakeholders, were some of the methods to increase knowledge, skills, and abilities suggested by the panelists. Chrys Rodrigue noted that her geography department has recently experienced an influx of faculty with interests in hazards. The department's first hazards course will be offered this coming fall. Its focus will be on building student skills in GIS techniques and other technological tools and uses.

EARLY WARNINGS OF EL NIÑO'S RETURN: DO WE KNOW WHAT TO DO WITH THEM?

Moderator: Bill Hooke, American Meteorological Society

Recorder: Bill Coulbourne, URS Corporation

Discussants: Lynn Highland, U.S. Geological Survey
Ellis Stanley, City of Los Angeles (CA) Emergency Preparedness Department
Tim Cohn, U.S. Geological Survey
Don Wernly, NOAA/National Weather Service

Don Wernly opened by saying that climate is the stage on which weather plays and numerical models are used to make forecasts. Climate can be predicted when there are strong climate signals. Temperature forecasts can be accurate, although precipitation accuracy is low. To improve predictions, models must be improved.

Tim Cohn noted that the benefits of accurate long-term forecasts are: lives saved, property not lost or damaged, and happiness (e.g., vacations planned in times of nice weather). The challenge is how to use long-term forecasts to reduce disaster losses given that forecasts are global and disaster mitigation is local. In order to realize benefits of forecasts, Cohn believes, we must characterize local hazards, educate citizens about them, provide global warnings when needed, increase money for research and development, and increase earth monitoring systems.

Lynn Highland said precipitation is the primary indicator for landslides. In 2002, a major drought is occurring in the west and southwest U.S. The drought is increasing the number of wildfires. In turn, this increases the susceptibility to landslides, which may occur when precipitation inundates areas burned by wildfires. The barren aftermath of fires can increase debris flows.

Ellis Stanley said Los Angeles has developed a process for including many partners in their disaster preparedness program. These include ad hoc groups who develop into bureaucracies. Stanley also emphasized the importance of involving local emergency management in partnerships and sharing of information about plans among the many elements of these partnerships.

Three major themes arose in the discussion following the presentations. First, how should scientific uncertainty be communicated to the public about El Niño events? It was noted that forecasting needs to be site- and case-specific, and organizations disseminating public information must be clear about what people should do with information. Second, the information disseminated must be clear and easy to understand as well as linked to what people know about their situation or location, i.e. street names placed on maps. Finally, emergency managers can be the vehicle for making programs come together. Close communication involving emergency managers is very important. Information tools include booklets (see, for example, the America Planning Association or USGS booklet on landslides), maps (including GIS), forecasts, and the media. All of these tools require well thought out approaches for the target audience.

REDUCING TSUNAMI HAZARDS: THE U.S. NATIONAL TSUNAMI HAZARD MITIGATION PROGRAM

Moderator: Lori Dengler, Humboldt State University
Recorder: Chris Jonientz-Trisler, FEMA/Region X
Discussants: Eddie Bernard, NOAA/Pacific Marine Environmental Lab
Rich Eisner, California Governor's Office of Emergency Services
Patricia Bolton, Battelle Seattle Research Center
David Johnston, Institute of Geological and Nuclear Sciences, New Zealand

Eddie Bernard defined tsunamis and presented their associated dangers of flood, debris, fires, and grounding ships. He stated that mitigation works. To be most successful, mitigation requires a combination of hazard assessment, education and awareness building, and a warning system that addresses the hazard, similar to the U.S. National Tsunami Hazard Mitigation Program (NTHMP). Partnerships between federal and state scientists and emergency managers are significant to mitigation program success as well. Components of a comprehensive program include assessment mapping, buoys and seismic networks for real time detection and quick warning (2 to 8 minutes), education, preparedness and awareness devices such as tsunami signs, and implementation of the TsunamiReady Community Program. Bernard noted that reviewers of the TsunamiReady Community Program said that the program needs more financial resources, some type mapping certification to ensure public credibility, evaluation tools, and full-time operations at the warning centers.

Rich Eisner presented California's view. The state is incorporating tsunamis into an all-hazard approach. Tsunamis are similar to weapons of mass destruction (WMD), in their uncertainty, unpredictability, dependency of prediction and warning systems on state and federal support, local response lead, and infrequent recurrence. Land use and development regulations are the controls in the built areas, although construction standards cannot control existing buildings. It is difficult to maintain interest in the maps. Given the uncertainty, do we let El Niño or Darwin do the mitigation? According to an FBI source, preparation for response to a catastrophic earthquake is perhaps the best way to prepare for WMD and terrorism.

Patricia Bolton discussed evaluation research versus applied research as two different approaches to improving program performance. Program evaluation begins from defined program objectives, and the program elements used to achieve those objectives. For the NTHMP, the program elements included tools for emergency managers, hazard education, construction abatement and land use guides, information sharing, and coordination. However it is also important to question whether program elements were actually implemented and why they were or were not. For example, for the NTHMP survey, local and county emergency managers were asked about what they had received from the state programs funded by the NTHMP that can provide important information on how to improve the program implementation. Applied research begins with a dependent variable and then, for example, can measure the strength of various interventions (or independent variables) on variations in the desired outcome (dependent variable). Again, this information can be used to design stronger programs and can be used across hazards. The designation of some small portion (e.g., 1%) of all program funds to either program evaluation or

social science research on organizational and individual behavior relevant to the program would provide a wealth of knowledge for the design of hazard mitigation programs.

David Johnston spoke about public response to warnings based on studies of past events, and presented some of his findings. Large numbers of people often move from safe areas into the warning area to observe even as people in danger areas are evacuating. Johnston described current work in progress in the state of Washington to measure audiences currently missed by the NTHMP. His survey found that residents understand that the program is directed at them, but visitors indicate that the program was not designed to address them. This opens the question of how visitors will react to sirens.

Discussion included the following questions and comments. First, are there lessons for tsunami response planning from the World Trade Center experience? The NTHMP promotes redundant sources to get information out, but the message itself is critical. For example, hotel staff response is critical because people will copy the behavior of others and it is important that there be a small number of people who understand what to do in the event of a tsunami warning or event. There are always a certain number of people who will do what they want to do rather than what they are advised to do. The NTHMP needs to take into account that tsunamis represent a multi-hazard, multi-scenario event because of the potential combination of earthquake, hazardous materials, and loss of lifeline consequences. The program also has as its goal to avoid "false," costly evacuations. Attitudes of businesses vary with tsunami, some see it as a liability that needs action and may be a tourist attraction, others have no interest or feel it is a negative thing to make visible in the community.

INVESTING IN COUNTER-TERRORISM: WHAT ARE THE PAYOFFS?

Moderator: French Wetmore, French & Associates, Ltd.

Recorder: Ken Deutsch, American Red Cross

Discussants: Jerry Horner, California State Water Resource Control Board
Tom Zimmerman, Illinois Emergency Management Agency
Eric Tolbert, FEMA/Office of National Preparedness
Michael Byrne, U.S. Office of Homeland Security
Shirley Laska, University of New Orleans

With an increased awareness of the threats of terrorism, all levels of government are seeking ways to protect their citizens while at the same time preserving mitigation efforts for other extreme events. Yet guidance for making wise decisions about effective counter-terrorism and how to compare the relative need for counter-terrorism versus mitigation for other hazards is limited. The problem is exacerbated by difficulties in measuring the benefits of disaster reduction investments and by the broad range of counter-terrorism strategies. How are decisions made about the level of resources to devote to counter-terrorism efforts? How can the performance of counter-terrorism programs be measured? What criteria should be used in deciding to invest in counter-terrorism as opposed to mitigation activities for other hazards? An experienced panel of academicians and local, state, and federal emergency management practitioners addressed these issues and questions.

The discussants made the following key points in response to these questions and issues. First, there are methods, tools and models available to measure the benefits of counter-terrorism efforts and compare alternative programs. For example, the Contingency Valuation Method (CVM) and Risk Based Analysis both produce comparable results. However, both methods are flawed (i.e., the former is theoretically vulnerable and the latter has data problems). Additionally, estimating the payoffs of natural hazards mitigation programs bears a distinct advantage over estimating the payoffs of counter-terrorism programs because of the availability of databases to predict the probability of natural hazards events and measure the effectiveness of programs to mitigate them.

Second, experience has shown that the skills, knowledge, expertise, and principles that are critical to helping the public to prepare for, cope with, and respond to, natural hazards also apply to helping communities prepare for terrorist attacks and other human-made emergencies. For example, strong building codes protect critical facilities and infrastructure from both terrorist attacks and natural hazards. Also, exercises and drills help officials at all levels to determine response capabilities and readiness levels as well as their need for assistance from other organizations. Therefore, the most prudent and cost-effective way to prepare for and mitigate both natural and human-caused disasters is to take a multi-hazard or all-hazards approach. In other words, investment in preparing for and mitigating one hazard will also benefit in preparing for other types of hazards. Thus, while terrorism preparedness poses some very unique and important challenges because it is the only hazard we face that presents an active intelligent opposing force, terrorism preparedness should not come at the expense of natural hazards preparedness.

Third, the real challenge for federal, state, and local leaders and emergency management officials is to take “stove-pipe” programs and integrate them in a multi-hazard, cost-effective, comprehensive and rational way. Doing so is in the best interest of the public’s safety, represents good stewardship, and good accountability of tax expenditures.

In view of all the above, the panel members agreed that it is imperative for the emergency management community to seize the opportunity provided by the increased interest in terrorism preparedness to help the public better prepare for natural hazards. In short, a multi-hazard preparedness strategy is clearly the most effective and efficient way to make our nation safer from and more resilient to all disasters—regardless of their cause.

CELEBRATING FEMA'S PLANNING FELLOWS

Moderator: Cecelia Rosenberg, FEMA/Federal Insurance and Mitigation Administration

Recorder: Lisa Holland, South Carolina Department of Natural Resources

Discussants: Kaori Yoshida, Florida State University

Calah Young, West Virginia Office of Emergency Services

Kaori Yoshida presented an overview of her work, "Hazard Mitigation by Small Business: An Analysis of Factors that Influence Mitigation Implementation and a Pilot Test of Engagement Strategy in Jacksonville/Duval County, Florida." She discussed her two basic research questions—the factors that influence small business owner decisions about hazard mitigation implementation, and how local government agencies can coordinate with other local agencies and organizations and work with public-private partnerships to promote hazard mitigation outreach targeted at small business.

Most of the study respondents do not have an accurate sense about the vulnerability of their businesses. Respondents' perceptions of flood risk were not correlated with independent data on the flood zone classification of their business locations.

Yoshida found that having access to outside mitigation expertise tends to be all or nothing for small business owners. Businesses with access to insurance managers typically also have access to structural engineers, business continuity specialists, and disaster recovery and mitigation managers. Smaller firms are less likely than larger firms to have a business continuity plan (BCP) or to have insurance coverage, as are home-based businesses. Single locations of locally owned businesses are not likely to have a BCP or structural mitigation in place. In contrast, people with previous personal disaster experience are likely to be working at a business with BCP and have insurance coverage. Small businesses that have taken one type of mitigation measure have often taken several measures.

Yoshida found that two significant determinants of mitigation implementation are access to a structural engineer and perceived vulnerability. Two significant determinants of insurance purchase are access to an insurance manager and personal disaster experience. Businesses with access to one type of specialist typically have access to other types of specialists. Not surprisingly, smaller businesses are less likely to have access to specialists.

Generally, government agencies, non-profit organizations, and insurance companies are the preferred sources of mitigation information. When working on mitigation with small businesses, local government should identify grants to fund small business hazard mitigation outreach projects, help owners to access available and needed resources within the community to support such projects, and identify and leverage grants and available resources in the community for establishment and continuance of small business hazard mitigation outreach.

State governments should target “small and impoverished communities,” and projects that may benefit small businesses as criteria for FEMA’s Pre-Disaster Mitigation (PDM) grant program. States should also enhance monetary incentive programs to promote small business mitigation and develop a system to support information sharing and mentoring between local communities to enhance small business hazard mitigation.

At the federal level, FEMA should continue to support the PDM grant program, create a database that is searchable and accessible via the Internet to summarize small business hazard mitigation projects, potential funding sources, community resources, types of programs and projects, and provide complete contact information.

Next, Calah Young presented an overview of her work, “Creating a Role for Regional Agencies in Hazard Mitigation Planning: Workshop on Hazards, Research, and Application.” She discussed her research topics—the regional actions that are already underway to address natural hazards, and the services that local governments need in order to meet FEMA’s local hazard mitigation planning requirements, along with an exploration of how regional organizations could be integrated into state and local hazard mitigation planning processes.

In the Triangle Region, there is minimal local participation in state-sponsored mitigation planning. Because there are infrequent hazard events, there is a low perception of risk. Young conducted an Internet search of regional agency websites for programs related to natural hazards, reviewed existing local comprehensive plans and conducted interviews with local government planners and staff in the Triangle J Region. Young created a typology for classifying Internet sites based on services provided and intended audience. Service provider groups were: public educators, technical advisors, and regional leaders.

Young conducted interviews with representatives of 10 local governments in the Triangle Region and found that there was a multi-jurisdictional approach to mitigation plans, with a good deal of support from consultants because of a lack of technical planning experience, a short time frame and limited resources.

Young made the following recommendations: regional leaders should supervise and coordinate all hazard mitigation planning activities in the region; technical advisors should provide technical services related to hazard mitigation and act as a repository for hazard-related data; and public educators should initiate public awareness campaign for citizens and local elected officials. At the federal level, FEMA should conduct reviews of the regional plans, highlight regionally based hazard mitigation programs in FEMA guidance documents, continue programs that support regional-level mitigation efforts (e.g. Project Impact), and develop guidance materials and training workshops to target regional organizations.

MAPPING THE RISK: NEW INITIATIVES AND TECHNOLOGY

Moderator: Mike Buckley, FEMA/Federal Insurance and Mitigation Administration
Recorder: George Riedel, Missouri State Emergency Management Agency
Discussants: Stephen Leatherman, Florida International University
James Aylward, Harvard Design & Mapping Co., Inc.
Linda Prosperie, Southwest Texas State University

This session focused on new initiatives to map hazardous areas, and technological and collaborative opportunities to create maps.

Mike Buckley reported for John Dorman on what actions North Carolina had taken in response to Hurricane Floyd to identify and revise flood hazards. Hurricane Floyd produced \$3.5 billion in damages and 31,000 jobs were lost. Following Hurricane Floyd, North Carolina became a Cooperating Technical State (CTS) with the Federal Emergency Management Agency (FEMA) to produce new flood maps. North Carolina has developed a state-wide plan for flood maps and has appropriated state funds for new maps.

To date, North Carolina has spent \$35 million on new flood maps. North Carolina is using three elements for the state plan: Airborne Laser Altimetry Technology (LIDAR), a Geographic Information System (GIS), and Geospatial Data. LIDAR has been produced for the entire state. The next step for the state is to establish a flood warning system using the new flood data.

Stephen Leatherman presented on LIDAR. High-resolution topographic data are essential to mapping and mitigating coastal flooding and erosion hazards. LIDAR allows for rapid and inexpensive topographic surveys of large coastal areas. The International Hurricane Center (IHC) at Florida International University in concert with the University of Florida was the first university in the U.S. to purchase an airborne laser.

This new high-tech system employs microcomputers, laser-ranging technology, and a global positioning system (GPS) mounted in a small aircraft to provide the necessary topographic information for predicting storm damage and flooding. The laser data are accurate to within 6-8 inches, compared to 5-10 feet with the United States Geological Survey (USGS) maps.

FEMA has spent over \$1 billion acquiring topographic data for coastal and riverine floodplains of the U.S. in order to generate 100-year flood maps. But these data are often dated and may quickly become inaccurate for coastal areas because of rapid urbanization and changes in beach and dune dimensions.

Leatherman gave examples of how LIDAR has helped communities in planning efforts (Broward County, evacuation plans and Vero Beach, coastal erosion). LIDAR may even be used to do damage assessments to buildings after a disaster.

James Aylward reported on the Multi-Hazard Mapping Initiative (MMI) sponsored by FEMA and NOAA. MMI incorporates advanced interoperability technology that enables it to access various types of GIS data available on the Internet, and then combines these data into a single map view. This system will allow opportunities to share data and hopefully prevent the duplication of data. The public version of MMI is available at: <http://www.hazardmaps.gov>.

MMI has been extended to the proposed Department of Homeland Security. MMI will have the ability to access specific data from multiple agencies to provide a coordinated view of historical and potential natural and human-made hazard data.

Linda Prosperie discussed how improvements in technology and visualization techniques and tools aid in the interpretation of research data and facilitate the communication of new discoveries. The research described by Prosperie is in direct response to a broader application of technological advances for future accomplishments in volcanic hazards mitigation research. Prosperie's studies focus on three objectives: 1) to demonstrate the utility of the National Land Cover Data (NLCD) for hazard mitigation visualization, particularly volcanic hazards; 2) to illustrate how visualization (not just cartography) is needed to transfer information—such as from site, socioeconomic, event and impact information—to policy-makers and the public; and 3) to invoke the visualization process by synergistically combining graphics, tables, maps, GIS layers, and qualitative data into models for hazard specialists and the public. These three research objectives were achieved using a systematic approach and the NLCD to visualize flow and tephra fallout hazards from Mount Rainer.

CEMENTING PARTNERSHIPS: NOW THAT WE HAVE THEM, HOW DO WE KEEP THEM?

Moderator: André Le Duc, University of Oregon

Recorder: Rory Connell, University of Delaware

Discussants: Diana McClure, Institute for Business & Home Safety

Don Markle, Blue Sky Foundation

Kathy Lynn, University of Oregon

Suzanne Frew, The Frew Group/Science Applications International Corporation

In his introduction, André Le Duc proposed that successful partnerships with public, private, and academic organizations must include communication, understanding, common ground, trust, and respect. Le Duc asked the panelists to address three aspects of partnerships: 1) how partnerships are established and sustained; 2) how public and private partners lead to long term actors; and 3) the limitations that exist in public and private partnerships.

Diana McClure related her experiences with partners in the Institute for Business & Home Safety Showcase States program. The Showcase States program utilizes public-private partnerships, education and outreach, and action to make homes and businesses safer from natural disasters. In addition to echoing Le Duc's sentiments on respect and communication, McClure stressed that sustaining partnership interest is key to cementing partnerships. This involves developing a strong and clear mission statement that incorporates both long-term goals and short-term successes. McClure also noted that programs often have to establish credibility in order to attract partners.

Don Markle is with the Blue Sky Foundation, a non-profit organization that encourages hazard resistant construction. Markle stressed the importance of a strong education initiative in maintaining and developing partners. Similar to McClure, Markle noted the value of having short-term successes and benefits in order to maintain partnerships and sustain momentum.

Kathy Lynn discussed her experiences with partners, specifically through her involvement in the Oregon Showcase State Program. Lynn noted that common objectives, shared successes, and long-term benefits are keys to attracting partnerships to a program. Lynn observed that it is important to frame projects and activities in a language or perspective that organizations can understand. Lynn noted several limitations of partnerships, including funding difficulties, problems with authority structure, and difficulties in attracting and maintaining the interest of community members in hazard related programs.

Suzanne Frew provided a case study of partnerships in her work with the Pacific Rim. Because the Pacific Rim is a huge geographic area with many risks, Frew remarked that there is the potential for significant social and economic losses in natural hazard events. Frew stressed the importance of developing a strong memorandum of understanding with partners. Frew also noted that hazard programs must publicize and celebrate initiative successes and the contributions of partners.

BENEFIT/COST: DOES MITIGATION MATTER?

Moderator: Robert Hirsch, U.S. Geological Survey
Recorder: David Applegate, American Geological Institute
Discussants: Tom Tobin, Tobin & Associates
Philip Ganderton, University of New Mexico
Katie Lessard, Institute for Business & Home Safety

Robert Hirsch began the session by noting that both public and private enterprises are expected to justify their value, and mitigation projects are no exception.

Tom Tobin discussed a congressionally mandated study to assess the future savings from various types of mitigation activities. Entitled *The Benefits and Costs of Mitigation*, the study is being carried out by the Multihazard Mitigation Council of the National Institute of Building Sciences under contract from FEMA. The study panel includes individuals with backgrounds in engineering, law, science policy, disaster relief, sociology, economics, and land-use planning. The panel divided mitigation activities into process-oriented (those that lead to policies, practices, and projects to reduce risk) and project-oriented (such as building relocation and structural retrofit). The study is taking two related tracks, one involving empirical testing of activities in varying risk contexts with nationwide sampling, and the other involving a qualitative approach to evaluating all mitigation activities in a smaller sample of communities. The compiled results will use both monetized and actual values, aggregated in ways to interest various decision makers.

Philip Ganderton spoke from an economic perspective on the current state of cost-benefit analysis and areas where both economists and practitioners should be looking when asking for such analyses to be done. Ganderton suggested that the best ingredient in any analysis is a healthy dose of skepticism. He also noted that cost-benefit analysis is undertaken in many different ways and at many different levels of government. While such analysis is an important input into public and private decisions about mitigation, it is only an input, not the decision itself. Rather, it is a way to defend decisions. One of the most difficult challenges is monetizing indirect costs and benefits, and economists have come up with controversial methods to make estimates. Choice modeling is becoming increasingly popular as an alternative to contingent valuation in evaluating non-market values.

Katie Lessard provided an insurance industry perspective on mitigation benefits, loss estimation techniques, and use of HAZUS models to support cost-benefit analysis. The Institute for Business & Home Safety (IBHS) is using HAZUS to quantify the net benefits of its model building code and *Fortified...For Safer Living* programs. Using the relative loss estimation capabilities of HAZUS makes it possible to compare building types and estimate the effect of replacing one with another. By comparing the response of different building types at different spectral accelerations (i.e., the structure-dependent response due to earthquake ground motion) it is possible to consider how to reduce losses at all levels of ground shaking, not just for high-level shaking that building codes are designed to address. IBHS is using the information derived from HAZUS to quantify losses caused by technical changes in the model codes and for development and refinement of *Fortified...for Safer Living* criteria. IBHS will also use this information for new programs to fortify businesses and prioritize future retrofit activities.

RESILIENCY: INTEGRATED APPROACHES TO SUSTAINABLE MITIGATION

Moderator: Jim Johnson, U.S. Army Corps of Engineers
Recorder: Jane Bullock, Bullock & Haddow
Discussants: Arrietta Chakos, City of Berkeley, California
Clancy Philipsborn, The Mitigation Assistance Corporation
Priscilla Nelson, National Science Foundation

Jim Johnson opened the session by discussing how the concept of sustainability is being incorporated into the philosophy of operations at the U.S. Army Corps of Engineers (USACE). The USACE has revised its guidance on acceptable projects to promote balancing economics and the environment to achieve sustainability. To achieve this balance, a collaborative process must be employed which allows the entire range of stakeholders to play a role in the decision-making process.

Arrietta Chakos gave a brief history of the investments Berkeley has made since the 1989 Loma Prieta Earthquake to create an environment that addresses the hazards Berkeley faces and to be ready for the next earthquake. Berkeley has approved six special tax measures to rebuild/retrofit schools, firehouses, and other public buildings. It has created incentives that have resulted in the retrofit of 40% of the 23,000 single-family homes in the city. Chakos emphasized that these programs haven't been easy. Sustainability is not easy, even in Berkeley where there are politically active citizens and an educated, strong technical base to draw on from the university. The key factors to making mitigation programs work are continued public awareness, development of partnerships, and political will. Berkeley's new general plan that was adopted this year includes disaster resistance as a community goal, and provides the policy framework to institutionalize the concept throughout the government. To meet the challenge of continuing to move forward, Chakos believes you need to cultivate community champions, maintain a motivated program staff, take advantage of technical advisors, and continue to support partnerships.

Clancy Philipsborn began his remarks by defining the principles of sustainable development:

- maintain and enhance the quality of life
- enhance economic vitality
- promote social equality
- enhance the environment
- incorporate disaster resilience

Philipsborn then discussed what is needed to put these principles into practice. It requires local endeavor, using the principles as decision-making criteria, incorporating them into what communities are already doing, and providing technical assistance to educate and implement the principles into a community. Philipsborn contends that sustainability is not occurring internationally and is rarely occurring in the U.S., although significant good mitigation projects are being undertaken. A variety of factors contribute to this, including the post-disaster mentality of returning to normalcy as quickly as possible, lack of community understanding of what

sustainability is, and internationally, a lack of infrastructure and funding. Philipsborn believes that to promote sustainability we need to incorporate it into what a community is already doing, create the political will, and support the application of existing models. Some immediate actions that would enhance sustainability are: 1) change the formulae for benefit/cost to account for sustainable “benefits,” 2) capitalize on the aging infrastructure crisis to incorporate the principles, 3) enforce existing authorities, and 4) make sustainability a condition of disaster assistance.

Priscilla Nelson discussed the latest developments in the National Science Foundation (NSF) programs supporting loss reduction, rapid response, and technology leading toward a sustainable society. The network Earthquake Engineering Simulation project (NEES) was developed through a collaborative process within the earthquake engineering community to define testing equipment needs. NSF has expanded the concept beyond equipment to include collaboratively networked facilities. NSF supports knowledge on rapid response through the Earthquake Engineering Research Institute (EERI) Learning From Earthquakes project, National Earthquake Hazards Reduction Program (NEHRP) and others. The future goal for NSF in this area goes beyond earthquakes to develop a coherent plan for inside and outside NSF for any extreme event or disaster.

To support a sustainable society, NSF is promoting internal collaboration between its engineering directorate and the social, behavioral, and economic sciences directorate. Nelson stated that this is a major step forward as NSF makes it clear to its grantees that they expect to see a similar collaboration for funding of projects. Current NSF support is concentrated in the areas of dynamic modeling, information technology systems and multi-discipline databases, societal response and risk management, interdependencies, and education and workforce training. The joint NSF ENG/SBE program will be expanded in fiscal year 2004 to concentrate on: 1) extreme events and complex systems, 2) organization sciences, 3) risk, decision, and uncertainty, 4) centers, and 5) data and education. Nelson concluded her remarks with a very interesting discussion of the concept of the window of ambiguity as an idea to be considered when calculating the time of recovery.

ROUNDTABLE ON LAND USE AS A MITIGATION TOOL AND THE 10 MOST NEEDED RESEARCH QUESTIONS: SESSIONS I AND II

Moderator: Diana McClure, Institute for Business & Home Safety

Recorders: Paula Gori, U.S. Geological Survey (I);
Janet Kennedy, City of Berkeley, California (II)
Diana McClure (transcriber)

Discussants: Buzz Baldwin, Hartford Financial Services Group
Ray Burby, University of North Carolina, Chapel Hill
Steven French, Georgia Institute of Technology
Suzanne Frew, The Frew Group/Science Applications International Corporation
Nan Johnson, City of Boulder (CO) Planning Department
Robert Parker, University of Oregon
Alka Sapat, Florida Atlantic University
Gavin Smith, Durham Technologies, Inc.
Tom Tobin, Tobin & Associates

Session I: Roundtable Presentations

The Land Use Committee of the Institute for Business & Home Safety (IBHS)—an initiative of the insurance industry to reduce injuries, deaths, property damage, economic loss and human suffering caused by natural disasters—organized a two-session roundtable to generate costs, benefits and losses avoided research regarding land use as a natural hazards mitigation tool. The roundtable brought together insurers, practitioners, and researchers to begin to develop the *Ten Most Needed* research questions, which would:

- respond to key results from the IBHS *Community Land Use Evaluation* survey on natural hazards, conducted in 2001, with the help of the American Planning Association and the American Institute of Certified Planners, and;
- lead to a better understanding of how incorporation of natural hazards into development and redevelopment decisions can reduce social and economic losses from a natural disaster.

The discussants were encouraged to answer the following questions in order to develop a preliminary list of research questions which, when answered, could be used to build public and private sector demand for land use planning as a mitigation tool, and inform the insurance industry about how safe development can reduce losses:

- What are the best methods available to meet the needs of local land use and development decision makers to determine the benefits and costs of alternative land uses in hazardous areas and to foster greater understanding of land use planning as a meaningful mitigation tool?
- How can the benefits and costs of alternatives to development be compared with the benefits and costs of so-called “safe development” of hazard areas based on regulation of building design and construction materials?

- What has worked in the past to convince diverse interests of the benefits of safe land use policies, and how have benefits and costs been defined and applied?

The following research questions were developed by the discussants:

Buzz Baldwin—Which hazards would see the greatest loss reduction or contribute to the greatest damage reduction over time, if planning included hazard mitigation in the process?

Issue: Insurers need to see a quantifiable relationship between safe development and safe land use practices and a reduction in insurance claims in order to become stronger advocates of land use as a mitigation tool. To the extent land use decisions reduce future insured losses, those impacts could be reflected in the loss cost portion of ratemaking.

Nan Johnson—Are there case studies of communities or regions where policymakers decided before a natural disaster how much financial responsibility they would bear and how much the citizen, homeowner, and businessperson would bear? How was that decision communicated, understood, and implemented? Did that shift of financial burden change behavior before the event?

Issue: The assumption—and often the reality—that “someone else” will bear the cost of recovery keeps governments, homeowners, and businesspeople from taking mitigation action.

Ray Burby—What kinds of costs does development in hazardous areas impose on local governments above and beyond existing costs of providing infrastructure and services for that development? How does location in hazardous areas affect the revenues to local government? Is there a big enough change in fiscal outcomes of development proposals when costs and revenue implications of hazards are analyzed to make the fiscal impact assessment worthwhile?

Issue: Fiscal impact assessments are part of the decision-making process for development proposals, but do not typically include the impact of natural hazard events. If procedures could be developed to include hazards, local governments could justify steering development to hazard-free locations when costs outweigh the benefits of development.

Suzanne Frew—How does the changing face of America impact land use planning and risk reduction? How can diverse populations be incorporated into community planning and review processes?

Issue: If planners stick to the traditional risk review process, based solely on regulatory compliance, the broader questions of how to meet the needs of an increasingly diverse population (racial, ethnic, language, physical disability, lifestyle) and how to integrate them into community planning and review processes will not be addressed.

Tom Tobin—What policies can be included in land use plans that empower building officials to have significant quality control over the construction process?

Issues: Community values influence decisions about development – if disaster safety is attached to important values such as affordable housing, there will be community buy-in. Construction quality and code enforcement are the keys to reduce earthquake losses, and plan policies need to provide the value required to offset mitigation investment (e.g. increased density along with meeting earthquake construction standards).

Robert Parker—What collaborative tools and techniques are effective to get mitigation plans adopted *and* implemented?

Issue: Collaboration among many public and private sector partners works to develop mitigation plans, but often is not sustained during implementation. Implementation architecture to maintain collaboration through implementation is necessary, such as the structure provided by *Partners for Disaster Resistance: Oregon Showcase State*. A non-regulatory, collaborative approach to build support for mitigation is necessary to address property rights and “takings” concerns.

Alka Sapat—What are the main political constraints that arise when mitigation tools such as land use or building codes are being considered, and what are some ways to get around those constraints?

Issues: Short-term, political considerations affect policy formation, and long-term benefits are often ignored or not rewarded in the political and administrative arenas. Interest groups, policy entrepreneurs (catalysts), and/or advocacy coalitions have a major influence on policy development and implementation. Mitigation advocacy coalitions, such as IBHS, could set mitigation agendas and formulate policy before a disaster, so that policy is not crisis driven.

Gavin Smith—How can states and communities meet the intent of the Disaster Mitigation Act (DMA) of 2000, given the current federal, state, and local capability and capacity to meet the Act’s requirements?

Issue: DMA 2000 requires local and state governments to do more before a disaster strikes to lessen the impact of natural hazards, but FEMA and state and local governments do not have the capacity and capability to meet all those requirements. A realistic capability assessment should guide state and local plan development, and compliance with DMA 2000 evaluated pragmatically.

Steven French—What is needed to motivate local elected officials to adopt and implement land use planning as a hazard mitigation technique?

Issue: Local elected officials are the weak link for adoption and enforcement of land use plans. Understanding the context of a community and choosing appropriate strategies to influence them is essential—e.g. use of hazard/vulnerability information; benefit/cost information; increasing public demand; emphasizing state and federal mandates, etc.

Session II: Research Questions and issues raised by the audience

Following a summary of Session I by the moderator, the audience formulated additional questions. Discussion centered around five basic concepts: property rights and legal issues; public information; political and social issues/realities; incentives; and insurance and mitigation.

Property rights and legal issues

Q: Does multi-hazard mapping affect property values?

Many other factors affect property values. Also, it depends on when mapping is introduced during real estate transactions.

Q: What is the liability of the political entity that “knows or should have known” if the risk is not shared with property owners?

In California, mapping fault zones has been challenged, not upheld in courts.

Liquefaction or soft-story could be challenged. There is currently limited coordination between city attorneys and planners, and attorneys need access to this information.

Q: How can large state institutions be influenced or regulated to comply with local policy?

Examples from Boulder, Colorado and North Carolina demonstrate the difficulty of compliance. Suggested interventions include sharing information with those affected, which may lead to public demand and political change.

Public Information

Q: What are inconsistent messages presented by different levels of government that impede understanding of risk and need for behavior change?

Inconsistency of message (government or insurance will help you recover vs. “you should take care of yourself and mitigate.”) Everyone “plays the game.” Must create/support consistent messages.

Political and Social Realities

Q: How can communities access and utilize expertise to help them comply with DMA 2000? What if DMA 2000 requirements and the findings of the net societal benefits research contradict each other?

Use of a three-tiered approach—state, regional, and local planning—will pull in range of expertise. FEMA can provide guidance and they evaluate compliance with DMA 2000 in a site-specific manner that is based on local capacity and capability. DMA 2000 requirements and research on net societal benefits are different and serve two different purposes.

Q: How do we sustain capacity for mitigation?

North Carolina used state resources for mitigation in 1990s, but those resources are no longer available. States have responsibility for their internal public health, safety and welfare, and therefore should apply their own resources.

Q: What constitutes a state or local issue or interest? What constitutes a federal issue or interest?

Planning is a local responsibility, but there is a larger public interest in safety, which justifies expenditures at the state or federal level. It is unclear where the line should be drawn.

Q: Is election reform necessary to institutionalize hazards into planning?

Elected officials receive campaign donations from powerful interest groups. Some municipalities, Broward County, Florida, for example, legislate against that. There is an alternate view that election reform will not address disparities between who benefits from development (builders) and who pays later for disasters (homeowner and taxpayers)

Q: Should mitigation be related to social values?

Wealthy homeowners are building disaster-resistant homes (along coastlines, for example) and they also receive benefits of taxpayer-funded projects such as beach nourishment. Land use policy needs to benefit those with fewer resources or less choice about living in high-hazard areas.

Q: Should benefits/costs definitions be broadened?

Social displacement, homelessness following disaster, psychological trauma, placement of socially and economically vulnerable people in high hazard areas will incur future costs. Land has a symbolic and emotional value, and decisions are based on those values as well. These variables need to be included in risk assessment.

Incentives

Q: What market-driven incentives could be utilized to reward safe development?

Developers should pay more for building in high hazard areas and should be rewarded for safe development

Q: Should risk-averse behavior be rewarded through state regulatory process, such as energy conservation?

Through rate structures, insurance commissioners could reward safe development or construction

Q: How effective are incentive programs?

Compare experience in Australia, where those living in high-hazard areas are responsible, with U.S. experience. What could work in U.S.?

Insurance and Mitigation

Q: Could insurance companies use their own data to justify or reward policyholders for safety? Could insurance trust(s) be formed that collect fees for development in hazardous areas and provide incentives for safe development?

State insurance regulation dictates much of what can be rewarded, and companies do not have the kind of data needed to evaluate broader land use policy and its relationship to individual properties.

INFORMATION INTERRUPTUS: LIMITING ACCESS TO DATA AND RAMIFICATIONS FOR HAZARD MITIGATION

Moderator: Deb Thomas, University of Colorado, Denver
Recorder: Jamie Mitchem, University of South Carolina
Discussants: Mike Buckley, FEMA/Federal Insurance and Mitigation Administration
Sarah Michaels, University of Waterloo
Robert Hirsch, U.S. Geological Survey

This session addressed the impact of limiting data, especially post-September 11, on hazards mitigation. Limiting access to sensitive data (e.g., dam inventory data, drinking water intakes, nuclear power plants, etc.) may be good for national security, but can have negative consequences as well, particularly for the hazards research and mitigation community. The ramifications of limiting sensitive data and some possible criteria for determining what data is in fact “sensitive” were major themes throughout the session.

Deb Thomas presented several reasons why data may not always be available on the Internet. However, there are legal requirements for the availability of certain data including the Freedom of Information Act, Open Records Laws, and Community Right-to-Know Guidelines. Balancing these provisions with confidentiality, privacy, and homeland security is a problem that must be resolved. Finding the right combination of information availability and security is currently not clear-cut.

Mike Buckley defined “sensitive” data as unclassified, potentially harmful data that can be used for destructive purposes. Unfortunately, there are currently no standards or procedures to define what data is sensitive and what is not. Buckley also talked about the opposing forces of the Chemical Security Act, and the Community Protection from Chemical Terrorism Act, which create a dilemma over whether the public (and mitigation planners) should be aware of chemical risks or if chemical data is too sensitive to be released. Finally, the role of the media in homeland security and the potential need for censorship were discussed.

Sarah Michaels addressed the consequences of interrupted information flows for hazards mitigation. Michaels showed that determining information needs helps delimit what information is missing and how essential that data is. When data is missing, people often use what is available, even if it is not ideal, a concept that Herb Simon called “satisficing.” Michaels also classified the likelihood of seeking out alternative sources is based on how people intend to use information. The recent data restrictions may allow us to find a better format for providing data to mitigation planners in the future.

Robert Hirsch described some problems the U.S. Geological Survey has encountered with providing data on the Internet. These potential information interrupts include holes in security, viruses, hackers, lawsuits, high demand, and ironically, natural hazards (e.g., Hurricane Fran). Hirsch also discussed the Safe Drinking Water Act, which focuses on getting information to the public and how the American Waterworks Association's concern about the data availability caused the FBI to enforce the destruction of data CDs at several large university libraries. This event captured lots of attention from librarians and the media. Hirsch also noted that the EPA may soon be creating a data policy.

A very active question and answer session followed, with many more questions than answers. There was concern that the general public is uselessly inconvenienced by data restrictions because terrorists have alternative means of locating critical structures. Some discussants conceded that there might be some overreaction, but that these policies might yield guidelines for data restriction processes. Some questioned the effectiveness of restricting data that has been public on the Internet because it has probably been downloaded already. Also, others suggested that businesses might rely too much on the Internet.

Nobody wants to have a website that terrorists end up using, and many agencies err on the side of caution. However, we may be entertaining the fantasy of controlling the uncontrollable. If removing data makes us more vulnerable, whose interest does it serve? Is it possible that our freedoms are being used against us? The purpose of terrorism is to instill fear and disrupt normalcy, which may be exactly what is occurring. There was general consensus that the session posed more questions than solutions and that further discussion is needed, particularly in the hazards community.

INFRASTRUCTURE: THE KEY TO VULNERABILITY

Moderator: Stu Nishenko, Pacific Gas and Electric

Recorder: Jim Murphy, Michael Baker, Jr., Inc.

Discussants: John Porco, Michael Baker, Jr., Inc.

Jan Benini, U.S. Department of Transportation

Ed Laatsch, FEMA/Federal Insurance and Mitigation Administration

Rick Sloan, Pima County (AZ) Wastewater Management

Dave Seaver, Pacific Northwest National Laboratory

Stu Nishenko opened the session by saying that protection of critical infrastructure is a concern with both natural and human-caused hazards. The lessons learned from one can frequently be applied to the other. Questions to be addressed by the participants were:

- What are the similarities between natural and human-caused hazards related to infrastructure?
- What actions are being taken?
- What role does risk management play?
- How do we measure success?
- What impediments/incentives are there to mitigation?
- What research needs to be conducted?

Jan Benini spoke about the 4,000,000 miles of roads, 600,000 bridges, and over 400 major airports that need protection from human-caused hazards and terrorism. Much of the work done for natural hazards will apply to terrorism. Examples are seismic retrofitting for bridges, guidelines to protect buried pipelines, and SCADA systems for airports. New issues arising from terrorism include how much passengers can be inconvenienced; detection of chemical and biological hazards and the associated problems with false positives; what sensitive but useful information can be released to the local people who need it, but do not have clearance; and the cost of providing protection.

Benini identified the following research needs: effective benefit/cost processes, sensing chem/bio agents and decontamination (how clean is clean), and processes for large-scale evacuations/quarantines.

Ed Laatsch said that FEMA is working with American Society of Civil Engineers (ASCE) and other organizations on the American Lifelines Alliance (ALA). The Alliance's basic mission is to improve lifeline performance during disaster events be they natural or human-caused. This is done by identifying the status of the specifications, guidelines, and design requirements in the industry and determining what gaps may exist. Once identified, the ALA works with the appropriate industries and "standards committees" to fill those gaps. Recent examples of success include: the seismic fragility standards with American Society for Testing and Materials (ASTM), the ice load map for the eastern U.S. with ASCE, and the guidelines for buried steel pipes with the American Society of Mechanical Engineers (ASME).

One issue with the transition from natural to human-caused hazards is the lack of guidelines and standards that exist for human-caused hazards. One of ALA's partners, Baker Engineering, just completed a compilation of the manmade hazard standards for cyber, blast, biological, chemical, and radiological threats. There are many gaps and frequently information is classified. Laatsch said that future activities for the ALA include: design guidance for power, wastewater, and oil and natural gas pipelines.

Rick Sloan noted that wastewater system vulnerability analysis is advancing rapidly. A good checklist can be found at <http://www.amsa-cleanwater.org>. Sloan listed the following security issues that need to be addressed: passwords for databases; manhole protection; monitoring of SCADA systems; and automatic contamination sensing, diversion and holding capabilities. Other challenges include how to protect people without letting them know the actual threat, "crying wolf," and making use of previous lessons learned from dealing with natural disasters.

Sloan believes that research opportunities on this topic include: automated sampling and detection systems, line of site communications requirements, and SCADA system protection.

John Porco said that the water utility industry is vulnerable to natural hazards, hazardous material releases, and terrorist or criminal intervention. Much of what has been done for natural hazards protection is transferable. Recent actions to address the homeland security issues include EPA grants for vulnerability analyses and legislation such as H.R. 3448 that requires a water system vulnerability analysis for water systems serving more than 3,300 people. The Sandia Risk Assessment methodology will be useful. Porco remarked that one major new challenge for water system operators who respond to a terrorist incident will be that it will be a crime scene and evidence must be preserved.

Impediments to moving ahead include cost, inadequate research into biological and chemical agents, and our open culture in this industry. However, the need to protect the public is an incentive to overcome this impediment.

Dave Seaver focused on questions such as how do "infrastructure decision makers" make decisions related to natural and terrorist mitigation activities and what gets funded? Pilot studies with PG&E and Caltrans provide some insight. Risk management techniques can be used for both types of hazards. In addition, training and exercises are similar for both natural disasters and terrorist threats. For terrorism, however, prevention is also an issue.

Seaver believes that politics frequently carry greater weight than B/C analysis in implementing mitigation projects. Also, the temptation to act quickly and provide a rapid solution may not be as cost effective over the life of a project. The "do-something syndrome" is a real issue.

In the discussion following the presentations, the following issues/questions were raised:

- There is a need to get critical information in the hands of the people on the ground. Declassification is a real issue.
- Who is in charge during a terrorist event? A potential problem is how to weigh the need to get a utility up and operating versus the need to preserve evidence.
- What training needs to be provided to operators of infrastructure?
- Who is responsible for cargo at ports and harbors?

THREAT-LEVEL SCALES AND STANDARD TERMINOLOGY FOR IMPROVING ALERTS, ADVISORIES, AND NOTIFICATIONS

Moderator: Peter Ward, The Partnership for Public Warning
Recorder: Chris Adams, California Governor's Office of Emergency Services
Discussants: Rocky Lopes, American Red Cross
John Sorensen, Oak Ridge National Laboratory
Ellis Stanley, City of Los Angeles (CA) Emergency Preparedness Department
Dennis Wenger, National Science Foundation

Effective warning systems have long been an issue in hazards mitigation, and the new homeland security advisory system again raises questions about the generation and delivery of timely warnings and critical information regarding threat levels. How does this new system relate to other methods of risk communication? What information is needed to alert people effectively to an imminent terrorism event? Can standard warning terminologies be developed for natural disasters, accidents, and acts of terrorism?

Rocky Lopes described the American Red Cross (ARC) system designed to tell people what homeland security system colors/alerts mean, and what actions they should take. Individuals and families must decide for themselves—the alert does not tell people what to do, but rather individuals, families, schools, and businesses respond to choices. The ARC systems presents specific information targeted at different groups. The report was presented to the President in late July.

John Sorensen and Peter Ward visited the White House to address the question of what can be done to increase response to warnings that have been issued. Sorensen and Ward made three recommendations: issue frequent warnings; include the threat content; and clearly identify the hazard and what action is recommended. Sorensen made the point that people do not remember threat advisories and therefore they must be repeated.

Dennis Wenger discussed a warning workshop that was taught by Ward. The workshop was successful, and a summary document was produced. Wenger encouraged the audience to submit basic research proposals to the National Science Foundation for work and research on warnings.

Wenger also described the difference between a mass communication model and a model of individual communication. An example of a mass communication model is an anti-smoking campaign, in which dire consequences are presented to the individual through the venue of mass media communication and public attention. Advertisements are different from warnings. During Hurricane Hugo, a number of neighborhoods received evacuation-warning messages. Despite receiving the same message, the number of people who evacuated ranged from 10-90%. Researchers found that the difference in response centered on the sense of attachment in a given neighborhood to the place, and to each other.

The final speaker was Ellis Stanley, who discussed the long-term efforts required to establish effective communication among all the partners and organizations required to respond to a catastrophic event. Many of the changes that were initiated following the Northridge Earthquake are still in the beginning phases. Stanley recognized that for partnerships to be successful, a strategic plan is needed that can anticipate the impact of an event and plug the required fix into an existing warning system. Stanley raised the issue of how to deal with those people who do not respond to warning messages. “Joe Public” has a single focus on himself, his family, and his home. This is the area where the mass communication model could be useful.

The ensuing discussion addressed the issue of false warnings and rumors versus official response. Public policy decision-makers do not have control of the warning system—mass media has a greater impact than a public warning system. The old style warning system of sirens is no longer effective and new partnerships for public warning need to be forged. GIS is an example of an excellent tool with limited distribution and access due to the high cost of startup and system maintenance. It would be most effective to target for effect rather than to scare the entire population. There must be recognition of the costs that warnings have on individuals and businesses, and of the impacts of false warnings. Furthermore, there must be a clear distinction between “informational” and “take action” messages.

DISASTER POLICY: WHAT SHOULD IT BE?

Moderator: Dan Alesch, University of Wisconsin, Green Bay
Recorder: Steven Stehr, Washington State University
Discussants: Margaret Lawless, FEMA/Federal Insurance and Mitigation Administration
 Susan Ude, Minnesota Housing Finance Agency
 Michael Armstrong, ICF Consulting
 David Godschalk, University of North Carolina, Chapel Hill
 Frank Koutnik, Florida Division of Emergency Management
 Dick Krajeski, Presbyterian Church USA

This session was convened to open a collaborative discussion of what can be done to improve national disaster policy and the impact it has on the states and local communities, as well as on the people it is intended to help. Several common themes emerged during the opening statements of the panel members and informed much of the ensuing discussion. Overall, current disaster policies:

1. Rely too much on intervention by the federal government. Communities and citizens need to take more responsibility (for example, through more aggressive mitigation measures) for preparing for and responding to disasters. The nation cannot afford to “rescue” every victim.
2. Should focus on community resiliency (e.g., the ability to bend without breaking). This focus could be used to link natural disaster mitigation plans with counter-terrorism efforts.
3. Should be implemented with an increased emphasis on collaboration, integration, and mutual respect between emergency and non-emergency personnel such as city planners, the volunteer sector, the business community, and other government agencies that do not have disaster preparedness as their main focus but whose decisions affect the hazard-scape.
4. Should focus on mitigation and providing stronger incentives that prevent rather than respond to disasters. These mitigation measures should be based on accurate and high quality data.

The audience raised several questions: How can we break the cycle of political pressure that induces the federal government to respond quickly and comprehensively to every disaster? Have we created a disaster “welfare state?” Should disaster policy take into account that some people choose to live in vulnerable locations? How best can government fulfill its central function as the protector of public security? Should “mitigation impact statements” be required as part of the community planning process? Should we create “mitigation extension agents” to assist local communities? Will natural disaster planning become a “step child” of homeland security?

The speakers and audience were in agreement that current national disaster policy is counter-productive. More emphasis should be placed on empowering community level partnerships between public agencies and local policy makers, the private sector, and the volunteer sector.

EMERGING RESEARCH AND PRACTICE IN DISASTER MENTAL HEALTH

Moderator: John Clizbe, American Red Cross

Recorder: Deborah Riopelle, UCLA Center for Public Health & Disasters

Discussants: Jerry Jacobs, University of South Dakota

Robert Hayes, American Red Cross

George Everly, International Critical Incident Stress Foundation/Loyola College

This session focused on recent practices and research findings in the area of disaster mental health, and examined areas in which disaster mental health services need further assessment. In general, disaster mental health refers to post-disaster response for people directly and indirectly impacted by a disaster and community mental health issues and preparedness (i.e., risk communication).

There was discussion about the usefulness and theoretical underpinnings of research findings in the area of disaster mental health. Overall, early intervention is better than later intervention. However, successful intervention is often contingent upon the training and experience of the therapist. Licensed and experienced practitioners can respond appropriately, and can effectively read the signals of those needing help. In some instances, one-on-one debriefing or counseling is not effective and, depending on the practitioner, it may even be harmful. Small group debriefing, such as Critical Incident Stress Debriefing (CISD), has been found to be effective, and may reduce alcohol use and other stress reduction symptomatology. Critical Incident Stress Management (CISM) appears to be effective as well.

Research in disaster mental health is complicated. However, we must continue to scientifically evaluate the effectiveness of disaster mental health interventions. Issues that need to be addressed in future research include:

- *Standardization of definitions and measures.* Conflicting research results are often due to differing definitions and measurement standards. We need to be very clear about what is being done, and how and what is being measured. Intervention definitions should include information on what is done, when it is done, and who does it. Are there other criteria or measures besides post-traumatic stress disorder? Should long-term outcome measurement be included?
- *Study design.* It would be very useful to have studies that use repeated measures and/or random assignment to multiple interventions. Both quantitative and qualitative assessments should be undertaken. Replicability is also an important issue.

The body of disaster mental health research suggests the following: disaster mental health interventions should be matched to the needs of the situation and the population. Moreover, to be most successful, interventions should be phasic, multi-componential, and integrated.

Robert Hayes shared some of his experiences with the Red Cross as a responder to the events of September 11. Some of the major organizational challenges in responding to the Pentagon site included:

- The number of people, not just those at or near the site, who were emotionally impacted by the event.
- Coping with spontaneous volunteers, many of whom only wanted to help at “Ground Zero.”
- Giving assistance in areas with strong security measures and a significant FBI presence.
- Fielding advice from many outside sources about how to do things differently.
- Counseling disaster response workers to take care of their own needs (rest, emotions).
- Family members wanting to enter the sites.
- The multitude of players.

In closing, lessons learned from the events of September 11 about mental health intervention strategies included:

- Current models worked well, even in difficult and new situations.
- Responders appreciate the visible presence of mental health workers, regardless of whether or not they use their services.
- People are surprisingly open to getting psychological support.
- Interventions should be visible, available, and low key as well as conducted in a more private manner.

ROUNDTABLE ON LAND USE AS A MITIGATION TOOL AND THE 10 MOST NEEDED RESEARCH QUESTIONS: SESSIONS I AND II

Moderator: Diana McClure, Institute for Business & Home Safety

Recorders: Paula Gori, U.S. Geological Survey (I);
Janet Kennedy, City of Berkeley, California (II)
Diana McClure (transcriber)

Discussants: Buzz Baldwin, Hartford Financial Services Group
Ray Burby, University of North Carolina, Chapel Hill
Steven French, Georgia Institute of Technology
Suzanne Frew, The Frew Group/Science Applications International Corporation
Nan Johnson, City of Boulder (CO) Planning Department
Robert Parker, University of Oregon
Alka Sapat, Florida Atlantic University
Gavin Smith, Durham Technologies, Inc.
Tom Tobin, Tobin & Associates

See S02-15.

REMOTE SENSING: NEW TECHNOLOGIES FOR DISASTER MANAGEMENT

Moderator: Levin Lauritson, National Oceanic and Atmospheric Administration
Recorder: Jim Buika, Pacific Disaster Center
Discussants: Helen Wood, NOAA/National Environmental Satellite, Data & Information Service
Timothy Gubbels, NASA/Solid Earth & Natural Hazards Program,
Paul Greenfield, U.S. Forest Service
Vince Ambrosia, California State University, Monterey Bay
Andy Bruzewicz, U.S. Army Corps of Engineers
Earnest Paylor, Pacific Disaster Center

The discussants presented new remote sensing technologies and described current stages of research, with emphasis on the operational environment and involving end-users. For more than 40 years, NASA and NOAA have researched, launched, and operationalized Earth-observing satellites that have saved lives and reduced the costs and risks of loss to human life and property. In the near future, sensors on these satellites, other satellites, and aircraft will provide powerful information resources and analysis tools for disaster managers. Increased data options include high-resolution imagery, rapid digital processing, and communication of analyses to emergency managers in near-real time. The field of remote sensing can provide data ranging from snapshots of the same spot on Earth every 30 minutes provided by geostationary satellites, to satellites that cover the Earth in 2000-mile swaths every two days, to longer-return intervals over smaller areas. For disaster operations, there is the future promise of high-resolution commercial imagery offered at increasing revisit frequencies.

Helen Wood discussed Earth-observing satellites and operational hazard products derived from these satellites. Hazard areas include disaster response and recovery, tropical cyclones, heavy precipitation (flash floods), volcanic ash clouds as a hazard to aviation, fire detection and monitoring, sea ice as a hazard to navigation, coastal hazards, and drought monitoring. Operational examples presented include an experimental fire analysis for a California showing fire hotspot locations and smoke plume extent, a sequence of images of Montserrat volcanic ash cloud development, nighttime imagery depicting power outages from a 1998 storm in Ottawa, Canada, and a recent Antarctic ice analysis to guide icebreakers to rescue the Magdalena Oldendorff. NOAA's current effort includes bringing classified and unclassified remotely sensed data together to improve hazard products such as fire detection and monitoring via an Integrated Hazard Information System.

Tim Gubbels presented an historical view of remote sensing advances from the 1960s to today and beyond. NASA's Earth Science Enterprise is dedicated to understanding the total Earth system and the effects of changes on the global environment. Applications research focuses on global change, natural hazards and disaster management, resource management, environmental assessment, and community growth. These applications are based on data from the entire constellation of systematic and exploratory NASA missions. Gubbels emphasized the broad range of partnerships needed to understand the Earth's systems. Non-geostationary satellite missions range from global coverage every day or two at low spatial resolutions (one-quarter to

one kilometer) through high spatial resolutions in the meter range. Organizational partnerships range from long-standing partnership between NASA and NOAA, for example, to emerging partnerships with commercial high-resolution data providers.

Andrew Bruzewicz presented the data requirements and current or potential uses for remote sensing to assist emergency managers. Bruzewicz stated that it is critical for emergency managers to define the impact area and estimate damage ranges, along with receiving site-specific information. The U.S. Army Corps of Engineers mission is to support “Emergency Support Function #3, Public Works and Engineering under the Federal Response Plan.” These activities include the provision of temporary power, debris removal, provision of potable water and ice, and temporary roofing. Bruzewicz explained problems with image dissemination at the World Trade Center site and provided potential solutions: 1) train, train, train; 2) prescribed mission assignments for imagery; and 3) acceptance of low-tech approaches, such as non-electronic images, courier delivery, etc., to deliver imagery in disaster settings. Bruzewicz also suggested the idea of an Imagery Ombudsman, who would be assigned to move data from one area of acquisition to where it is needed. The Corps’ philosophy, along with NOAA and NASA, is to involve the end-user early in remote sensing applications development.

Vince Ambrosia discussed emerging disaster monitoring technology development and transfer, along with closing the research-to-operations gap. The Ecosystems Science and Technology Branch at NASA/Ames serves as a research and development technology integration facility, providing four main research foci: 1) improved remote sensing systems and solutions; 2) improved data telemetry capabilities; 3) demonstrating emerging technologies in unmanned aerial vehicle (UAV) platform use for disaster monitoring, and; 4) improved data discovery, data analysis, and data distribution mechanisms for rapid, global information dissemination.

Paul Greenfield discussed the strategic and tactical use of imagery to fight wildland fires. For fire detection, data imagery needs include rapid alerts for small fire sizes, and accurate geolocations with few false alarms. MODIS active fire mapping provides a regional image as well as providing cumulative thermal detection four times a day. Airborne infrared systems provide sufficient resolution to resolve smoldering stumps and vegetation. Geocorrected digital imagery, draped over digital elevation models, provides excellent detail for briefings and tactical planning. Commercial high-resolution imagery can provide one-meter resolution which gives burned area recovery teams and community planners adequate information about vegetation loss and potential for sedimentation and other post-fire problems.

An issue that is becoming more prevalent in the remote sensing community is the need for geocorrected image products that can be rapidly integrated with GIS coverages and base maps. A future need for the wildland fire community is the better integration of fuel modeling, fire behavior models, and weather information with on-going wildland fire imagery and mapping.

Earnest Paylor described the challenges of applying remote sensing analysis to support operational end-users, ranging from federal and military customers to local governments. The heart of the Pacific Disaster Center is GIS analysis—integrating imagery for hazards, land-use, demographic, and infrastructure analysis—as well as carrying out risk and vulnerability assessments for emergency managers throughout the Asia Pacific region. The Pacific Disaster Center’s experience is that many emergency managers have neither the time, training, or interest to evaluate the proliferation of remote sensing technologies. The value of remote sensing to emergency managers greatly increases when it is integrated with other information or is part of a larger information infrastructure, such as those that link victims’ needs with resources. The Pacific Disaster Center played an important proactive role in the Afghanistan humanitarian relief effort by delivering remotely sensed images integrated with GIS data resources to provide interactive mapping and product dissemination over the Internet to relief workers.

The Pacific Disaster Center applies remote sensing applications to output situational awareness, risk and vulnerability assessments, damage assessments, and mitigation strategies, as well as educational and training capacity building products. Some remote sensing data challenges at Pacific Disaster Center include: 1) cost of acquisition; 2) proprietary rights and restrictions, and; 3) moving from data access to integration, production, and dissemination of applications and products in a timely and relevant manner.

The ensuing audience discussion focused on international policy and activities that foster increased usage of remote sensing data.

THE SCIENCE AND ART OF VULNERABILITY ASSESSMENT

Moderator: Roger Pielke, Jr., University of Colorado, Boulder
Recorder: John Carroll, California State University, Fullerton
Discussants: Betty Hearn Morrow, International Hurricane Center
Stu Nishenko, Pacific Gas and Electric
Ralph Cantral, NOAA/National Ocean Service
Inés Pearce, Seattle Emergency Management
Bill Hooke, American Meteorological Society

The purpose of this session was to explore the techniques and implications of vulnerability assessment.

Betty Morrow described vulnerability as the potential for losses or harm, and focused her discussion on the conditions that effect vulnerability. Morrow presented a broad outline of socially-constructed characteristics of communities that contribute to their vulnerability: economic constraints; human capital; dependency rate of a community; mix of age, gender, and ethnicity in a community; knowledge base; cultural differences; lack of social integration; and lack of control over housing conditions. Morrow suggested that the household was the most important unit of analysis, as this is where decisions are made that most greatly impact vulnerability. Morrow also noted a lack of research geared toward renters, who make up a third of all households in the United States.

Stu Nishenko compared risk versus exposure metrics in predicting damage. Nishenko defines exposure as the probability of a hazard combined with an inventory of the variables (population, buildings, etc.) that have been impacted. Risk, according to Nishenko, adds vulnerability, or some measure of fragility, to the equation. Most studies have dealt only with exposure and have provided consistent results over time. However, investigating the social parameters of vulnerability will allow for empirical observations of risk over time and the ability to determine the effectiveness of mitigation.

Ralph Cantral outlined coastal-zone management issues related to vulnerability. Cantral began by noting that in a coastal zone, the most valuable property is often the most vulnerable. This issue raises the question of how to limit or constrain coastal zone development. Barriers to addressing this question include a lack of all-hazard vulnerability assessments at the state level, shifts in political will to enforce management programs, and property rights rulings from the courts.

Bill Hooke described H.R. 4900, a bill to “establish a national climate change vulnerability and resilience program,” which is being considered in the 107th Congress. H.R. 4900 has been named the “Weather Safety Act,” and one of its key components is a requirement for completing vulnerability assessments at local, state, regional, and national levels to comprise an overall vulnerability “scorecard.” H.R. 4900 also calls for preparedness recommendations, vulnerability research, and dissemination of information. All of these areas provide opportunities for the Hazards Community.

Inés Pearce described issues that arise when dealing with vulnerability at the local level. Much of her presentation focused on ways that local hazard managers need to translate and disseminate vulnerability information to various audiences. Like Cantral, Pearce noted that the will of elected officials is often a significant barrier to policy implementation. Pearce has found that when informing the public about vulnerability it is important to pair the information with the steps individuals can take to reduce their risk.

A lively discussion followed the presentations focusing on definitions of vulnerability and the need for a common language when referring to the ideas inherent in this concept.

BIOTERRORISM: THREAT, INTERVENTIONS, AND STRATEGIES

Moderator: David Teeter, Department of Veterans Affairs
Recorder: Rich Weber, University of North Texas
Discussants: Kim Shoaf, University of California, Los Angeles
Gary Roselle, Department of Veterans Affairs
Ellyn Segal, Stanford University

Kim Shoaf began by discussing the role of public health agencies in disasters. Public health agencies and officials provide a variety of important functions during disasters. The role of public health is intensified during terrorist events, as public health agencies may be the first to report trends that diagnose a chemical or biological attack. Shoaf noted that responders to a chemical or biological attack would not be aware of what had occurred until patients showed symptoms or were reported. A public health response is imperative when dealing with a bioterrorism event.

Gary Roselle presented current initiatives and tools that are used to diagnose chemical and biological agents. Roselle explained different types of surveillance programs, such as the Emergency Pathogens Initiative. Such programs have the ability to determine trends through multiple tracking systems in use by different medical systems, while maintaining confidentiality. General questions about surveillance programs were also addressed.

David Teeter explained different models that are or can be used to stockpile medicines in the event of chemical and biological incidents. Teeter discussed the shortfalls of the stockpiling systems. Jurisdictions may have problems determining the number of patients to be treated and this influences plans to move, stockpile, or distribute medicine. In preparing for distribution of medicines, training exercises, such as TOPOFF, show the importance of planning.

Ellyn Segal provided a case study using events that occurred at Stanford University in the fall of 2001, when an employee received two letters that contained suspicious substances. She gave an overview of the University's coordinated response. A number of issues arose during the incidents, such as contamination and decontamination, continuity of university operations, re-occupancy issues, and authority to test for a possible agent. Based on lessons learned during these events, Stanford University's response system was updated. One change was the inclusion of a flow chart to deal with hazardous materials.

Several themes emerged from the speakers and their topics. One key to preparedness in chemical and biological incidents is an effective surveillance program. In addition, being prepared for patient treatment (decontamination or prophylaxis) is an important consideration for the response community. Communication between medical personnel, responders, and emergency management officials is important to protect life and property.

There were a number of questions. Transportation of agents and contaminated people were discussed. The audience also asked why more was not being done to combat potential chemical and biological events.

U.S./JAPAN COOPERATIVE RESEARCH: LEARNING FROM EACH OTHER

Moderators: Kathleen Tierney, University of Delaware
Haruo Hayashi, Kyoto University

Recorder: Dorothy Tao, Multidisciplinary Center for Earthquake Engineering Research

Discussants: Kimiro Meguro, University of Tokyo
Michio Miyano, Osaka City University
Jane Preuss, GeoEngineers, Inc.
Marizen Ramirez, University of California, Los Angeles

In this session U.S. and Japanese researchers presented their findings and discussed how their results contribute to an understanding of hazard-related problems in their respective societies. Discussants also discussed the implications their findings might have in both societies, and the transferability of the lessons learned from their research.

Kimiro Meguro began the session by describing a proposed hypertext “Disaster Manual for Improvement of Countermeasures,” an interactive, dynamic manual covering disaster mitigation, preparedness and response, and recovery and reconstruction. Meguro pointed out a key lesson learned from the Kobe earthquake—the importance of structural strength. Eighty-three percent of earthquake fatalities, and almost all casualties in Kobe, are caused by entrapment in collapsed buildings. This high number of casualties is the result of a “lack of imagination,” according to Meguro, who explained that the existing disaster manual, a hard copy publication that focuses on preparedness, is static and does not provide a mechanism for incorporating new knowledge and lessons from current earthquakes. Since emergency personnel in Japan turn over regularly, the proposed hypertext manual would provide a mechanism for new ideas and lessons to reach practitioners. In addition to preparedness, the manual would cover retrofit, damage assessment, and estimation of personnel required for upcoming earthquakes. Meguro said the new manual had been tested in the municipality of Kawasaki.

Michio Miyano discussed “Casualties Caused by the Hyogo-Ken Earthquake, 1995.” The purpose of his research was to obtain data for the development of a dummy designed to measure damage to the human body. A survey of households in the cities of Kobe, Nishinomiya, and Ashiya was conducted to determine earthquake-related casualties and the extent and location of injuries to people. One hundred and forty-two people were interviewed. The main cause of death or serious injury was falling ceilings beams and collapsed houses, especially those constructed prior to 1949. The casualty rate was higher for the elderly. The major cause of death was mechanical asphyxia by thoracic compressions, and the major cause of serious injury was bone fracture to the pelvis or legs.

Jane Preuss reported on a study a U.S. team conducted for the Kobe Reconstruction and Recovery Planning Board. The study revealed lessons that may be applied to other industrial nations. The team was interested in the effect of the planning process on reconstruction and recovery, and they visited Kobe over a 4-year period. The team focused on growth management areas, in contrast with the U.S. practice of declaring disaster areas by county. In Kobe, the first year of rebuilding focused on construction of single-family homes in outlying areas where there had been no damage. In the second and third years, development occurred in areas that had experienced damage. The team concluded that rebuilds should be located in areas where people want to live.

Preuss discussed the importance of planning community redevelopment efforts and the impacts of active public involvement in the process. People who had been area-residents tended to move back and actively participate in the rebuilding process, helping planners to ensure that recreation, affordable commercial space, and medical services were provided to a greater degree than in areas without public participation. Bringing neighbors together is very important. This conclusion is directly applicable to the U.S. In the U.S., there has not been similar outreach, and low citizen participation has resulted in fewer amenities such as bike paths, curvilinear streets, etc. Government processes that offered quality building zoning bonuses and incentives in the recovery plan played an important role in rebuilding.

Preuss noted that despite the preconception there is not much public involvement in Japan (especially contrasted with the U.S.), the team found that public involvement proved very important. Subjective observations indicate that areas with good community relations before the earthquake were better able to cope during disaster situations. Preuss also noted that income and education had an impact on survey response as well as perceptions about access to government facilitators. These issues are seen in the U.S., especially in areas where there are many immigrants. In both Japan and the U.S., volunteer groups develop in the aftermath of disaster.

Marizen Ramirez reported on preliminary findings and the beginnings of a U.S.-Japan epidemiological theory-based study that is exploring how and why people are injured in earthquakes. The framework for the research is the "Injury, Morbidity, Injury Pyramid," which provides a way to study the impact of an earthquake on humans. This initiative is intended to include case-controlled studies of earthquake-related injuries worldwide. Ramirez described a case-controlled study where researchers examined the effects of seismic, geologic, building, and personal factors on injuries. Results indicated those over 65 were three times more likely to be injured and females were more likely to be injured. An earthquake with a moment magnitude (MM) greater than 8 resulted in a greater number of injuries, and damage was more likely to occur in commercial and multiple family buildings than in single-family dwellings. Brief mention was made of a questionnaire created by Kerry Sauter, MPH, who conducted a population-based survey comparing Kobe and Northridge fatalities. Ramirez concluded by saying the study will organize international meetings to work toward standardization of methods, cross national training, and research.

DEVELOPING DISASTER SAVVY KIDS AND FAMILIES: CITIZEN CORPS AND OTHER NEW INITIATIVES IN PUBLIC EDUCATION AND COMMUNICATION

Moderator: Bill Massey, FEMA/Region IV

Recorder: Brock Long, FEMA/Region IV

Discussants: Heidi Taylor, American Red Cross

Vickie Johnson, Cooperative Program for Operational Meteorology, Education and Training

Kelly Kelkenberg, FEMA/Region IV

John Ogren, NOAA/National Weather Service

Heidi Taylor spoke about the American Red Cross (ARC) *Masters of Disaster* and *Facing Fear* disaster curricula that are designed to help children prepare for and recover from disaster, including terrorist events. *Masters of Disaster* contains K-8 curricula for educators to integrate disaster safety concepts into their regular lesson plans. *Facing Fear* is broken into chapters, and focuses on helping children deal with terrorism and tragic events. It contains a strong mental health component with strategies for dealing with ongoing feelings of loss, sadness, and anger. *Facing Fear* is a stand-alone addition to the *Masters of Disaster* curriculum and can be downloaded at: <http://www.redcross.org>.

Vickie Johnson discussed *Hurricane Strike!* an interactive educational multimedia-learning package aimed primarily at middle school students. Designed for classroom use, *Hurricane Strike!* integrates hurricane disaster safety and preparedness lessons with science instruction, while providing an engaging interactive learning environment. *Hurricane Strike!* meets a majority of the National Science Education Standards and was developed by the Federal Emergency Management Agency (FEMA) in cooperation with The Weather Channel, National Oceanic & Atmospheric Administration, National Weather Service, and American Red Cross. It can be downloaded at: <http://meted.ucar.edu/emgmt/access.htm>.

Kelly Kelkenburg introduced *Citizen Corps*, a program developed since September 11, 2001. *Citizen Corps* is a network of volunteer organizations, in line with the administration's volunteer initiative, which utilizes the skills and abilities of the American people to prepare communities for the threats of terrorism, crime, and disasters. *Citizen Corps*, administered by FEMA, is locally driven and designed to help increase citizen participation at the local level through coordinating programs, identifying volunteer opportunities that will support local law enforcement and emergency response personnel, and identifying local resources to support *Citizens Corps*. Participants must complete a 20-hour introductory course. For more information visit: <http://www.citizencorps.gov>.

John Ogren discussed the National Weather Service (NWS)/FEMA CD course *Anticipating Hazardous Weather and Community Risk*. The course is designed to assist emergency managers anticipate and prepare for hazardous weather while enhancing their ability to recognize hazards and understand NWS products. This course encourages local government decision-makers to develop partnerships with the NWS well in advance of a threat. *Anticipating Hazardous Weather and Community Risk* consists of four parts: Weather, Hazards, Forecasting, and Warning Partnerships. To obtain a CD visit: www.meted.ucar.edu/emgmt/access.htm.

Discussion included whether disaster education should be hazard-specific or all-hazards, and ways to increase volunteerism within communities. Developing partnerships was seen as crucial when trying to educate communities about disasters. Additionally, partnerships help to insure that the message the public receives is organized and consistent. Due to the cost of course development and production, information sharing is very important.

BUILDING HAZARD MITIGATION PARTNERSHIPS BETWEEN HIGHER EDUCATION INSTITUTIONS AND COMMUNITIES

Moderator: Sara Nathe, University of California, Berkeley
Recorder: Darrin Punchard, PBS&J
Presenter: Stephen Meinhold, University of North Carolina, Wilmington

Sara Nathe introduced the session and provided some background information on FEMA's *Project Impact and Disaster Resistant Communities Initiative*, which is specifically aimed at promoting partnerships between colleges and universities within the towns in which they are located.

Stephen Meinhold presented the design and results of an ongoing project to assess the collaboration between higher education institutions and their communities. The project is an outgrowth of the *Project Impact Higher Education Conference of 2000*, a gathering of academics, scientists, and researchers who came together to foster support for sustained partnerships that would lead to disaster resistant universities and communities.

The session primarily focused on the first of Project Impact's five phases, which is the creation, administration, and coding of a community survey. This phase identified and measured the number of formal partnerships and the level of informal collaboration between Project Impact communities and higher education institutions. Data was collected through a survey instrument sent to 245 communities (161 responded, with a representative sample that included communities from all 10 FEMA Regions).

Survey Hypotheses

- Formal partnerships lead to greater collaboration.
- The more disasters a community has experienced, the more likely they will be to collaborate.
- The larger the community, the greater the collaboration.
- The greater the number of nearby education institutions, the higher the instance of collaboration.

Results and Significant Findings

- 55% of Project Impact communities have one or more higher education institutions as a formal partner.
- Medium-sized communities were most likely to have formal partnerships.
- Community experience with disasters does not impact the creation of formal partnerships.
- The greater the number of nearby education institutions, the higher the instance of collaboration.
- 62% of communities sampled have engaged in collaborative efforts with higher education institutions.
- 14% of collaborative efforts were teaching-related (course development, incorporation of emergency management into existing curriculum, seminars, etc.)

- 33% of collaborative efforts were research-based (GIS, technical assistance, planning, etc.)
- 52% of collaborative efforts were service-based and dealt with administrative support (facility access, equipment use, etc.)
- A formal relationship between a university or college and a community will lead to collaborative efforts.

During the discussion, Meinhold noted that results from a different phase of Project Impact indicate that there appears to be a general disconnect between local emergency managers and the resources of local colleges or universities. Cooperative Extension agricultural specialists were also identified as an untapped resource for communities aiming to become more disaster-resistant.

The audience generally agreed that collaborative hazard mitigation efforts between higher education institutions and communities not only has to overcome the challenge of being a relatively new arena (i.e. disaster mitigation), but in many cases must also contend with existing political and social relationships between universities and their towns—which may not be collaborative, but rather quite the opposite.

CANADIANS IN PERIL: AN UPDATE ON THE CANADIAN ASSESSMENT OF NATURAL HAZARDS

- Moderator:** Lianne Bellisario, Canadian Office of Critical Infrastructure Protection and Emergency Preparedness
- Recorder:** Laurie Pearce, University of British Columbia
- Presenters:** Dave Etkin, University of Toronto/Environment Canada
Grace Koshida, Environment Canada
Emdad Haque, University of Manitoba
Larry Pearce, University of British Columbia

David Etkin presented background information about the Canadian National Hazards Assessment Project. The project was developed to accomplish three objectives: 1) network the Canadian hazards community; 2) provide a better understanding of Canadian risks and coping strategies, and; 3) help create a society that is more resistant and resilient to natural hazards.

Based upon area, Canada is the world's second largest country, and it is very diverse geographically. Canada's population of 31 million is scattered mostly along the U.S. border. The six most expensive Canadian natural disasters since 1961 include the 1998 ice storm (\$5.1 billion), four droughts, and the 1996 Saguenay flood (\$1 billion).

The Canadian Natural Hazards Assessment project brought together natural hazards experts from across Canada and asked participants to write a series of background papers, many of which are being published in a special edition of the journal *Natural Hazards*. The individual background papers are also being synthesized into a book by David Etkin which will be completed by the end of 2002. The book is intended to assist local elected officials, emergency managers, planners, and emergency responders. The U.S. equivalent of this publication would be *Disasters by Design*, by Dennis Mileti.

The following is a brief overview of some of the data which is emerging from the background papers:

- Weather related disasters (ranging from floods to ice storms) have continued to increase.
- As the number of weather related disasters have increased, the number of people affected by these disasters has also increased.
- Post-disaster government funds for flood recovery have been disbursed across the country, but most of the costs have been incurred by Manitoba.
- The Canadian provinces use different approaches to flood mitigation. Some mitigation strategies are more successful than others. Along with other factors, this has contributed to the recognition that Canada needs a national mitigation strategy

Etkin then gave a quick overview of examples of how Canadian provinces, the U.S., the U.K., Switzerland and other areas have dealt with flood mitigation. Some efforts have been more successful than others. The question remains: “What characteristics must a flood mitigation program have in order to realistically reduce vulnerability?” Canada is working toward a comprehensive answer to this question.

“It is not necessarily those lands which are most fertile or most favored climate that seem to be the happiest, but those in which a long stroke of adaptation between man and his environment has brought out the best qualities of both.” (T.S. Elliot)

EARTHQUAKE AND TSUNAMI MITIGATION TECHNOLOGIES FOR THE ASIA-PACIFIC REGION

Moderator: John Gaynor, NOAA/Office of Atmospheric Research

Recorder: Nathan Wood, U.S. Geological Survey

Presenters: Neil Britton, Earthquake Disaster Mitigation Research Center, Japan
Hiroyuki Kameda, Earthquake Disaster Mitigation Research Center, Japan

This session focused on the *Earthquake and Tsunami Disaster Mitigation Technologies and its Integration for the Asia-Pacific Region (EqTAP)* project, with presentations by Hiroyuki Kameda, EqTAP Principal Investigator, and Neil Britton, EqTAP Chief Coordinator. The presenters described the EqTAP Project as a five-year, two-phased program sponsored by the Government of Japan. EqTAP has partners in 14 countries and was begun under an APEC requirement to better understand the hazardousness of the Asia-Pacific Region and develop appropriate strategies to reduce hazards. The goal of the project is to establish a framework for international research collaboration among and between researchers, stakeholders, and partner nations within the Asia-Pacific Region. Specific objectives of the EqTAP project include technology development with a regional perspective, followed by integration of this technology into a risk-management framework, implementation strategy, and multi-disciplinary collaborative mitigation strategy.

The current phase of the EqTAP project (Phase II /FY2002-2004) focuses on the application and implementation of technologies and strategies that were developed during Phase I. Research areas within Phase II include vulnerability assessment, hazard assessment and structural mitigation, urban and system planning, tsunami risk and mitigation, and development of a Master Plan Framework for comprehensive disaster management. In addition to the Master Plan Framework, other EqTAP products include case studies and a “Digital City Tool Box,” designed to provide stakeholders with a way to gain information, insights, and experiences relating to hazards. Additional information on the EqTAP project can be found at:
http://www.edm.bosai.go.jp/eqtap/default_e.htm.

After the initial presentations, the presenters and session participants discussed the difficulties of conducting applied research in a research climate that does not reward such work and does not consider applied projects to be scientific endeavors. The presenters said the shift to dynamic researchers who include applications in their research projects is slowly occurring in Japan and the Japanese government is beginning to require accountability from government researchers. This, however, has yet to include academic institutions. Other issues discussed include understanding the interaction between geo-hazards and socio-economic attributes within a technological framework, acknowledging the societal context within which research may be used, identifying how to provide hazard management information to practitioners that meet the needs of Asia-Pacific region, and assessing the needs of stakeholders that vary considerably throughout the region by country and culture.

IMPLICATIONS OF NON-ENERGY BASED POLICIES ON RELIABILITY OF ELECTRIC POWER DELIVERY

Moderator: Marc Levitan, Louisiana State University
Recorder: Frank Stead, Arizona State University
Presenters: Jane Preuss, GeoEngineers, Inc.
Dorothy Reed, University of Washington

After any disaster, the rapid restoration of lifelines is critical. However, because of their interrelationships with other lifelines such as water and wastewater, energy systems are particularly important. This project analyzes the potential influence of external factors on recovery rates for an urban electric power distribution system. Because the utility covers multiple jurisdictions, researchers have been able to correlate outage causes, outage rates, and recovery duration with selected local procedures that appear to influence outages causes most directly.

A number of external factors, such as access, for example, influence how fast a distribution system is restored. This project analyzes outage data provided by an urban utility distribution system in relation to local policies and procedures, comparing recovery rates for five events that fall within the “major outage cause” category. A basic analysis reveals that local policies play a role in both vulnerability and recovery processes, and even influence where the outages are located. The local policies that were reviewed include sensitive-area ordinances (adopted as part of the zoning code and required under the Growth Management Act), and forestry management procedures concerning tree planting and maintenance.

The utility in the research area tracks outages according to seven categories: trees, wires down, bird/animal, lightning dig up, car/pole, equipment failure, and other/unknown. Storm event data indicate that the highest percentages of outages are from trees (for overhead systems that constitutes 75% of the system), and equipment failure of underground elements. It was difficult to ascertain the cause of the failures because, for example, repair crews simply noted “earthquake” rather than a specific cause from the categories above.

To explore the potential influence of the local regulatory context on the system in more detail, three additional correlations are being undertaken by researchers. The city’s jurisdictional boundary, neighborhood boundaries within the jurisdiction, and boundaries to the north and south of the urban area are being superimposed onto the system as a whole.

Date	Type of Event	Storm duration	# of feeders affected	# feeders affected as % of total in system
January 1993	Windstorm	63.1 hours	107	45.9
November 1995	Winter storm	12.7 hours	12	5.2
November 1996	Winter storm	30 hours	39	16.7
December 1996	Winter storm	143.7 hours	34	14.6
February 2001	Earthquake (Magnitude 6.8)	30-40 seconds	17	10.7

Acknowledgements: Project funded by: NSF Award Number 0099638

**ANALYSIS OF LIFELINE DAMAGES AND ECONOMIC IMPACTS OF AN EARTHQUAKE:
DEVELOPMENT OF AN INTEGRATED ECONOMIC-ENGINEERING ASSESSMENT MODEL**

Moderator: John Lahr, U.S. Geological Survey
Recorder: Ken Zwickl, U.S. Army Corps of Engineers
Presenter: Yasuhide Okuyama, University of Buffalo

This research project is based on the assumption that the indirect impacts of a catastrophic earthquake spill over to other regions and even other countries through economic transactions such as domestic and international trade. The goal of the project is to develop an integrated economic/engineering model to investigate and analyze the economic damage of an earthquake through focusing on the indirect impacts generated by monetary connections between the impacted urban area and the larger economy. Within the study, a lifeline-network model is used to estimate the direct damages, and researchers have developed an inter-regional model to assess indirect damages. Some of the difficulties encountered by the researchers include data scarcity, the variety of disaster types, and actually linking economic and engineering models. The project strategy has been to develop a micro-level model for specific on-site damages, a meso-level model to account for inter-industry impacts, and a macro-level model to describe inter-regional impacts.

The results from these models are encouraging. On the micro-level, the model simulates activities in small sub-areas, and is most similar to a hospital simulation model that measures supply consumption. The meso-level model links anticipatory and responsive demand in a dynamic manner, providing a more complete picture than other, more static models. On the macro-level, gross output readings indicate that there are more impacts outside the disaster area than within it, largely due to the economic impact of reconstruction activities. Future work includes refining the way the three models are linked so that variables such as inter-regional trade systems, smaller regions, and greater information about production processes may be included.

An audience member asked if the research figures were compared to actual earthquake impacts. Due to factors external to the research effort, such as national economic stimulus activities, this is a difficult to accomplish. Another question concerned assessing the impacts of loss of life in the disaster area. Currently, this is only done indirectly, using loss of income/consumption/productivity as a measure. The transferability of these models to other nations was questioned. The models may be transferred, as long as some calibration is attempted to reflect national sensitivities and cultures.

RESEARCH IN HAZARDS BY NEW PROFESSIONALS – I

Moderator: David Neal, Jacksonville State University
Recorder: Barbara Vogt, Oak Ridge National Laboratory
Presenters: Seong-Nam Hwang, Texas A&M University
Toni Morris-Oswald, University of Manitoba
Mike Olczyk, University of Manitoba
Jie-Ying Wu, Texas A&M University

This session provided an opportunity for students to discuss their research projects. The first two discussants, Mike Olczyk and Toni Morris-Oswald, described a multi-year project to study risk perception and stakeholder participation in floodplain management in the Red River Basin in Manitoba, Canada, following the 1997 “flood of the century.” Their findings suggest a divergence between expert and resident perceptions of risk. This divergence may be influenced by media reports. Olczyk and Morris-Oswald also described a qualitative case study using semi-structured interviews to assess the individual and community value systems about risks from flooding. The findings suggest complacency among residents perhaps based on strategies that a pro-development group initiated to reduce the perception of future flood risk. In reality, no such program has occurred. Increased public participation is being encouraged.

Seong-Nam Hwang described research regarding location-based behavior between in-migrant and long-term residents in Harris County, Texas. The data incorporated both demographic and hazards variables to test whether levels of environmental risk (flood, hurricane, and chemical) influence residents’ initial choice of location and the duration of their stay. The results (in progress) indicate that locational behavior is not significantly correlated with hurricane or flood risk.

Jie-Ying Wu described the findings of his study on housing reconstruction after the 1999, 7.3 magnitude Chi-Chi earthquake (also called the 921 earthquake) in Taiwan. Two-and-a-half years later, the major constraints to reconstruction are financing, the level of building collapse, the difficulty in reaching consensus among multiple owners of condominiums and parcels of land, and the shift in reference points (it takes a year to re-survey properties). The study also found mitigation was seldom included in recovery plans because of lack of pre-impact planning.

RESEARCH IN HAZARDS BY NEW PROFESSIONALS – II

Moderator: John Cross, University of Wisconsin, Oshkosh
Recorder: Jack Rozdilsky, Michigan State University
Presenters: Melanie Bartis, University of South Carolina
Chris Emrich, University of South Carolina
Kirsten Finnis, University of Otago
Miho Yoshimura, University of Tokyo

This session highlighted the work of natural hazards research in the academic arena. Two of the research projects are based in the U.S. and two are from international scholars.

Melanie Bartis asked the question, “What factors distinguish repetitive loss communities from those that are not?” Bartis focused on South Carolina communities facing repetitive flood losses. Bartis performed a descriptive analysis, applied a community flood-loss reduction tool, evaluated state and federal flood programs affecting South Carolina, and conducted a field study of Georgetown County, South Carolina. Through her research and methodological perspective, Bartis will be able to determine the key factors influencing what makes certain communities victims of repetitive losses.

Chris Emrich’s research focused on revealing the vulnerability of the Columbia, South Carolina metro area. Emrich’s assessment involved looking at community resources and demographics for the Lexington and Richland County areas. A series of indicators were culled from demographic information: access to resources (proximity to bus stops, hospital, etc.), number of renters, number of owner-occupied housing units, and income. These variables were mapped using a GIS-based analysis. Preliminary results indicate that there are differential patterns of vulnerability between inner-city core areas and the city periphery.

Kirsten Finnis investigated resilience and vulnerability in a community around the Mt. Taranki volcano in New Zealand. The Mt. Taranki volcano is apparently dormant, as its last recorded event was in 1755. However, because it is located in a dynamic geologic region of New Zealand, the volcano still represents a risk to the 36,500 people living within 25 kilometers of the summit. Potential volcanic hazards facing the study area include debris avalanches, pyroclastic flows, lahars, and ash falls. Finnis surveyed residents in the area about their knowledge and awareness of volcanic threats, and found that a majority of residents feel that an eruption would pose a threat to their daily lives. Additionally, Finnis stated that residents should increase their levels of preparedness to effectively decrease their vulnerability.

Miho Yoshimura’s research evaluated the financial support system for retrofitting low, earth resistant timber houses in Kobe, Japan. Focusing on factors related to the impacts of the 1995 Kobe City earthquake, Yoshimura performed a cost-benefit analysis of government programs for retrofitting structures in the region of the Shizuko Prefecture. Yoshimura used the current financial support system as a case study and looked at the benefit/cost rationale for the system from the government’s perspective. Using the data she had collected, Yoshimura designed simulations to determine what factors would contribute to both cost effective and risk reducing financial support systems.

RISK PERCEPTION AND FLOOD WARNING: A CASE STUDY

Moderator: Emdad Haque, University of Manitoba

Recorder: Alan Taylor, City of Boulder (CO) Public Works Department

Presenter: Eve Gruntfest, University of Colorado, Colorado Springs

Eve Gruntfest presented the study, “An Evaluation of the Boulder Creek Local Flood Warning System,” funded by the Urban Drainage and Flood Control District and the Boulder City/County Office of Emergency Management. A comprehensive survey was developed for two populations living in the Boulder Creek 100-year floodplain. Population A included year-round, non-student residents and population B included residents of University of Colorado Student Family Housing. The survey was the first of its type for Boulder Creek and the first such study in Colorado since the Waterstone report in 1977, following the Big Thompson flood.

Residents were surveyed about their knowledge of the 100-year floodplain, flood risk awareness, preferred warning methods, perceived response, impacts of false alarms, flood and weather information, and to obtain general demographic information. Population A responded best, but only 30% of the respondents answered all flood knowledge questions correctly and 33% were not aware they lived in the 100-year floodplain. Population B responses appeared to reflect the reduced local awareness of non-resident and international student families. Generally, responses from both groups indicated that half of the respondents understood the term “100-year flood,” many have seen “Climb to Safety” signs, and few had previously experienced a flash flood. For both groups, weather information was obtained from television, radio, newspaper, and Internet, and the preferred flash flood warning mechanisms were sirens, direct phone calls, television, knocking on doors, and radio. Most participants said they would prefer to receive more warnings than fewer even if some were false alarms.

The Boulder Creek study offers important baseline data for flood warning and human response. Study findings indicate that people are more aware of flood hazards than 25 years ago, however, public awareness is still lacking among those at risk. Additional goals of the study were to evaluate the impacts of demographic changes, new sources of data and new technologies that have evolved over time, and test conventional wisdom about the impacts of false alarms and predicting flood warning lead times.

Key steps following the study would be to develop a national warning strategy, determine an understandable definition of flash flood, and provide incentives for graduate students to get involved in social science research. Funding for such research projects is vital. We should not wait 25 years to undertake the next study.

Emdad Haque closed the session by offering comments recommending that we need to rethink the “100-year flood” terminology because it offers no public service. Haque added that we should perform further research to test our assumptions about rational human response to hazards, and be cautious about having blind faith in science, since science has inherent limitations in dealing with nature.

A CONSEQUENCE-BASED ENGINEERING PARADIGM – SETTING PRIORITIES FOR NATURAL HAZARDS RESEARCH

Moderator: Craig Taylor, Natural Hazards Management, Inc.
Recorder: Mike Goetz, FEMA/Region I
Presenters: Dan Abrams, Mid-America Earthquake Center
Robert Olson, Robert Olson Associates, Inc.
Rose Grant, State Farm Insurance Companies

Craig Taylor began the discussion by briefly describing the move toward Consequence-Based Engineering (CBE) from the more narrowly focused (and traditional) performance-based engineering approach. The CBE approach looks at minimizing losses across an entire system and all of its components. By viewing the consequences that changes in a single component may have on an entire system, CBE provides a dynamic perspective that encompasses a holistic approach to engineering, insurance, and mitigation for natural hazards.

In her work, Rose Grant is the representative of one of the unique facets of the CBE approach—stakeholders. In the insurance industry, there is a need to look at all insured buildings as a system to make sure that the premium pool can handle all losses. There is also the additional requirement to view the large picture of impacts across a broad spectrum of users. For example, a bridge loss can have serious impacts on transportation companies and others that depend on that bridge. Under the CBE approach, input from stakeholder groups help to identify the parameters of a given system.

Dan Abrams noted that stakeholder groups have a significant interest in mitigating earthquake losses. Stakeholders represent groups with common interests, such as communities, transportation systems or networks, construction industries, or insurance industries. Since the CBE approach is directed toward reducing losses across a system, a CBE perspective allows each stakeholder group to understand how their interests relate to others' and to the system as a whole. The loss of even a single component in the system can affect the functionality of the entire system. Therefore, by seeing the consequences that a hazard may have on a complete system, stakeholders can understand the importance of focusing on hazard reduction.

Bob Olson discussed strategies to promote the acceptance of CBE and its components over the long term. This involves identifying impediments and barriers to CBE and looking for opportunities to advocate for existing and future CBE research. Olson sees potential CBE users as earthquake engineering practitioners and decision makers (who tend to be less interested in the technical aspects but control the money). Ultimately, a strategy to support CBE would: enable CBE as an innovation; equip stakeholders with the appropriate knowledge of their system; empower users to “sell” CBE; enhance the transfer of knowledge in the practice of CBE, and; exploit opportunities to utilize CBE.

Issues raised during the discussion focused on understanding the differences between CBE and performance-based engineering. All of the presenters were clear in the fact that these two engineering approaches are not mutually exclusive. In fact, CBE can incorporate a performance-based approach for individual components in a system. For example, if a particular bridge were critical to the performance of an entire transportation system, then a performance-based design approach for that bridge would be appropriate.

MODELING THE CHANGE IN HURRICANE LOSSES OVER TIME

Moderator: Robert Harriss, National Center for Atmospheric Research

Recorder: Mike Hewson, Meteorological Service of Canada

Presenters: Rachel Davidson, Cornell University
David Rosowsky, Oregon State University

Robert Harriss open the session and introduced the two presenters, who described the work done to date to develop a methodology for estimating the future risks of loss associated with hurricanes in North Carolina, South Carolina, and northern Florida.

Rachel Davidson provided an overview of the project, which has three objectives: 1) to quantitatively model the rate at which hurricane loss risk is changing, using a dynamic inventory of assets at risk; 2) to model the relative contributions to the change in risk from different forcing factors, and; 3) to project the effects of mitigation activities on future losses. The study attempts to move beyond discussions of past losses when assessing hurricane risk to account for projected changes in the infrastructure inventory, vulnerability, and the wind hazard itself. Sub-models are being developed to project changes in these three areas. It is hoped that by making loss estimation dynamic and linking what people do today with the risks posed by future hurricane events, the study will benefit policy makers, government agencies, insurance companies, and others involved in risk management.

Davidson went on to explain that the study covers estimated direct losses to residential buildings from hurricane winds. It uses the inventory sub-model and the vulnerability sub-model to develop, through a series of time-stepped simulations, a time history of how expected annual hurricane losses will change over time. Davidson described the loss estimation technique used, which includes GIS-based deterministic and probabilistic simulations and the dynamic inventory.

David Rosowsky described the wind-hazard sub-model, which was used in an event-based simulation to develop macro-scale wind speed time histories for 368 zip codes within the study area. One-hundred thousand years of maximum wind speed, maximum gust speed, and duration were simulated for each zip code—and the results were highly correlated with 100 years of real data that were available for two points within the region. The simulation was carried out by empirically filtering out and quantifying the transitional and rotational components of the wind, along with the rate of occurrence, approach angle, central pressure, radius of maximum wind, transitional velocity and decay rate of each type of event. Point-in time and event maxima predictions were then modeled for each zip code. The wind field was validated using surface measurements of wind speed distribution that were made during a number of storms that affected the Southeastern U.S.

Davidson then provided details about building inventory and vulnerability change sub-models. The inventory sub-model uses U.S. census data and the relationships between populations and structures to predict demographic changes and the resulting changes in the number, type, and locations of buildings in census sub-tract in 15 counties of North and South Carolina over the period 2000 to 2020, in 5-year increments. The number of households was projected by county-group and allocated to census tracts. Projected households were then transformed into projections of the number of housing units and broken down in a number of housing unit categories, from which building types, structural features, and construction types in each census tract were estimated. Six sources of uncertainty were considered collectively and individually in a simulation-based uncertainty analysis.

Using a Markov-based modeling technique, the vulnerability model captures changes in the region's building inventory over time due to factors such as changing construction practices, aging infrastructure, and building code content and enforcement. It is a component-based model that compares the predicted winds with the design wind for each of four components of a building (roof covering attachment, roof sheathing attachment, roof-to-wall connection, and the windows) to predict component failure. The study focuses on the changing vulnerability of the housing stock due to due building-code changes and based on building code history.

Davidson concluded the presentation by describing some work that is planned to refine the inventory and vulnerability sub-models, create an economic change model and integrate the sub models into a single seamless model that would be used to run an integrated case study.

Two related questions were asked about the transferability of the wind speed modeling methodology to other applications, and it was suggested that this could be practical depending on the application.

AN INTEGRATED ASSESSMENT OF CLIMATE VARIABILITY AND CHANGE IN THE ALASKAN NORTH SLOPE COASTAL REGION

Moderator: None

Recorder: Mary Downton, National Center for Atmospheric Research

Presenters: Amanda Lynch, University of Colorado, Boulder
Ron Brunner, University of Colorado, Boulder

This study focuses on impacts of climate change on people in the North Slope Borough (NSB) of Alaska. The NSB is an incorporated area covering 89,000 square miles, with a population of 9,700 people. It includes the town of Barrow and many scattered villages.

Amanda Lynch described climate variability and changes in the north slope region during the last half of the 20th century. Temperature records in Barrow indicate a significant warming trend in winter and spring between 1921-2001. Of greatest concern to the residents is the retreat of sea ice as a result of this warming. Sea ice tends to damp waves and storm surge, and provide protection from storms which, residents believe, usually tend to track the ice edge. The residents are therefore concerned that the increased harshness of meteorological events, combined with sea ice retreat, will cause greater risks due to flooding and shoreline erosion.

Severe storms hit the area in 1963, 1986, 1989, and 2000. The October 1963 storm was the most severe, with 3-meter waves topping a 3-meter storm surge. The storm was associated with an unusual storm track. In typical fashion, the storm formed on the Siberian front and did not track the edge of the sea ice. However, it was qualitatively different from the usual storms in the region. The researchers hope to assess the likelihood of recurrence of similar events in the future.

Ron Brunner discussed the policy aspects of the study, focusing on the most severe storm (October 1963) and the most recent (August 2000). In 1963, waves from the 1963 storm flooded Barrow, creating a 9-foot deep lake, breaching a sewage lagoon and landfill, spilling fuel oil from storage tanks, and seriously contaminating the town's drinking water. Sheet metal and pipes flew in the wind. In the NSB, 200 Eskimos were left homeless and rescue efforts were hampered by a blizzard.

The population of Barrow has increased from less than 1,500 in 1963 to 4,700 in 2000. Although the August 2000 storm caused damage estimated at \$7.7 million, long-term residents described it as "not that bad." Beach nourishment and dredging had begun in 1999 to deal with shoreline erosion, but the dredging equipment was ripped from its moorings during the storm and the project was officially terminated in 2001.

The U.S. Army Corps of Engineers predicts that severe storm damage will occur in the area within the next 10 years. They recommend beach nourishment and elevation of the road along the coastline. However, concerns about effectiveness and environmental impacts have been raised. Future research plans include exploration of adaptive approaches for increased resilience of the NSB community.

This research project illustrates that although climate change is a global issue, ultimately, problems must be faced at the local level. The study demonstrates the importance of the local context in determining impacts and appropriate policy responses.

A NATIONAL PERSPECTIVE ON HURRICANE EVACUATION TRAFFIC OPERATION AND MANAGEMENT POLICIES, PRACTICES, NEEDS, AND RESEARCH

Moderator: Bob Bacon, South Carolina Sea Grant
Recorder: David Loss, U.S. Army Corps of Engineers
Presenter: Brian Wolshon, Louisiana State University

Hurricane George (1998) and Hurricane Floyd (1999) were wake up calls that demonstrated the need for a planned evacuation strategy in the New Orleans area and the rest of the U.S. A survey of other hurricane-prone areas reveals that there are few good models to follow, and many existing models have not been tested. The need to involve transportation professionals in the field of emergency evacuation, in partnership with emergency officials, has become evident.

Louisiana State University (LSU) Hurricane Center provides a logical location for the surveys, research, and evaluation of alternative strategies for emergency evacuation currently being investigated.

To date, the LSU Hurricane Center's findings indicate that:

- The number of evacuees should be minimized. With better data becoming available about geographic areas of risk, evacuation problems can be reduced significantly by reducing the number of evacuees.
- The limited capacity of highway systems needs to be maximized. Reverse-flow operations may be part of the solution, but they must be used with caution since in many cases they only change the location of a bottleneck.
- The acquisition of real time traffic data must be maximized. Highly instrumented highway systems can provide valuable information for operating decisions.
- Public awareness is critical to make a system work. This is important in advance of and at the time of the evacuation.

Although traffic models are helpful in testing various plans for evacuation, it is difficult to validate the results, especially when human reactions to specific situations are included. There are traffic-flow investigations in Dallas, Texas, and Washington, D.C. that share similar concepts to those used under evacuation conditions. Another similar situation being evaluated is traffic-flow for departure from LSU football games, where a reverse-flow concept is being successfully used.

Some concepts brought up by the audience included: metered or controlled access of evacuees into a system; the use of frontage roads for servicing stalled vehicles and tending to needy evacuees; the use of public transportation to move "low mobility" and "special needs" evacuees out of threat areas; and making the public aware of secondary, less-traveled, non-designated evacuation routes.

RESEARCH IN HAZARDS BY NEW PROFESSIONALS – III

Moderator: Gary Webb, Oklahoma State University
Recorder: Carla Prater, Texas A&M University
Presenters: Daniel Braun, Carleton University
Tim Collins, Arizona State University
Buren B. DeFee II, Texas A&M University
Sara Grineski, Arizona State University

Daniel Braun presented an overview of the sociology of scientific knowledge and classification theory, and then applied these concepts to Canadian disaster assistance legislation and policy, using the government's reaction to infectious salmon anemia as an illustrative case. Braun used a realist-constructivist perspective, noting that some events come to be defined as disasters, while others, although objectively similar, are not defined as disasters. Disaster classification is an ongoing process in which categories, over time, become institutionalized definitions. Once institutionalized, individuals decide how to categorize specific events. Written categories are never fully defined, however, and the process of negotiation fills gaps in definition.

In Canada, classification guidance is found in 30-page document, "Disaster Financial Assistance Arrangements." There is no comprehensive definition of a disaster in the document, but it does mandate that provinces spend a certain amount per capita before they become eligible for federal assistance. There are other decision-making considerations as well. Although there was no direct risk to human health or infrastructure in the 1998 salmon poisoning example, the risk to the industry and the economy was judged to be both unanticipated and disastrous, therefore meriting federal relief. In a subsequent outbreak in 2000, funding was denied on the grounds that the poisoning was a normalized industry risk.

Sara Grineski and Tim Collins presented their work in a low-income Phoenix, Arizona, neighborhood. This community faces a number of environmental problems, including close proximity to a truck stop where diesel trucks idle 24 hours a day, a power plant sited next to a neighborhood park, and a recycling plant that had experienced numerous fires. This neighborhood is among the most environmentally hazardous neighborhoods in the city.

Students from Arizona State undertook a neighborhood survey, and they enlisted community members to do the interviews. The survey unearthed many health problems such as allergies, asthma, migraines, and bronchitis, and it revealed that residents were more concerned about pollution than crime. Statistically, education levels were low among the respondents, and the average age of community residents was young. In spite of its many problems, however, researchers found high rates of satisfaction with the community and a good deal of neighborhood cohesion.

The neighborhood project was a combination of research and advocacy. Students were able to help the community resolve some pollution issues with the power plant; force a rendering plant to clean its scrubbers, thus reducing odor problems in the neighborhood; perform an audit of community problems; carry out demographic research; and get a grant from the city to address some of the community's environmental problems.

While the practical side of the project had some very real results, the lack of a perfect sample and the defining the research problem with community input rather than a priori may have compromised the scientific validity of the research. This may constrain the researchers' ability to publish this work. Grineski and Collins believe their work has merit based on the idea of use-inspired basic research, called "Pasteur's Quadrant" that combines the quest for fundamental understanding with consideration of the usefulness of the work.

Buren DeFee examined the use of spatial metrics to study the effects of the pattern of the built environment on flooding, using Harris County, Texas, as a study area. The spatial metrics are *patch number*, *size*, and *shape* of a specified habitat type; *nearest neighbor* (distances between patches of the specified habitat type); *contagion* (interconnectedness of the specified habitat type); *lacunarity*, (number of gaps in the dominant type of cover in a specified habitat); and *fractal dimension*, (an indicator of whether landscape formation processes are repeated at different scales). By comparing spatial data over time, DeFee demonstrated that development has increased, and that the increase was exponential in the 1960s, with slight dips in the 1980s and 1990s, due to economic disruptions. DeFee also used data on water flow to show a corresponding increase in average flows and extreme events over the same period of time. In addition to modeling storm surge, as in this application, this method of analysis can be used for other purposes such as modeling wildfires.

RESEARCH IN HAZARDS BY NEW PROFESSIONALS – IV

Moderator: John Cross, University of Wisconsin, Oshkosh
Recorder: Bruce Houghton, University of Hawaii, Manoa
Presenters: Bryan Boruff, University of South Carolina
Jamie Mitchem, University of South Carolina
Jeanette Sutton, University of Colorado, Boulder
Jay Wilson, San Francisco State University

Brian Boruff presented an outline for a future survey of place vulnerability in two small Caribbean nations—Barbados and St. Vincent. Boruff’s study will adapt existing models and apply them to developing nations as well as in data-limited situations. Boruff will contrast the hazard portfolios of hurricanes and landslides in Barbados with hurricanes and eruptions in St. Vincent. Audience feedback included the importance of contrasting types of long-term land use, and the use of the analogs of neighboring islands such as Montserrat, that have a recent hazard history.

The second presentation, by Jamie Mitchem, was the preliminary analysis, on a decadal scale, of tornado frequency data across the U.S. for the period 1960-2001. Data from metropolitan and rural counties were contrasted. Mitchem concluded that there is a metropolitan bias in event reporting, but the significant contrasts between regions preclude finding any consistent temporal or spatial pattern in the data. Mitchem will continue to examine the data on a yearly time scale.

Jeanette Sutton presented a study of the theory of complex adaptation to the World Trade Center disaster by the American Red Cross Spiritual Care Aviation Incident Response Team. Sutton’s research is based on qualitative data gathered from 78 interviews over 3 site visits. The team was simultaneously expanding and extending during an event that was never officially classified as an aviation disaster (creating some conflicts of jurisdiction). The data suggests that the existence of latent tasks permitted rapid group expansion but also required difficult multidimensional adaptations. Sutton will consider measures of effectiveness of the adaptation and its link to latency.

Jay Wilson presented an extended excerpt from a 1-hour video documentary centered on earthquake risk in the area south of market in San Francisco. The video was a dramatic and effective communication tool that demonstrated the complex feedback between geographic, economic, and human factors that lead to exceptionally high seismic risk and low resiliency on a very local scale. This tape has great potential as an educational tool in the classroom and in the community. For more information, contact Wilson at: j.m.wilson@earthlink.net.

REDUCING DISASTER RISKS AND LOSSES THROUGH STRATEGIC COLLABORATION

- Moderator:** Helen Wood, NOAA/National Environmental Satellite, Data & Information Service
- Recorder:** Patricia Jones Kershaw, National Research Council
- Discussants:** Bill Anderson, National Research Council
James Russell, Institute for Business & Home Safety
Margaret Lawless, FEMA/Federal Insurance and Mitigation Administration
Bill Hooke, American Meteorological Society

This plenary session discussed the national/federal mechanisms that exist to improve collaboration between policy-makers and hazards researchers along with ways to more easily deploy hazards research experience to directly reduce disasters losses. All speakers addressed the need for the broad hazards management community to bring authoritative information, insights, research results, and recommendations to all levels of national decision-makers.

Helen Wood discussed the current status of the Subcommittee for Natural Disaster Reduction (SNDR). SNDR is a federal coordinating committee constituted under the National Science and Technology Council's Committee on Environment and Natural Resources. Membership in SNDR consists of representatives from U.S. federal agencies that have a charge to reduce disaster losses. The goals of the SNDR include creating a sustainable society, natural hazards resiliency, and improved coordination among federal agencies. SNDR is the U.S. government body that will be developing a platform for the International Strategy for Disaster Reduction and has been tasked to serve as a quick-response resource to the White House and Congress for science and technology related matters. This subcommittee has recently been reactivated with Helen Wood as chair, Margaret Lawless of FEMA as vice-chair for policy and John Filson of USGS as vice-chair for science and technology.

The Institute for Business and Home Safety (IBHS) is a nonprofit association representing the insurance industry that engages in communication, education, engineering, and research in order to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Jim Russell discussed the IBHS role in building strategic collaborations in order to reduce disaster losses by influencing public policy. IBHS and SNDR partnered in 1997 to create "Public Private Partnership (PPP) 2000." This successful strategic collaboration produced 14 forums and culminated in a final report, "Lessons Learned from PPP2000: Living with Earth's Extremes." IBHS is also a member of the Senate Natural Hazards Caucus Working Group and the Natural Disasters Roundtable. IBHS is currently working with FEMA to look at the levee system in the United States.

The National Academies (including the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council) have had a long history of advising the government on ways to reduce disaster losses. Bill Anderson, current director of the Natural Disasters Roundtable (NDR), described the scope and intent of the roundtable, the Academies' current endeavor. The NDR, established in 2000, is modeled after the aforementioned PPP2000. It holds 3 one-day interdisciplinary forums a year on topics related to

reducing disaster losses, with the goal of enhancing communication and enabling interaction among policymakers, practitioners, researchers, and the public. Membership on the NDR includes representatives from FEMA, USGS, NASA, NOAA, NSF, EPA, PG&E, and IBHS and several appointed members from business, industry, and academia.

Margaret Lawless discussed what she termed, “going from research to reality.” Lawless sees this as a major challenge to the hazards community, if key research results are to be used to improve the nation’s resilience to disasters. FEMA approaches this challenge by supporting research that is directly relevant to people’s lives. For example, FEMA made wind-engineering research more practical through its “safe room” program. FEMA is also aiding local governments doing risk assessments for hazard mitigation plans, which have been mandated for all local governments by the Disaster Mitigation Act of 2000. FEMA cannot be successful in its mission without actively engaging with other agencies and the academic community. Practical tools have come out of the academic community and have been directly beneficial for hazards management. For instance, the development of GIS technology has been used in mapping and recovery efforts for the World Trade Center. Also, a new accounting standard has been established for state and local governments to allow for placing a higher value on infrastructure that has been mitigated.

Bill Hooke described the Natural Hazards Caucus on behalf of David Applegate of the American Geological Institute (AGI) who was unable to be at this session. The caucus is currently made up of 18 senators and is working on increasing that number. Information on the caucus can be found at: <http://www.agiweb.org/workgroup/>.

Hooke pointed out that prior to September 11, researchers were concerned about what happens when disaster strikes small businesses or nonprofit organizations; post September 11, it became possible to see that a larger-scale disaster creates similar disruptions on the sector-wide level—such as the extreme effects of September 11 on the financial, travel, and tourism industries. The rules and the lessons seem to be the same for large and small-scale events. It is futile to wait to return to “normal” after a disaster; instead we must adapt to our new set of circumstances. As the natural hazards/disasters community, we must define what it means to “adapt.” In the post September 11 world, the natural hazards community has much to offer. Hooke concluded by presenting a “top-ten” list of things our hazards community can contribute:

- 1) *Disasters by Design*. Not just the book, but also the entire process of thinking and evaluation embodied by it.
- 2) An understanding that disasters have social root causes.
- 3) A bias towards mitigation.
- 4) A true understanding mitigation.
- 5) An international reach and perspective.
- 6) Pre-existing infrastructure/diversity/connectivity as a community.
- 7) Ability to put terrorist acts into a larger context.
- 8) Our emphasis on learning from mistakes.
- 9) Discipline in keeping score.
- 10) Understanding that mitigation is not just adjunct to, but needs to be integrated into the national agenda.

2002 NATURAL HAZARDS WORKSHOP CLOSING REMARKS: DENNIS MILETI

Thank you for coming, participating, and staying until the end of the 27th Annual Hazards Workshop. Thank you for sharing your ideas, fears, concerns, and worries. Thank you for doing these things as people with different experiences, with varied expertises, as people who want to contribute, and as members of a diverse community in the U.S. and abroad with a profound commitment to making this a safer planet on which to live and to help others in the best possible way. But mostly, on behalf of the Natural Hazards Center staff, thank you for generating your participation in this workshop. The workshop remains an assemblage of some of our best, and is a national and international think tank about hazards and disasters.

For nine years, I have traveled many places as director of the Natural Hazards Research and Applications Information Center (NHRAIC). It has been a profound privilege to be the director of this center. Worldwide, everyone I've ever met has the same reaction to our center: They know us, but not because of a reputation based on past achievements. Rather, people turn to us in a particular way. They listen to us for:

- Leadership.
- Direction.
- To create the agenda.
- As the source of new ideas.
- As the keepers/creators of knowledge.
- As the origin of commitment and community.

Shortly after the prior FEMA director was appointed, we invited him to speak at this workshop. His response to me was that he “had been trying to get invited for 10 years.”

I know, perhaps better than anyone, that none of these wonderful things people think about us are true. There actually is no NHRAIC. We are a handful of people who go to work every day in an old house. The NHRAIC isn't me or its staff. This center is YOU!

The new ideas from these workshops are yours. The publications we catalog and make accessible are yours. Our newsletters report about you and what you are doing, and our sometimes provocative, perhaps even prodding, humor is yours.

The NHRAIC is a mirror that reflects the unending energy and commitment of the community of people you represent. So, to the people of that community, to you—thank you for staying the course this year. The events of September 11 transformed our culture and society in moments, in ways we have yet to distinguish. (I can actually say that because I'm a sociologist.) We are not “safe” any more (but we never were). We can no longer ignore and discount low probability risks (but we never really had the right to do that anyway). None of us can now accomplish our missions working alone (but we never could do that anyway).

Some of the human fears I have heard surface at our workshop:

- Terrorist fears will overshadow “my” hazard.
- I’m an engineer. I don’t really like NSF telling me to work with sociologists.
- I know all we need to know to solve the hazards/disaster problem. Don’t you tell me I don’t.
- They’re re-organizing the federal government again, and my favorite agency, hazard, or approach, could get lost.

This has all happened before, and this time won’t be the last! In the end, it is still us—you and the people you are sitting next to—working to increase safety from disasterous events and better relieve human suffering when such events do occur.

I have spent a few minutes in every session to listen for just one thing: “What ideas came out of our conversations concerning what does not exist—the presence of which could make a big difference?”

Here is what I heard:

- Holistic Approach. Eric Tolbert told us that our nation is on the eve of an “all hazards comprehensive emergency management that will be based on national standards, involve all levels of government, and the relevant people will be trained and our plans will be exercised.” Who among us, informed by experience or the scientific record of research into preparedness and response, could not rejoice in this future? This one silver lining in the cloud that was/is that September 11 will save more lives in our future from other disastrous events than anything imaginable. And, quite frankly—I don’t care who said it, what agency they work for, what fears it instills in those who live other stovepipes—there is a reason to rejoice!
- Many here pointed clearly to the road to success that builds disaster resilient/resistant communities. Many others were pessimistic that we don’t have such communities yet. But it took 226 years to build the communities we have now, and the solution will take many more years.
- Arrietta Chakos, (with all of Berkeley, California’s dollars and well-educated locals) described the prototype approach when she said it takes a community, a network of city officials, professors, mitigation organizations, FEMA for federal leadership, consultants, workshops like the one you’ve just attended, a local champion, and the private sector. Okay, so that is the type of community that needs to be built elsewhere. I ask that none of us get stopped by circumstances and places with less money and education than Berkeley. It will take more work in less ideal situations, but that is what we get paid for. It will take a community, a network of partners – none of us can do it alone.

- Lori Dengler, at the beginning of our workshop, in support of this center’s central mission, said “Grow the pool of people who are involved in this work.” That’s the reason our newsletters are free and why we keep adding new agencies and groups to our advisory board.
- And Priscilla Nelson—out of the mouth of an engineer—warned the research community that NSF really means that disciplines will have to work together if the researchers of today want to get funded in the future. For those of you who might not be aware, you should know that it takes guts to ram a spear through the academic departments of our universities and demand interdisciplinary research and approaches that violate the boundaries of century-old disciplines and paradigms.
- Mike Martinet said that we’ve created a “disaster welfare state” where local authorities have all of the authority but none of the responsibility.
- Betty Morrow spoke of comprehensive vulnerability analysis and of the blended worlds of risk, the constructed environment, and people factors such as the strength of local community institutions and local population parameters.
- And Kathleen Tierney told us of a September 11 lesson: those that cannot handle surprises and improvise cannot handle complex emergency situations. We will never know all there is to know and we will never totally be safe.

What ideas came out of our conversations concerning what does not exist, the presence of which could make a big difference?

- Holistic approaches.
- A network/community at the local level.
- Interdisciplinary approaches.
- Shifting the national culture.
- Comprehensive vulnerability analyses.
- We will never be totally safe, and we will never know all there is to know.

None of these are new ideas. Each has been said in our recent past. What I heard this year is that there is now movement and action underway in our nation to work toward achieving them.

It was Bob Olson who best captured what could be seen or heard from this year’s workshop, when he said, “We are on the threshold of forging continuing links across hazards and disciplines and approaches on common issues.” There is every reason to experience human fear and uncertainty if you do: We are not familiar with doing business this way and we may not even know how to do it yet. However, we will work together as long as we can. Thank you.

HEALTH CARE RESEARCH AND DISASTERS ROUNDTABLE

Convener: Joanne McGlown, Batelle Memorial Institute

The Fourth Annual Health Care Research and Disasters Roundtable met during the Hazards Workshop. Twenty-four participants introduced themselves, and discussed their current or ongoing research in the medical aspects of disasters.

During 2002, the roundtable completed its first service work by hosting and conducting the "first-ever" research track at the National Disaster Medical System (NDMS) annual meeting in Atlanta. Through the efforts of roundtable members, researchers filled 16 hours of education sessions, and provided a current and unique view of the benefits of research and the application of theory to practice. The session was a tremendous success. NDMS Conference Director and roundtable member, Pete Brewster, invited the health care roundtable to organize another 3-day research track at the NDMS 2003 meeting in Reno, Nevada. The title of the 2003 conference is "Unity of Response—Putting the Pieces Together."

Roundtable members Kim Shoaf and Deb Riopelle will lead volunteers interested in planning the upcoming research track, who will review abstracts and select the papers to be presented at the 2003 meeting. Joanne McGlown is the general research track organizer and primary NDMS contact. McGlown and Shoaf are both members of the NDMS Planning Committee. Please notify any of these people if you have research you feel would be beneficial to first responders and medical teams in disasters—and please help spread the word about the session and conference. The selection process will begin very soon, and we welcome your participation.

Members suggested that the roundtable identify a journal that might be interested in publishing a special issue from the papers presented during the 2002 NDMS Research Track. McGlown agreed to make initial contact and asks the assistance of the hazards community to identify journals that may be interested in producing a special medical research issue.

Those interested in research involving medical aspects of disasters are invited to reconvene in Boulder next July for the 5th annual informal gathering of the Health Care Research and Disasters Roundtable.

GIS FOR NATURAL HAZARDS ROUNDTABLE

Co-Conveners: Andy Bruzewicz, U.S. Army Corps of Engineers
Charles Real, California Geological Survey

The meeting was called to order by the co-organizers, Charles Real and Andy Bruzewicz. Following group introductions, Real presented a draft mission statement for the group: GIS for natural hazards management. Discussion included the fact that as data are collected for natural hazards, they can be used for all types of hazards and that there needs to be consideration of the fact that some data may be sensitive and not necessarily available to everyone. The group determined that the focus would be all hazards and emergency/disaster management.

In discussion that followed, key points included: GIS implementation could be more complete; interconnectivity problems exist; loss of key sites could create serious problems; some federal agencies are not as supportive of GIS as they once were; opportunities exist for local communities to work with universities; the technology is being pushed by some software vendors and some agencies; agency statements of GIS support would be helpful; funding may be available through FEMA, Homeland Defense, and the Department of Justice; and there is an opportunity for this group to provide a link between high level committees and working applications.

Possible group objectives:

- Help the hazards community use GIS more effectively.
- Assist first responders.
- Move toward consideration of GIS as one of a suite of technological tools.

Action items:

- Request that there be a GIS plenary session at next year's workshop.
- Solicit GIS applications posters for next year's workshop.
- Solicit volunteers to develop case studies of the use of GIS for all hazards disaster/emergency management. Mitigation examples need to be included.
- Request assistance to create a web site.
- Develop a newsletter.
- Convene a quarterly on-line meeting.
- Develop more complete mission and vision statements.
- Determine whether the Natural Hazards Center could provide space for a web page, assistance with a chat room, or facilitated web-seminars?

John Pine and Andy Bruzewicz were selected as co-chairs for next year. An electronic group was set up for all members of the working group. Contact Pine (jpine@lsu.edu) or Bruzewicz (Andrew.J.Bruzewicz@erdc.usace.army.mil) for complete attendance and membership information.

GENDER AND DISASTER ROUNDTABLE

Co-Conveners: Cheryl Childers, Washburn University
Kristina Peterson, Presbyterian Church USA
Recorder: Barbara Vogt, Oak Ridge National Laboratory

The Sixth Annual Gender and Disaster Caucus met during the Hazards Workshop. Forty-five participants introduced themselves, and discussed their current work, interest, or area of research. E-mail contact information was collected, and information about web sites, resources, contact suggestions and educational opportunities was shared. In addition, paperback copies of the *Gendered Terrain of Disasters* were available for purchase.

Several participants noted that the general discussion of the World Trade Center (WTC) disaster during the workshop largely centered on physical and economic impacts, persons who died during the incident, or those who are connected in some way to the victims. What was not discussed were the “invisible victims”—such as people working in or near the WTC who, since losing employment, cannot send wages back to relatives; women in other countries who felt afraid to venture outside or to travel after the disaster; students studying in the U.S. being forced to return home because of parental fears; and people living in the U.S. experiencing bias simply because of their ethnic heritage or religious background.

There was consensus that the theme of the “invisible victims of September 11” is a worthwhile topic to explore during next year’s workshop, from both domestic and international perspectives. The caucus co-conveners will ask for a panel discussion on “invisible victims” for next year’s workshop.

Peterson displayed a necklace with bells formed by women in war-ravaged areas from metal from melted down land mines. Money from sales is returned to the women’s groups. Peterson also displayed the beaded shawl made for Mary Fran Meyers to show the support of the Gender and Disaster Roundtable.

HAZARDS CENTER DIRECTORS ROUNDTABLE

Convener: David Godschalk, University of North Carolina, Chapel Hill

During the 27th Hazards Research and Applications Workshop, representatives of the North Carolina Institute of Disaster Studies planning committee conducted a focus group with directors and faculty from twelve Hazards Centers and Institutes from around the country. Dave Godschalk moderated the session. Participants were asked for their input about the planning, organization, staffing, and funding of an Institute like the one being considered in North Carolina.

Participants noted that the creation of an Institute would make it easier for faculty and researchers in North Carolina to submit collaborative proposals and secure funds that increasingly go to multi-disciplinary and multi-institutional projects. The Institute would provide valuable information and training in the area of hazards and disasters for the State of North Carolina.

The organizations participating in the focus group began in a variety of ways. Most were created through bottom-up approaches that were rooted in faculty interests. Others were started because of a large grant to the institution or as the result of an internal strategic planning process. Regardless of the way they began, participants emphasized the importance of having a clearly defined mission. Having a mission helps develop a reputation (the Institute will be “known for something”) and is essential for developing a strategic plan, which is necessary for successful fund-raising strategies. An important part of the basic planning is to determine if an academic degree will be offered. Very few of the participating organizations offer academic degrees, although several of them offer certificate programs and professional training.

Related to the issue of mission and purpose is the type of activities the centers perform. Very few are doing applied research or working closely with the private sector, but several are working closely with state divisions of emergency management. Even fewer are working closely with or involve in their advisory boards representatives of the private sector. Only a couple of centers reported having a specific information transfer component. The vast majority is doing basic research.

Only one organization is truly a multi-institutional organization. To participate, the associated institutions are required to provide a cash or in-kind match. Most of the centers are multi-disciplinary, but they also tend to be housed in a specific college or academic unit. Very few of the centers have broad-based advisory boards, but many representatives believed this is a good idea. One center reported that having an influential advisory board had helped prevent major cuts to its funding.

There is a considerable range of staffing size across existing hazards centers. All of the centers have a director. None reported having associate or assistant directors. Most reported having 1-2 administrative assistants, and all supported graduate assistants—both with university support and on one-time monies. The university commitment toward personnel was unclear. Participants spoke of release time and summary salary support and most appeared to indicate that there was some university administrative support. Some centers reported using undergraduate students for research and administrative support. Many of the participants emphasized the importance of having staff with good financial skills. The management time to oversee a large number of projects is substantial.

The optimal balance between grant and contract work for a specific organization should be pre-determined. Most participants favored grant work over contract work, but it is clear that contract work provides an important source of funding for the organizations. Three centers reported that they conduct training for various audiences and some charge for training which results in a very flexible source of income. Grants are for research that advances the strategic mission of the organization and normally range between \$25,000-50,000. Center budgets varied widely. Most participants indicated that their organization has a very small base budget and operating costs are derived largely from contracts and grants. It was unclear how much of the base budget is provided in-kind by the university (e.g., space, telephone, etc.) versus dedicated funds. No center reported having receiving a dedicated state allocation. One organization was started primarily with a substantial donation from the private sector. Centers report a variety of ways to handle overhead—some return all of the overhead they receive to representative colleges, departments and investigators, and some retain their overhead monies. The amount of overhead received varies as well. All of the participants noted the importance of fund-raising.

Participants: Jim Kendra and Kathleen Tierney, Disaster Research Center, University of Delaware; Mike Lindell and Carla Prater, Hazard Reduction & Recovery Center, Texas A&M University; Susan Cutter, Hazards Research Lab, University of South Carolina; Marc Levitan, Hurricane Center, Louisiana State University; Diana McClure, Institute for Business & Home Safety; Jack Harrald, Institute for Crisis, Disaster, and Risk Management, George Washington University; David McEntire, Institute of Emergency Administration and Planning, University of North Texas; Steve Leatherman, International Center for Hurricane Damage and Mitigation Research, Florida International University; Dan Abrams, Mid-American Earthquake Center, University of Illinois Urbana-Champaign; Dorothy Tao, Multidisciplinary Center for Earthquake Engineering Research, State University of New York at Buffalo; Mark Benthien, Southern California Earthquake Center, University of Southern California; Steve French, Center for Geographic Information Systems, Georgia Institute of Technology; Gavin Smith, Durham Technologies, Inc.; Don Markle, Blue Sky Foundation; Rutherford Platt, Department of Geosciences, University of Massachusetts; Jane Bullock, Bullock and Haddow; and Wayne Brown.

Planning Committee Members Present: Ray Burby, Dave Godschalk, Ed Jones, Steve Meinhold, Ron Mitchelson, John Morrison, Sethu Raman, and John Stone.