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Supporting EERI Reconnaissance Activities Following the December 26, 2003, Bam (Iran) Earthquake, Using Remote Sensing Imagery and the VIEWS Field Reconnaissance System

Remote sensing technology is playing an increasingly important role in post-disaster decision support. In the aftermath of major earthquakes, high-resolution imagery can bring significant benefits to crisis response activities, through urban damage detection and situation assessment. Following the successful use of satellite data for mapping building collapse caused by the 2003 Boumerdes (Algeria) earthquake, the Earthquake Engineering Research Institute (EERI) formed a Subcommittee on Remote Sensing, bringing together international expertise from research organizations in the U.S., Europe, and Japan.

The Bam earthquake of December 26, 2003, marks the first occasion where remote sensing imagery has played a central role in EERI reconnaissance activities. The distribution of collapsed buildings was mapped on a city-wide scale, using a change detection algorithm to compare QuickBird satellite images[1] acquired before and soon after the earthquake.[2] The damage map agrees closely with ground-based observations by the U.S. Agency for International Development (USAID), with the hardest hit areas concentrated in eastern districts of Bam. On a neighborhood scale, damage to individual buildings was assessed by close-up inspection and 3-D visualization of the imagery. Satellite data also provided valuable information about potential traffic disruption due to obstructed routes, and evolving relief operations as victims were re-housed in temporary accommodations. These same techniques could help responders to future events gauge the magnitude of response efforts, tell search and rescue teams where victims may be trapped, and facilitate initial casualty and loss estimates.

In order to support EERI field-based activities with the satellite imagery and derived damage map, ImageCat (through funding from the Multidisciplinary Center for Earthquake Engineering Research) developed a notebook-based system called VIEWS (Visualizing the Impacts of Earthquakes with Satellites). Using a live GPS feed to display the team's position on the satellite coverage, VIEWS enabled the reconnaissance team to track their daily movements around the city; visualize damage to individual buildings "on-the-fly"; and link comments and photograph identifications to specific locations.

The future of remote sensing in disaster response is bright. As multi-sensor fusion algorithms take shape and new satellites are launched over the next few years, our vision of a real-time decision support and reconnaissance system for post-earthquake response and recovery will become a reality.

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[1] Courtesy of http://www.digitalglobe.com.
[2] Images purchased by the University of California at Irvine and the EERI Learning from Earthquakes program.

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Perceived Stakeholder Characteristics and Adoption of Seismic Hazard Adjustments: A Survey of California and Washington Residents

This study examines the relationship between gender, perceptions of risk and stakeholder characteristics, and self-reported adoption of 16 seismic hazard adjustments in a sample of Southern California and Western Washington residents. The seven stakeholders selected ranged from the federal, state, and local government (official group) to the media, employers, friends, family, and respondents themselves (informal group). The perceived characteristics of the stakeholders included knowledge of the seismic hazard, trustworthiness, and responsibility for taking protective action. The data revealed significant correlations between perceptions of stakeholder knowledge with protection responsibility, trustworthiness with protection responsibility, and risk perception with protection responsibility. However, no significant differences among residents of higher seismic risk areas (California) with those of medium seismic risk (Washington) were observed. There was a weak support for the hypothesis that gender differences would be evident in perceptions of stakeholder characteristics and consequently adoption of seismic hazard adjustments. Female respondents were more likely to believe that the local government and the media had greater knowledge about the hazard and that the media was a trustworthy source of information. They engaged in fewer adjustments and believed that stakeholders other than their family and themselves were responsible for their safety. Thus the principal policy lessons from this study concern the need for increasing stakeholder knowledge, improving their trustworthiness, and focusing efforts on increasing their responsibility for taking protective actions. Further, in taking a gendered perspective by carefully targeting the female sections of the population, emergency managers can have a greater impact on improving household adjustments to earthquake hazard.

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Disaster Mental Health Intervention: Where do we go from here? What do we look for? How do we get there?

The current standard of practice for mental health response following a major disaster is based on limited empirical evidence. There is a critical need for inter-agency cooperation to generate *a priori* plans on how to conduct ethical research during mental health interventions following a major event in order to determine the best standard of practice. Basic research can assist in providing critical variables that may moderate or mediate the effects of different types of interventions. Self-regulatory factors may be pivotal in post-disaster recovery. Coping self-efficacy is a prime self-regulatory variable for understanding previous research on post-disaster interventions and may be a strong candidate for direct intervention.

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Political Aspects of Natural Disasters: Issues of Governance and Risk Management in Developing Countries

Rising disaster losses and devastation to human life and property has led to great concern within the international community in recent decades. Their destructive and cross-boundary impacts affect developing countries in particular. Natural disasters repeatedly become disasters that threaten sustainable development of some of the world's most vulnerable and poorest nations. To address the risk of natural disasters, in 1990, the United Nations General Assembly launched the International Decade for Disaster Reduction (IDNDR/the Decade) with the aim of mitigating and preventing natural disasters. During the Decade many initiatives were taken. The United Nations established a secretariat to follow up on the Decade. Called the Inter-Agency Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), the secretariat was convened to explore the importance of social sciences in understanding the impact of natural disasters. In spite of this and growing international attention on disasters, natural disasters continue to claim many lives, impose great hardship, and cause large economic losses. What could the international community have done more effectively? Where might the international community have gone wrong? Is it really a lack of political will that causes these outcomes? And how do we define "political will"?

These are the driving questions of this study. The author argues that despite all the efforts undertaken to date, the incentive structures on national and international political levels do not favor risk reduction and disaster prevention. National political environments, especially in developing countries with limited resources, are not conducive to anticipating highly probabilistic future events: it is not politically rewarding, and resources have to be diverted from other more imminent problems. This results in internal political obstacles for adopting preventative measures. On an international level, major financial organizations such as the World Bank, along with international humanitarian branches of main organizations, such as the United Nations or the European Union, are preaching disaster prevention while their incentive structures, mainly consisting of distributing relief or loans, send out an opposite message than prevention to developing countries (that is to wait until the disaster has occurred).

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Comparing the Vulnerability of the Built Environment Among U.S. Cities

Earthquakes, tornados, hurricanes, flooding, hazardous material accidents, and terrorism are just a few of the wide variety of threats that can potentially affect urban places. Cities, which were once viewed as places of security from such threats, are now considered especially vulnerable to environmental hazards. This research examines the relative vulnerability of the built environment among the nation's top 132 U.S. cities. The research questions ask which factors of the built environment help to define its vulnerability to environmental hazards; and if there is there regional variability with respect to the vulnerability of the built environment among U.S. cities. A comparative index of vulnerability was computed with a principal components analysis for the built environment using data from the 132 cities in the study area. Analysis of the results allowed for the identification of the underlying dimensions that contribute to different levels of vulnerability in the built environment. The built environment vulnerability index (BEVI) produced 11 components explaining 73.6% of the total variance among the input variables. Some of the components extracted include industry and public utilities, emergency services, landmarks, and transportation hazards. Mapping the BEVI revealed clusters of high vulnerability in the Northeast, Southeast, and among smaller, non-primary cities. Lower vulnerability was evident in the Southwest region of the U.S.

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Coastal Community Response to Land Loss

This case study describes the accounts of residents of six coastal communities in Louisiana, all of which have experienced change due to events including hurricanes, erosion, development, and the impact of global seafood markets. The purpose of this research project is to explore the relationship of self and identity to place. Attachment to place and identity as members of a community is examined in relation to community members' response to land loss. Self and identity are explored as they are linked to a changing environment and response to disaster.

Intensive qualitative interviews were used in gathering narratives from local residents in all the communities. As the interviews were analyzed, common themes emerged from the narratives. Additionally, other first person accounts from historical documents and other studies were included in the analysis. Preliminarily, we have found that the everyday lives of these individuals reflect a constant awareness of place affecting their choices, behaviors, and belief systems. Further, we found that their sense of self-definition in relation to others is directly linked to their conceptualization and attachment to place and their response to land loss.

The project is designed as a collaborative with the communities in which the interviews have been conducted. Following the completion of transcription and analysis, the interviews will be used as a focus of conversation in meetings with the residents in each of the communities with the interviewees as key participants.

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A Trans-Border, Comparative Examination of Media Coverage of the SARS Outbreak

This study investigates how newspapers and television stations in Detroit and Toronto reported on the recent Severe Acute Respiratory Syndrome (SARS) outbreak. In examining the framing, content, and accuracy of the news coverage, this research seeks to understand how such factors as public health practices, culture, and political agendas may have influenced the coverage of this health crisis and the implications of these influences on effective crisis communication.

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Worst Cases

This presentation is about the social organization of the worst-case imagination. Notions of "the worst" permit investigation of how imagination is shaped by cultural influences and institutional contexts. Designations of the worst involve both prospective and retrospective social constructions. As such they tell us about people's orientations toward the past and the future, as well as toward self, others, and society.

It happens early. The child wants to learn how to ride a bicycle, but is afraid. "What's the worst that can happen?" the parent intones, failing to understand that the child imagines the multiple failures of falling *and* embarrassment. Later, the teenager drives with abandon, operating on the unarticulated presumption that the worst "can't happen to me." She survives to become a CEO of a major industrial concern where she must consider "worst case scenarios" that go beyond anything government regulations require, and then must decide whether to cover them up. When a major accident causes half the plant to explode, killing 200 workers and contaminating two neighboring towns, the carnage exceeds everyone's expectations. The lead paragraph in the paper is "No one could have planned for it. It was the worst industrial accident in 60 years."

Worst cases operate at all societal levels—individual, group, organizational, national—but they haven't received much attention as either empirical phenomena or as an idea. Actual worst cases are quite common, as is worst case thinking. Therefore, we need to understand worst cases, and peoples' ideas about them.

Worst case thinking is decidedly not the recommended way to think about disaster and risk. The accepted way to think about risk and calamity is in terms of probabilities. Indeed, in the modern day we've come to equate probabilism with rational thinking. But this is a political equation, not inherent to probabilism, rationality, or modernity. Practically, we're all admonished to "be reasonable," and to consider courses of action in terms of their *likelihood* of causing harm. It is the probabilistic urge behind the mental salve from airline pilots, when they tell us at the end of flights: "You've now just completed the safest part of your trip."

The key problem is that equating probabilism with reason crowds out *consequential* thinking. If we imagine the future in terms of probabilities, then risks look safe. That's because almost any given future event is unlikely. You're probably not going to die tomorrow. Terrorists probably won't destroy the White House, the Sears Tower, and Harvard University all in the same day. Four tornados probably won't converge on Toledo at the same time. Thinking in terms of probabilities will usually lead to the conclusion that most actions are safe.

But thinking in terms of consequences, which has an affinity with worst cases, leads to more conservative recommendations. Worst case, probabilistic, thinking recognizes that the chances of a modern, American aircraft getting into a crash are low. But it also recognizes the terrible reality if one should occur.

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A System Dynamics Approach to Natural Hazards Mitigation:
Identifying Stakeholders and Preferences for U.S. Flood Mitigation Policies

Extreme events can cause severe damage to many people in a very short period of time. They also have a great potential to do harm. Despite this, policy makers who seek to change individual and community mitigation behavior face considerable challenges. Previous research efforts on extreme events and natural hazards have tested the impact of disasters on policy making by using each disaster as a discrete event, exogenous to the system. The model developed for this research develops an endogenous view of changes to extreme event policies through stock and flow feedback structures.

Floods are among the costliest natural hazards in the U.S. and they account for the largest category of federal disaster declarations. Additionally, floods are broadly distributed across the country. The first piece of this research begins with floods. However, the ultimate goal of this ongoing research is to develop a generic structure for extreme-event policy making and implementation. Future research will replicate the effort undertaken with flooding with other natural hazards, and with the additional variables of technological or social problems such as terrorism or aviation safety.

A key insight from the early stages of this modeling process is the tension in extreme event "policy analysis." At times dominated by a cost/benefit approach, these traditional analyses leave out variables which would give endogenous explanations for changes in policy over time. The more dynamic stock and flow modeling perspective recognizes the contributions of several disciplines that study different aspects of the "policy process." By taking a multi-disciplinary approach to extreme event policy making, this research opens up new avenues for policy analysis.

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Analyzing Effectiveness of Growth Management in Mitigating Hurricane Flooding Exposure and Vulnerability

This ongoing research analyzes shifts in the exposure of people and property to hurricane flooding in a sample of Florida coastal communities between 1995 and 2003. It also analyzes the resulting impact of that exposure on local service demands for emergency shelters, evacuation clearance times, and community vulnerability. The project also will investigate the extent to which the implementation of hazard mitigation policies in local comprehensive plans has influenced observed patterns of land development and growth within hurricane hazard zones.

This work was undertaken in the context of Florida's growth management legislation, which requires local governments to include policies in their comprehensive plans that limit development in and direct populations away from "coastal high hazard areas," which are defined as the category 1 hurricane evacuation zone. State law also requires local governments to enact land development regulations and take other initiatives to implement these policies.

This study uses direct empirical measures of land use change during the period 1995 to 2003 as a basis for quantifying shifts in community exposure to hurricane flooding and for comparing growth rates within and outside of designated hazard areas. To complete this work we have developed a method to document shifts in land use at the parcel level, and associated population changes, using GIS technology. In addition, we have developed a method of consistently defining evacuation zones and storm surge zones and estimating shelter demand, thereby remedying previous limitations to comparing exposure across jurisdictions within the state.

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Non-Technological Problems in Emergency Management Decision-Making

The increasing sophistication of radars, the refinement of atmospheric prediction and detection algorithms, and the design of faster and more efficient means of communication are necessary but not sufficient conditions for the creation of an effective decision-making environment for emergency managers. To create such an environment, we must also consider how non-technological factors shape the practice and process of decision making in emergency management. Emergency managers must not only make decisions, they must do so within the limits of their personal experiences, competing resource and informational demands, and the need to understand and make appropriate use of new technology.

Data for this project are drawn from surveys and interviews from National Weather Service (NWS) employees and local, county, and state emergency managers in Oklahoma. Based on these data, I argue that the decision-making process is complicated by four general, non-technological categories of problems: 1) personal histories and experiences of emergency managers; 2) the political structure of the emergency management role within particular communities; 3) the media; and 4) issues related to technology, resource allocation, and liability. We must generate policy that takes into account these issues in order to enhance the effectiveness of decisions regarding preparedness, mitigation, and response activities.

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Gender and Social Power in Disasters

Following a recent review of the international literature on gender and disaster (Enarson and Meyreles, forthcoming), I argue the need for an approach emphasizing social power and resilience in disaster contexts rather than a population-based reckoning of vulnerability.

- Gender should always be included in some way in vulnerability theory and research though it may not always be a primary concern. In any subfield, ask "Where are the women? How do sex and gender matter? What happens to women/men? Who benefits?" Gender-blind social science is not good science.
- Conversely, gender researchers should always consider the context of gender, e.g. with respect to economic structures, stage of development, cultural systems, (dis)abilities, etc.
- We must investigate, not assume, apparent differences based on gender, e.g. the vulnerability of single heads of households.
- Gender-based vulnerabilities should be investigated directly not indirectly (e.g. as "single parents").
- We should reintroduce bodies and sexuality into disaster theory and practice, drawing attention to reproductive health, sexuality in social crises, gendered bodily constraints, discrimination against lesbians and gays in disaster contexts, etc.
- We must focus more on patriarchy as a cultural and material constraint in disaster contexts.
- We must differentiate "women and children" analytically though they are often joined empirically.
- Gender and disaster researchers should build on the extensive gender and development literature as well as materialist ecofeminist theory and critical men's studies, seeking international collaboration when possible.
- Taking a global approach, researchers should explore how international trends engage women around the world in ways that matter in disasters, e.g. through the global "maid trade," water management practices, transnational family life, etc.
- We must resist the containment of gender analysis as relating to women only, or relating to personal identity. Gender analysis is essential to grasp the implications of globalization, epidemics such as HIV/AIDS, migration, hyper-urbanization, sustainable development, new information technologies, and other broad areas of concern to disaster researchers.
- Simple equations and binary thinking [male: female/power: powerlessness] must be resisted. We must understand how life experience empowers women with skills, resources, and capacities of great practical significance for reducing risk and responding to disasters.
- We need a wider-angle lens to move from case studies to system-wide perspectives. We should study spectacular failures as well as best practices to better inform the debate about engendering risk reduction.

A five-year action plan is needed to: 1) plan regional workshops on gender and disaster; 2) implement a 2-year curriculum transformation project based in a U.S. university with funding for international scholars; and 3) establish an international Working Group on Gender and Disaster to advocate for change, e.g. at the next World Conference on Disaster Reduction (Kobe 2005).

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Physics-Based Modeling of Wildland-Urban and Community Fires

In this research, physics-based modeling of fires in the wildland urban interface (WUI) and housing community fires are used to develop practical tools for fire hazard evaluation of landscaped properties. The approach differs from that used for wildland fire operation models in that individual fuel elements, such as trees, shrubs, and buildings are resolved, and the ignition and burning characteristics of these fuel elements are identified separately. The model is an extension of capabilities of the widely used National Institute of Standards and Technology (NIST) Fire Dynamics Simulator (FDS). Burns of single dry Douglas-fir trees were conducted to measure peak heat release rates, burn durations, and visible flame heights. The rise and fall in the heat release rate curve for the Douglas-fir trees is well represented by a simple triangular shape. Insights from the FDS simulations of WUI fires are used to construct a user-friendly fire model that can demonstrate major effects of ignition by radiant flux.

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Exploring New Data Sources: A Study of SHELDUS and the 1993 Midwest Flood

In the last century, floods were the number one natural hazard in the U.S. when evaluated by the number of lives lost and destruction of property. In 1993 the Great Flood of the Mississippi River Basin caused approximately $20 billion in damage. The flood affected nine states and covered 20 million acres.

The U.S. Army Corps of Engineers and the U.S. Geographic Survey (USGS) have extensive data, including the number of acres flooded, commercial damage from flooding, damage to public facilities, damage to residences, damage to transportation facilities, and damage to utilities. There are other potential sources of hazard data. Within the last year, the Hazards Research Lab of the University of South Carolina released a version of their Spatial Hazard Events and Losses Database for the United States (SHELDUS). SHELDUS includes deaths, injuries, property damage and crop damage at a county level for any event causing at least $50,000 in damage. The data was compiled from multiple sources for 18 different hazard types from 1960-2000.

This research project compares the different sources of information on the Great Flood of 1993 with the intent of investigating the accuracy, benefits, and limitations of SHELDUS. There are obvious differences in the source information, including the fact that SHELDUS only records events reported as causing $50,000 or greater in damage. However, the main goal of this project is to examine the SHELDUS database for a specific hazard event. The Great Flood of 1993 was chosen due to its large spatial extent and lengthy time frame.

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Nowhere to Run, Nowhere to Hide: The Experiences of Low-Income and Minority Households of Eastern North Carolina in Hurricanes Bonnie, Dennis, and Floyd

Some natural hazard literature has suggested that certain categories of people, such as poor and minority populations, are at a greater risk of negative consequences following a disaster event. In this paper, the experiences of low-income and minority households in eastern North Carolina during Hurricanes Bonnie (1998), Dennis (1999), and Floyd (1999) are examined. Telephone interviews were conducted by the East Carolina University Survey Research Laboratory in two waves on a total of nine North Carolina counties. Results indicated that low-income and minority populations fared much worse in the wake of these disasters than other populations. A variety of impact measures were used including self-reported measures of evacuation, property damage, and job loss. Additionally, measures of proportional impact and the comparison of differences in raw and proportional impact measures are included.

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A Survey of GIS and Remote Sensing in State-Level Hazard Offices

Geographic information systems (GIS) and Remote Sensing (RS) technologies have been used in hazards-related applications for the past two or three decades. Research scientists in GIS/RS frequently portray these methods as commonly and successfully used in hazard related applications. Is this true? Do state offices frequently and successfully use remote sensing in each phase of the hazard cycle, particularly the response phase? To acquire an understanding of the current state of GIS and remote sensing use by state agencies involved in hazard mitigation, a nationwide survey of these agencies was conducted. We sought to understand *who* is using these approaches and *what segments* of the disaster cycle (e.g., emergency response, cleanup, recovery, planning, etc.) they are used for. This survey collected information on the agencies, their applications, and spatial information/data needs. If they used GIS/RS approaches we also determined what segment in the disaster cycle the technology was used for. Finally, where appropriate, we surveyed why GIS/RS approaches were not used.

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Exploitation of ISO Quality Assurance/Quality Control Data Processes for the Assessment of Population Mental Health and Fitness

The key to any process is the ability to *measure* its impact on the environment around it. In the manufacturing and services industry, this process is generally typified through the application of one or more *standards,* such as ISO 9000 and ISO 9001. The purpose of these standards and the processes to which they apply is to quantitatively measure and assess the affects and effectiveness of management processes on the quality and performance of an organization. It may also be possible to make use of this same process and the data that is derived from it to assess the mental health and well being of a distributed population.

In initial reviews of Israeli data from ISO 9000/9001 compliant organizations it was noted that there was a high correlation between external events (i.e., terrorist acts, elevated threat warnings and alerts, etc.) and a general decrease in quality of output from a variety of organizations. While this observation may seem intuitively obvious, the use of collected performance data, in accordance with ISO processes and practices, allows for the standardization of the collected data and its comparison across multiple populations.

The value of this type of analysis can be considered in the context of concurrent or near real-time assessment of population mental health and well-being. Not only is this vital in the aggregate, but over time this data can provide an overall assessment of the mental health of the population. It is also of considerable value in measuring the effectiveness of various communication techniques for preparing a population to deal with disaster and in evaluating the state of a population after facing disaster or other adversity. Further, the granularity provided by this method will allow more specific focusing of populations based on temporal and geographic position, as well as other forms of demographics.

The utility of this technique can be considered in the context of providing a diagnostic methodology to assess population health and response to stimuli. Also, of equal value is the fact that the technique builds upon an existing framework of data collection and standardization, thereby significantly reducing the "barrier to entry" of new systems for monitoring and measuring mental health. It has the potential to act as a valuable adjunct to existing measurement techniques, as well as providing a greater and potentially more valuable data set than is currently available.

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Warning and Early Response for Typhoons and Floods

Taiwan is located on the main path of Western North Pacific tropical cyclones. On the average, there are 4.5 typhoons affecting Taiwan annually, with 1.8 of them making landfall. The continuous torrential rain associated with typhoons often causes flooding, landslides, or debris flow, all of which lead to serious damage. Since most of the disasters caused by typhoons in Taiwan are due to their torrential rainfall, a methodology to for quantitative precipitation forecast (QPF) during typhoon period is greatly desired. At the same time, effective emergency response is essential to controlling flood damage and decision makers must be able to forecast the flash flood events and respond. However, their response is usually time-constrained and their actions, such as resident evacuation and traffic closure, are expensive and inconvenient. To reduce these efforts and costs, false alarms must be avoided. The more precisely and timely messages are, the better decisions can be made.

National Science and Technology Center for Disaster Reduction (NCDR), Taiwan, has long been devoted to developing techniques and strategies for mitigating disasters caused by typhoons. In this study, NCDR divisions, including meteorology, flood and drought disaster reduction, slopeland disaster reduction, and information, successfully collaborate to establish decision support system for emergency responses.

The study will introduce the collaboration between the meteorology and flood drought disaster reduction divisions of NCDR. The meteorology division investigates the features of precipitation to develop usable schemes for forecasting rainfall amounts during typhoon periods. A typhoon rainfall climatological model is developed to estimate typhoon rainfall.

The flood and drought disaster division has built, using numerical simulations from 2001, an “Inundation Potential” mapping database of Taiwan. By integrating the forecasting results with the real-time rainfall records and the database, areas with high flood potential can be quickly indicated. The flood warning maps are generated and displayed by the decision support system. With the help of the maps, the emergency managers can realize the area with high flood risk, issue earlier alarms, and deploy rescuers to minimize damage.

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A Comparative Study of Hurricane Evacuation Between the U.S. and Taiwan

Evacuation is a common form of protective action for tropical cyclones as leaving hazard zones is generally effective in saving lives and preventing injuries. People's evacuation behaviors are shaped by physical conditions and social characteristics. However, little published research has examined evacuation behaviors in different environmental and social settings, or discussed the possible causal relationships between these settings and behaviors.

The Hazard Reduction and Recovery Center at Texas A&M University conducted a survey regarding evacuees' experiences in Hurricane Lili in 2003. The survey targeted the evacuation behavior of the residents in two Louisiana parishes (Cameron and Vermilion) and three Texas counties (Chambers, Jefferson, and Orange). Then, the National Science and Technology Center for Disaster Reduction in Taiwan used the questionnaire as the basis for their evacuation behavior survey in four mountain villages of central Taiwan in 2003.

This presentation is based on the results of the U.S. and Taiwanese surveys. It compares the behavior differences in these two cases, discusses the possible causes of the differences, and brings up policy implications for evacuation management.

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Regulatory Considerations for Addressing Risks

My research in recent years has addressed various aspects of the use of regulation as a tool for addressing risks posed by natural and other hazards. This draws attention to the role of building codes, land use regulations, and environmental regulations in helping to avert losses.

What are appropriate regulatory objectives?

A major shift in regulation is taking place for a range of regulatory functions including building codes in moving from "prescriptive" regulation to "performance-based" regulation. The latter entails regulating for results as opposed to prescribing particular means and assessing adherence to those prescribed actions. This shift entails a number of issues relating to the setting of objectives, assessing accomplishments, and shifting forms of accountability. With funding from the Pacific Earthquake Engineering Center (PEER), a National Science Foundation (NSF) funded Earthquake Engineering Research Center, I have explored various facets of these issues. Relevant publications to date from this research include:

Peter J. May. 2004. "Making Choices about Earthquake Performance," *Natural Hazards Review* 5(2): 64-70.

Peter J. May. 2003 "Performance-Based Regulation and Regulatory Regimes: The Saga of Leaky Buildings," *Law and Policy* 25(4): 381-401.

Peter J. May. 2001. "Societal Perspectives about Earthquake Risk: The Fallacy of 'Acceptable Risk'," *Earthquake Spectra* 17(4): 725-737.

How can compliance with regulations be improved?

The factors that affect regulatory compliance are important to consider for the design of more effective regulatory regimes. With funding from the NSF and the U.S. Environmental Protection Agency, I have examined various aspects of compliance motivations and regulatory enforcement practices. Recent publications from this research include:

Peter J. May. 2004. "Compliance Motivations: Affirmative and Negative Bases," *Law and Society Review* 38(1): 41-68.

Peter J. May and Robert S. Wood. 2003. "At the Regulatory Frontlines: Inspectors' Enforcement Styles and Regulatory Compliance," *Journal of Public Administration Research and Theory* 13(2): 117-139.

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Emerging Issues in Risk Communication: Older Adults and Information Processing of Hazards Warnings

To adequately prepare members of the public for potential disasters and warn them to take action when facing an impending disaster, hazard researchers and practitioners must be aware of the needs, limitations, and capabilities of the nation's increasingly diverse population. One notable demographic trend is that the population of the world is aging at an unprecedented rate (Ross, 1995). Population estimates indicate that by 2025, more than 82 million people in the U.S. will be over the age of 60 (U.S. Census Bureau, 2001). Associated with chronological age are a number of factors that may limit the effectiveness of hazard preparedness and warning initiatives. For instance, social factors such as increased isolation and decreased social support may interact to make this segment of the population vulnerable to environmental hazards (Klinenberg, 2002). Likewise, perceptual and cognitive changes (see Craik and Salthouse, 2000; Ngo, 2001 for a review) may affect how well older adults can process hazards-related information whereas physical limitations in mobility can impact warning compliance.

To further elucidate the role of cognitive aging on hazard warning systems, this research uses an information processing model to describe potential deficits in older adults' comprehension of and compliance with disaster warnings. The communication-human information processing (C-HIP) model proposed by Wogalter, DeJoy, and Laughery (1999) describes receiver characteristics such as chronological age in terms of an individual decision maker's progression through a series of information processing stages to determine a course of action. These stages include noticeability/attention, memory/comprehension, attitudes/beliefs/motivation, and behavioral compliance. For a warning to be effective, it must first capture and maintain the attention of the person being warned before it can be understood. Following initial comprehension of a warning message, information concerning the nature of the hazard and hazard avoidance must be retained in memory for later retrieval. Individual difference variables such as age, familiarity with the hazard, anticipated severity of injury, and costs of compliance interact with pre-existing attitudes and beliefs to influence behavioral compliance. Failure in any one of these sequential information processing stages will result in non-compliance with safety information. Because there are documented age-related declines in attention and memory, there is a need for research that investigates the needs of older adults in preparing for hazards and interacting with warnings (Mileti, 1999; Tierney, Lindell, and Perry, 2001).

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Assessing the Impact of a Disease Release on Populations in Urban Centers

Whether spread by insects or in a malicious manner, infectious diseases and bioagents can be tracked through spatial interactions and patterns. As geographic information systems (GIS) get more sophisticated, their ability to help in disaster planning, response and recovery will only be more influential. This is where GIS plays such an important role in the assessment of vulnerability to a bioterrorist attack. For instance, the geographical patterns of interaction between infected and susceptible hosts are crucial for understanding how and where infectious diseases spread. Spatial diffusion is amplified in urban centers with large populations and transportation systems which move millions of people around. Large metropolitan areas tend to be the most vulnerable to terrorist attacks, but it is certainly not limited to these areas. Major issues for geographers and emergency planners alike are trying to understand how an agent could be released, how and where it would spread, and what portion of the population would be most vulnerable. Decision support systems such as GIS, remote sensing, and a robust spatial data infrastructure can help improve interactions among agencies involved with hazard management.

The purpose of this research is to address the following question: How can GIS and remote sensing be used in the hazard and emergency management planning cycle to better understand the geographic conditions and factors that affect the release of an infectious bioagent into an urban population?

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Closing the Circle: A Nursing Model for ILI Disease Management, Surveillance, and Response

In the past two years, we conducted two informal surveys: A survey of telephone nursing triage centers and a survey of registered nurses (RNs). The first survey was conducted to better understand how data might be gathered to predict an Influenza-Like-Illness (ILI) outbreak and develop a timely response to screen and treat influenza or similar epidemics. The second survey was conducted to identify the attitudes of nursing professionals regarding epidemics, isolation, and quarantine for the purpose of supporting a community home-based response.

One solution for improving the standard of care for patients with ILI symptoms is through the use of RN telephone triage and home visits for early detection and intervention at the community and national levels. Patients reporting ILI symptoms can be initially screened during a telephone interview, and receive timely home visits performed by RNs to evaluate symptoms and perform rapid diagnostic tests. Their assessment findings can then be shared with the primary care provider to determine the need for anti-viral medications or further evaluation. In-home screening reduces the need for potentially infectious individuals to be present in physicians' waiting rooms or emergency departments where others could be exposed. RN call centers could also aid in reducing public anxiety by providing a mechanism for worried-well to receive timely clinical advice during an epidemic or bioterrorism incident; potentially reducing the call volume to primary providers, hospital emergency departments, and local public health offices.

We have developed an ILI self-assessment survey that could be used to ease concerns of the worried-well during an outbreak. The survey could be accessed by a touch-tone phone or through the Internet.

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Program of Work – Orientation and Current Projects

My research is broadly focused on understanding the nature of risks and their impact within modern, western society. Mostly within a Canadian context, I have examined or am presently involved in assessing instances of natural and technological hazards including tornadoes, water-borne disease, electricity blackouts, wildfires, and nuclear waste. The latter case was the focus of my doctoral work which I completed in 2001. I along with co-researcher, R. Kuhn, now have a new research project specifically focused on the management of nuclear fuel waste (NFW). The purpose of the Social Science and Humanities Research Council of Canada research grant is to evaluate the management of NFW in other countries in order to gain insights from the international context that will lead to innovative recommendations for Canada's approach to NFW. ***We currently have funding to send master's students interested in doing a thesis to the USA and Europe. Please direct inquiries to the e-mail address provided above.***

Beyond NFW, I have been working on studies of community-level vulnerability and response to the Walkerton, Ontario, *e coli* disaster as well as the Pine Lake, Alberta tornado. In both cases, important aspects of the research involve gender, social capital, and empowerment for local-level emergency management. The Pine Lake project and the blackout study were funded by the Institute for Catastrophic Loss Reduction. I have also just completed an Ontario-wide general population survey for the 2003 electricity blackout and have two other on-going projects related to that event. Early results from the Pine Lake research will be presented at the poster session and two technical reports about the Walkerton tragedy are available on my web site (http://www.wlu.ca/~wwwbrant/pages/people/brenda.shtml). In most cases, however, the dissemination of results is just beginning. Please contact me for information about recent reports, publications, or conference presentations.

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The Identity of Crisis: Muslim Americans After September 11

My dissertation focuses on Muslim university student experiences following the events of September 11, as well as more general sociological issues of religiosity, ethnic minority visibility and immigrant status, gender identity, social class, and group solidarity in response to a crisis event. This longitudinal, qualitative research project officially began less than three weeks after the September 11 attacks when I received a Quick Response Research Grant from the National Science Foundation and the Natural Hazards Center at the University of Colorado. I used the grant funding to travel to New York City to interview Muslim students on several different university campuses. Over the course of two years, I visited New York City four times to examine the ongoing effects of September 11, as well as additional impacts on the religious community. I extended my research to Colorado, and have interviewed Muslim students at various universities in the region. To date, I have conducted 106 interviews (focus groups and individual interviews) with 127 Muslim students in New York and Colorado. The Muslims I have interviewed are primarily first- and second-generation immigrants who identify with over 30 different countries of origin.

Using a grounded theory approach, and drawing heavily from the theoretical traditions of symbolic interactionism and feminist thought, my dissertation offers an in-depth analysis of the experiences of a group of devout young Muslim men and women following September 11. I begin in Chapter Two by describing my research setting, how I gained entrée to the setting, the methodological tools I used to gather and analyze my data, my role in the setting, and issues and challenges that emerged during the data collection phase. In Chapter Three, I analyze the developmental process of religious identity formation. Through the application of role identity salience theory, I explore why and how religion emerged as the most significant source of personal and social identity for the Muslim interviewees. In Chapter Four, I present data regarding the contradictions and pressures associated with dual religious and ethnic minority status in the United States. In Chapter Five, I focus on gendered variation in impacts for the Muslim men and women interviewed for this study, and explore the transformation of religious identity. In Chapter Six, I examine Muslim experiences following the events of September 11. I outline several reasons why Muslims felt excluded from the nationalistic community that emerged in the aftermath of September 11, and the group solidarity that developed in response to the communal exclusion. Chapter Seven deals with social class and the ways that different forms of social, cultural, and economic capital are utilized in negotiating identity marginalization and stigmatization. Finally, in Chapter Eight, the conclusion, I discuss the theoretical contributions of this work, as well as outline recommendation for policy and future research.

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Disaster Mental Health Practices: Impediments to Research

Disaster mental health practices emerge in response to the manifest psychosocial needs of severely affected survivors of horrific events. Key historical events, such as the Coconut Grove Fire in Boston, the Buffalo Creek Flood, Hurricane Andrew, and the Oklahoma City Bombing, established the contexts within which disaster mental health interventions were defined, tried and modified. Publications addressing these events were vivid and compelling in their descriptions of the emotional suffering of the surviving victims and the profound grief among the relatives of the deceased.

Empirical research has focused mainly on epidemiological issues such as identifying risk and protective factors that predict the development of psychopathology. These findings have established the need for disaster mental health services by demonstrating elevations of Post Traumatic Stress Disorder (PTSD) and other mental health problems among samples of people exposed to disasters. They have also been used to identify target populations and suggest mechanisms that may influence either resilient or maladaptive adjustments. However, gathering surveys is much easier than conducting intervention studies under the "field conditions" of freshly devastated communities. Impediments are not only logistical and financial, but also psychological and cultural. Mounting a rapid and well-coordinated mental health response under disaster conditions is an extremely challenging and expensive enterprise. Services are seldom provided under the controlled conditions that are necessary for conducting valid treatment research. Moreover, there are stigmatizing public attitudes towards both mental health issues and research that persistently impede the implementation of scientifically superior designs to study the efficacy of disaster mental health interventions. Thus, the foundation of evidence for effective interventions with disaster survivors is heavily dependent upon logical extrapolation of findings from non-disaster studies (e.g., the trauma and PTSD literatures) conducted under more controlled (i.e., clinic) conditions.

This discussant will address various impediments to field studies of disaster mental health interventions and suggest ways of "coupling" research with interventions to create a more ethical model of providing mental health services to disaster survivors.

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A Probabilistic Risk Analysis for Taipei Seismic Hazard: An Application of HAZ-Taiwan with its Pre-Processor and Post-Processor

This paper employs probabilistic risk analysis to estimate exceedance probability curves, average annual loss (AAL) and probable maximum loss (PML) for seismic hazards. It utilizes an event-driven loss estimation model, HAZ-Taiwan, and develops its pre-processing and post-processing software modules. First, the pre-processing module establishes a set of hazard consistent scenarios. Then, HAZTaiwan model estimates hazards, vulnerabilities and economic losses for each scenario. Finally, the aggregate and occurrence exceedance probability curves for losses and their confidence intervals are simulated using the Monte Carlo simulation method in the post-processing module. The methodology is then applied to analyze seismic risks in Taipei. It finds that the exceedance probability of an aggregate loss of NT$ 40.398 billion is 0.001. This amount of loss is approximately 2.78% of the total stock of buildings in Taipei. Its 5%-95% confidence intervals are NT$ 37.41-43.12 billion. The average annual loss of buildings in Taipei is 1.06 billion, approximately 0.07% of the total stock.

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Comprehensive Plan Quality Evaluation on Natural Hazards Mitigation Provisions: The Case of Arizona

Natural Hazard Mitigation Plans (NHMP) have multifold advantages to reduce community vulnerability to hazards and it has been widely argued that for sustainable planning and a more resilient community against hazards such plans should be integrated with comprehensive (land use) plans (UNISDR 2003,[3] Burby et al 2000[4], Godschalk, Kaiser, and Berke 1998[5]). Though there is no current initiative to integrate the ongoing hazards planning with comprehensive plans in Arizona, interviews with comprehensive planners and emergency planners reveal strong support for such a move.

The primary focus of this research is to evaluate the plan quality of selected jurisdictions in Arizona for their provisions on natural hazards mitigation and identify a strategy for possible integration. Since past studies on plan quality evaluation have focused on floods but not on wildfires and droughts, it is required to revise the plan evaluation protocol to suit Arizona's context. First, I refine this protocol by adding assessment indicators relevant to wildfires and droughts by in-depth review of research done by various agencies and research institutions. Then I evaluate plans of the selected counties in Arizona which have been mandated to adopt comprehensive plans.

The findings indicate that drought has been relatively well addressed in the plans due to the requirement of including a "water element" mandated by the state's "growing smarter plus" program. Wildfire is rarely talked about in plans though there is growing awareness about its impact and some local initiatives to address it pre-disaster. Floods are mainly taken care of by having a design review by Floodplain Zoning Regulation. I then identify areas of plan improvements with respect to fact bases, goals, objectives, and policies. Though the planners are aware that detailed integration of hazards mitigation provisions would be beneficial to the community as well as the government, they express apprehensions about the political will, public awareness, and financial feasibility for such an effort. I conclude by stating that there exists a clear optimism for this type of integration but a strong awareness is needed among all segments of the society about the tremendous benefits of comprehensive planning that includes hazards mitigation.

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Protein Energy Malnutrition Vulnerability in Nine Selected States of India

Since independence, the government of India has attempted to reduce the number of malnourished persons within its borders through implementing several aid programs. Despite this national commitment, over the course of approximately fifty years, have these programs fully resolved the malnutrition problem in India? To answer this question, it is necessary to explore what makes a population vulnerable to malnutrition and how to reduce malnutrition among vulnerable populations.

Protein Energy Malnutrition (PEM) is a form of malnutrition that is some combination of deficient protein or caloric/energy levels. Using Protein Calorie (PC) status levels and variables associated with characteristics related to malnutrition, the specific relationships between geography and vulnerability to PEM were investigated. The aim of the study was to provide a baseline assessment of PEM in India and to identify vulnerable populations. What are the underlying characteristics of PEM vulnerability? Which states are most vulnerable and how can PEM vulnerability be reduced? From the analysis conducted, vulnerable locations were identified and potential measures to reduce PEM were discussed.

Locations in India were selected based on data availability, previous work that highlighted the feminization of malnutrition in India, and efforts initiated by the national government to address the crisis of malnutrition. A statistical analysis of age, gender, and place was undertaken to distinguish patterns in PEM, and analyses of the underlying characteristics of the region were used to quantify vulnerability with the construction of the Dimensions of PEM Vulnerability Index (DiPVI). Results identified the state of Maharasthra as most vulnerable and Gujarat as least vulnerable to PEM. Findings indicated efforts to reduce malnutrition vulnerability should include components that encourage gender equity, increase educational attainment, and increase standards of living.