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## All Hazards

**Ayyub, Bilal M., William L. McGill, and Mark Kaminsky. 2007. Critical asset and portfolio risk analysis: An all-hazards framework. *Risk Analysis* 27(4): 789-801.**

This article develops a quantitative all-hazards framework for critical asset and portfolio risk analysis (CAPRA) that considers both natural and human-caused hazards. Following a discussion on the nature of security threats, the need for actionable risk assessments, and the distinction between asset and portfolio-level analysis, a general formula for all-hazards risk analysis is obtained that resembles the traditional model based on the notional product of consequence, vulnerability, and threat, though with clear meanings assigned to each parameter. Furthermore, a simple portfolio consequence model is presented that yields first-order estimates of interdependency effects following a successful attack on an asset. Moreover, depending on the needs of the decisions being made and available analytical resources, values for the parameters in this model can be obtained at a high level or through detailed systems analysis. Several illustrative examples of the CAPRA methodology are provided.

**Beer, Tom. 2007. The natural hazards theme of the International Year of Planet Earth. *Natural Hazards* 42(3): 469-480.**

The United Nations has declared 2008 to be the International Year of Planet Earth. It is being organized under the auspices of the International Union of Geological Sciences and UNESCO. Planning for the International Year of Planet Earth has consisted of establishing 10 major science themes including hazards. The hazards theme is centered around the following key questions: (1) How have humans altered the geosphere, the biosphere, and the landscape, thereby creating long-term changes detrimental to life and the environment and triggering certain hazards, while increasing societal vulnerability to geophysical (geological and hydrometeorological) hazards? (2) What technologies and methodologies are required to assess the vulnerability of people and places to hazards and how might these be used at a variety of spatial scales? (3) How do geophysical hazards compare relative to each other regarding current capabilities for monitoring, prediction, and mitigation, and what can be done in the short-term to improve these capabilities? (4) What barriers exist to the utilization of risk and vulnerability information by governments (and other entities) for risk and vulnerability reduction policies and planning (including mitigation) from each of the geophysical hazards? Following the December 26, 2004 Indian Ocean tsunami and the UN World Conference on Disaster Reduction held in Kobe, Japan, in

January 2005, the International Council for Science (ICSU) decided to establish a major research program and initiative on Natural and Human Induced Environmental Hazards and Disasters that will cooperate with the hazards theme of the International Year and continue through to 2011.

**Drabczyk, Anne L. 2007. Ready, set, go: Recruitment, training, coordination, and retention values for all-hazard partnerships. *Journal of Homeland Security and Emergency Management* 4(3).**

All-hazards partnerships have the potential to expand the capacity of a community's ability to be ready, set, and able to go in disasters. The Citizen Corps Council is an example of an all-hazards organization, which exists across the United States. Although the membership of each organization might change slightly, an essential similarity remains the partnership of trained volunteers working alongside first responders. One approach to gain insight into the organizational dynamics of the partnership is to identify shared core values. Members validate values through an appreciative inquiry process, which encourages story telling about the organization. This essay documents values associated with recruitment, training, coordination, and retention elements of an all-hazards team. Recommendations for incorporation of identified value statements into all-hazards organizational campaigns, for example, will likely resonate with prospective members.

**Dunbar, Paula K. 2007. Increasing public awareness of natural hazards via the Internet. *Natural Hazards* 42(3): 529-536.** NOAA's National Geophysical Data Center (NGDC) is using state-of-the-art Internet tools for natural hazards education, public outreach, and access to natural hazards data. For example, NGDC acquires, processes, and provides access to geologic hazards event data that are useful in natural hazards risk assessment and hazards-related research. In addition, a collection of natural hazards slides and a teacher's guide on volcanoes are available online. NGDC also created an online "Kids Hazards Quiz" to test the user's knowledge of disaster safety information. An online Natural Hazards Data Resources Directory provides access to information and links to organizations that provide natural hazards data and information. Expanded access to these data and information by the public and researchers can increase public awareness of natural hazards, improve hazards research, and ultimately reduce the devastating impacts of natural disasters.

**Lerner-Lam, Arthur. 2007. Assessing global exposure to natural hazards: Progress and future trends. *Environmental Hazards* 7(1): 10-19.**

Global maps of natural hazard occurrence and risk are useful tools for policy makers and international development organizations. The ranking of countries or regions by relative exposure provides a metric for prioritizing strategies for natural hazard mitigation and risk management, and for planning for response and recovery. However, the calculations underlying global natural hazard

risk mapping depend on the availability and quality of geophysical and socioeconomic data, which are highly variable from region to region, and may impede the application of global rankings to regional decision making. This paper summarizes a recent synthesis of natural hazard occurrence, exposure, and loss data—the World Bank's "Hotspots" project—and describes the advantages and difficulties in such an approach. Several suggestions for more highly resolved, regional, and sub-national analyses are made.

## Business Continuity

**Coleman, Les, and Ira Helsloot. 2007. On the need for quantifying corporate crises and other man-made disasters. *Journal of Contingencies and Crisis Management* 15(3): 119-122.**

**Graham, Leigh T. 2007. Permanently failing organizations? Small business recovery after September 11, 2001. *Economic Development Quarterly* 21(4): 299-314.** Small businesses in Lower Manhattan after September 11, 2001, paint a telling portrait of vulnerability after disasters. This qualitative analysis of recovery for small retail and service firms with 50 or fewer employees is based on ethnographic fieldwork, interviews, and documentary research from September 2001 through 2005. A post-disaster emphasis is on place-based assistance to firms conflicted with macro-level redevelopment plans for Lower Manhattan. Small business recovery was impeded as aid programs responded to a new sense of urgency, attachment to place, and pre-storm conceptions of the neighborhood at the expense of addressing community-wide economic changes accelerated by the disaster. Ingredients for effective programmatic response to the shifting environment and recovery needs of small businesses include (a) long-range planning assistance and relocation options, (b) intelligence on all redevelopment initiatives that affect firms' recovery, and (c) a blend of grants and loans that acknowledges realistic disbursement schedules of private versus public monies.

## Climate Change, Drought, and El Niño

**Below, Regina, Emily Grover-Kopec, and Maxx Dilley. 2007. Documenting drought-related disasters: A global reassessment. *The Journal of Environmental Development* 16(3): 328-344.**

Until recently, drought events were inconsistently recorded in EM-DAT. Problems included inconsistent establishment of start and end dates, misattribution of losses, and difficulties with handling multi-year and multi-country events, mostly arising from the slow onset, spatially extensive, prolonged, and complex nature of drought. This article summarizes the procedures and results of a comprehensive review of 807 drought and 76 famine entries from 1900 to 2004. A standardized methodology has been

developed for characterizing drought events that is consistent with all other natural hazards recorded in the database. The result consists in a reduction of 56% from the original number of drought entries, a 20% increase in the number of deaths and a 35% increase in economic losses. Based on the revised data, more than half of all deaths associated with natural hazards are now classified as drought related, and only floods rank higher in terms of the number of people affected.

**De Sherbinin, Alex, Andrew Schiller, and Alex Pulsipher. 2007. The vulnerability of global cities to climate hazards. *Environment and Urbanization* 19(1): 39-64.**

This paper examines the vulnerabilities of three global coastal cities: Mumbai, Rio de Janeiro, and Shanghai to climate hazards. The paper highlights system characteristics that, in unique combinations, create place-based vulnerabilities to climate hazards. It describes these vulnerabilities then discusses the implications of the results for city planners and managers. A concluding section assesses some of the political obstacles to better disaster preparedness.

**deBoer, J. 2007. Framing climate change and spatial planning: How risk communication can be improved. *Weather Science and Technology* 56(4): 71-78.**

Taking the role of frames into account may significantly add to the tools that have been developed for communication and learning on complex risks and benefits. As part of a larger multidisciplinary study into climate-related forms of sensemaking this paper explores which frames are used by the citizens of Western European countries and, in particular, the Netherlands. Three recent multi-national public opinion surveys were analyzed to examine beliefs about climate change in the context of beliefs about energy technology and concerns about other environmental issues, such as natural disasters. It appeared that many citizens had only vague ideas about the energy situation and that these do not constitute an unequivocal frame for climate issues. In contrast, the results suggest that the long-lasting rainfall and severe floods in Central Europe have had a significant impact. Climate change was often framed in a way that articulates its associations with rain- and river-based problems. This result is extremely important for risk communication because, especially in the Netherlands with its vulnerable coastal zones, climate change may produce many more consequences than rain- and river-based problems only.

**Etkin, David, and Elise Ho. 2007. Climate change: Perceptions and discourses of risk. *Journal of Risk Research* 10(5): 623-641.**

This paper discusses some of the issues that affect risk awareness with respect to climate change and what their impact has been on people's attitudes. It highlights the large gap between the scientific community and the general public in terms of their understanding, awareness, and perception of risks associated with climate change. Awareness is driven both by environmental values or political and economic

agendas; particularly important are worldviews and 'myths of nature', which have a great impact on risk perception. Attitudes are further complicated because the problem of climate change comprises a form of 'post-normal science': it needs to be viewed holistically, with consideration of the feedbacks between the climate system, the human system, and ecosystems; there is large uncertainty and a plurality of legitimate perspectives; and the issue is complex and difficult or impossible to fit into a traditional linear problem-solving model. It is therefore not a rational decision for most individuals to take actions to reduce risk from climate change in the absence of collective action, yet collective action is extraordinarily difficult to achieve. The benefits of risk reduction also fall primarily upon future generations, while uncertainties mean that differences in perspective and problems of poor communication, misinformation, and unstated assumptions tend to cloud the social discourse.

**Isard, S. A., R. J. Schaetzl, and J. A. Andersen. 2007. Soils cool as climate warms in the Great Lakes region: 1951-2000. *Annals of the Association of American Geographers* 97(3): 467-476.**

The authors modeled soil temperatures at 50-cm depth, using 1951-2000 air temperature and precipitation data from 194 National Weather Service stations in Wisconsin and Michigan. The accuracy and bias of the physical model used in this study were validated by comparing its output data to 22,401 actual soil temperature readings taken from sandy soils at 39 forested sites throughout northern Michigan; the model was shown to have almost no temperature bias. Although mean annual air temperatures across the region show no strong spatial or temporal trends over the 50-year period, at many sites, especially in Wisconsin, wintertime air temperatures have been increasing slightly in recent years. Conversely, mean annual soil temperatures have been decreasing at most sites in the region, some by more than 0.5°C. Likewise, wintertime soil temperatures are also decreasing, especially at sites downwind from the Great Lakes—many of which are in snowbelt locations. Increasing wintertime air temperatures over the past 50 years coincide with (and probably have led to) more variable and thinner snowpacks, lessening their insulating impact and contributing to decreasing wintertime soil temperatures that our model shows are occurring in the eastern and northern parts of the region. These findings illustrate the complex response of natural systems to slow atmospheric warming, and draw attention to the potential changes that are occurring in growing season characteristics, phenology, and spring runoff characteristics in the Great Lakes region.

**Knutson, Cody L., Michael J. Hayes, and Mark D. Svoboda. 2007. Case study of tribal drought planning: The Hualapai Tribe. *Natural Hazards Review* 8(4): 125-131.**

Several American Indian tribes are currently leading the way in developing drought mitigation and response plans. These tribes are undertaking the process of identifying and implementing actions that will help them better prepare for and respond to future drought events. The Hualapai Tribe in Arizona is one such group that has recently completed a

drought plan with assistance provided through the Bureau of Reclamation's States Emergency Drought Program. The National Drought Mitigation Center has helped provide technical assistance in developing the Hualapai Tribe's plan and recently conducted interviews with tribal representatives to better understand lessons learned during the planning process. The efforts of the Hualapai Tribe provide an important case study for the development of similar plans for other tribal entities.

**Lemons, John, and Robert Shavelson. 2007. Local development and climate protection: A case study from Alaska. *International Journal of Environmental Studies* 64(4): 507-514.**

Resolution of conflicts between local development and protection of the global climate is difficult. In the United States, policies in the energy-rich state of Alaska favor development of resources rather than protection, and, further, most state policies are not based on jurisprudence principles that consider the problem of global climate change. This article describes a proposal to develop a large coal strip mine that raises conflicts between local development and protection of the global climate. The authors suggest that application of the Public Trust Doctrine might better protect the global climate. The study has import for similar situations elsewhere.

**Michaelows, Axel, and Katharina Michaelows. 2007. Climate or development: Is ODA diverted from its original purpose? *Climatic Change* 84(1): 5-21.**

This article analyzes the interaction of climate and development policy that has taken place since the early 1990s. Increasing dissatisfaction about the results of traditional development cooperation and the appeal of climate policy as a new policy field led to a rapid reorientation of aid flows. At the turn of the century, more than 7% of aid flows were spent on greenhouse gas emissions mitigation. However, the contribution of emissions mitigation projects to the central development objective of poverty reduction as specified in the Millennium Development Goals is limited and other project types are likely to be much more effective. Adaptation to climate change can be expected to have higher synergies with poverty alleviation than mitigation, primarily through its impact on health, the conservation of arable land, and the protection against natural disasters. An analysis of the Clean Development Mechanism shows that projects addressing the poor directly are very rare; even small renewable energy projects in rural areas tend to benefit rich farmers and the urban population. Use of development aid for CDM projects and/or their preparation via capacity building is thus clearly not warranted. The article further analyzes whether the use of development aid for climate policy could be justified as a countermeasure against the emission increase related to successful development itself. However, countries that are achieving an improvement of human development from a low level are unlikely to increase their energy consumption substantially. Only at a level where the middle class expands rapidly, energy consumption and greenhouse gas emissions

soar. Thus targeting middle class energy consumption by appliance efficiency standards and public transport friendly urban planning are the most effective measures to address developing country emissions. Rural renewable energy provision in poor countries has a much higher impact on poverty, but a much lower impact on greenhouse gas emissions. The article concludes that while there are valid reasons for long-term collaboration with emerging economies on greenhouse gas mitigation, there should be a separate budget line for such activities to avoid "obfuscation" of a decline of resources aimed at poverty alleviation. Nevertheless, mitigation will remain attractive for donors because it ensures quick disbursements and relatively simple measures of success. Moreover, mitigation activities in developing countries provide politicians in industrialized countries with a welcome strategy to divert the attention of their constituencies from the lack of success in reducing greenhouse gas emissions domestically.

**Wentz, Frank J., Lucrezia Ricciardulli, Kyle Hilburn, and Carl Mears. 2007. How much more rain will global warming bring? *Science* 317(13): 233-235.**

Climate models and satellite observations both indicate that the total amount of water in the atmosphere will increase at a rate of 7% per Kelvin of surface warming. However, the climate models predict that global precipitation will increase at a much slower rate of 1% to 3% per Kelvin. A recent analysis of satellite observations does not support this prediction of a muted response of precipitation to global warming. Rather, the observations suggest that precipitation and total atmospheric water have increased at about the same rate over the past two decades.

**Zwolsman, J. J. G., and A. J. van Bokhoven. 2007. Impact of summer droughts on water quality of the Rhine River: A preview of climate change? *Weather Science and Technology* 56(4): 45-55.**

It is generally recognized that climate change will affect the discharge regime of the Rhine River. Especially, the anticipated increase in extreme river discharges (floods and droughts) poses serious problems to water management, both with regard to water quantity and water quality. Water quality effects of climate change are not sufficiently recognized, however. The purpose of this study is to investigate the impact of droughts on the water quality of the River Rhine. Time series of river flow and water quality were analyzed for Lobith station located at the Dutch-German border. Over the past three decades, three major droughts were identified, occurring in the years 1976, 1991, and 2003. The water quality during these dry years was compared with the water quality in reference years, characterized by average hydrological conditions and similar chemical pollution. Four groups of water quality parameters were investigated: (1) general variables (water temperature, dissolved oxygen, chlorophyll-a); (2) major ions (chloride, sodium, sulfate, fluoride, bromide); (3) nutrients; and (4) heavy metals. It was found that water quality is negatively influenced by (summer) droughts, with respect to water temperature, eutrophication, major ions,

and heavy metals. Effects on nutrient concentrations were small for ammonium and could not be demonstrated for nitrate, nitrite, and phosphate. The decline in water quality during summer droughts is both related to the high water temperatures and to low river discharges (limited dilution of the chemical load from point sources). Moreover, the impact of the 1976 drought on water quality was far more important than that of the 2003 drought, indicating that the impact of droughts on water quality will be greater when the water quality is already poor.

## Critical Infrastructure

**Brown, C. B., and D. G. Elms. 2007. Structural design codes of practice and their limits. *International Journal of Risk Assessment and Management* 7(6/7): 773-786.**

Structural design codes of practice have been replaced and revised since their inception some 100 years ago. This paper first provides a review of the background to the use and the probabilistic form of codes of practice in structural design. The topic of assessment is treated in two parts involving epistemic and ontological thinking. Firstly, the evidence of the success of the modeling in codes is examined; secondly, matters leading to possible omissions and errors are discussed. Two suggestions for future work are the detection of impending surprise and the possibility of schemes to predict disastrous outcomes. The discussion considers features of assessment including the ownership of codes, functional restrictions, the effect of impact, structural life, the independence of failure and safety, microzonation, and economic and social objectives. One repeated theme is the tendency towards increased precision rather than enhanced accuracy in such assessment studies.

**Ellingwood, Bruce R. 2007. Strategies for mitigating risk to buildings from abnormal load events. *International Journal of Risk Assessment and Management* 7(6/7): 828-845.**

Building structures customarily are designed to withstand loads from their occupants and the natural environment. The normal design process provides a measure of structural integrity that is also available to withstand events that traditionally have been outside the design envelope, including accidents, misuse, and sabotage. Changes in design and construction practices over the past several decades have lessened inherent robustness in certain modern structural systems, making them vulnerable to such events. Social and political factors also have led to an increase in hazardous events that may pose a risk to buildings. Finally, public awareness of building safety has increased as a result of well-publicized natural and man-made disasters. Building practices to mitigate the risk of abnormal loads and ensuing unacceptable damage or collapse can be improved using concepts of structural reliability and risk analysis. This paper summarizes the basis for such practices, from the perspective of a structural engineer.

**Haimes, Yacov Y., Joost R. Santos, and Gregory M. Williams. 2007. Assessing and managing the inoperability of transportation systems and interdependent sectors. *International Journal of Risk Assessment and Management* 7(6/7): 968-992.**

As the global economy continues to grow, the importance of the transportation system increases. Many economic sectors depend upon it either for the transport of goods or for commuting purposes. Disruptions to the transportation system, such as those caused by a terrorist attack or a hurricane, can adversely affect the productivity of interdependent sectors. This article seeks to assess the impact of transportation failures on interdependent sectors, leading to the development of a risk management framework for systemic analysis and mitigation of potential consequences. To provide specific insights on interdependencies surrounding transportation systems, case studies have been conducted.

**Reid, Stuart G. 2007. Reliability-based load-rating procedure for existing bridges. *International Journal of Risk Assessment and Management* 7(6/7): 945-967.**

A procedure has been developed to enable structural engineers to assess the reliability of existing bridges and to determine reliability-based load-ratings for existing bridges without using the classical methods of structural reliability analysis. The reliability index  $\beta$  is expressed as an explicit function of load and resistance parameters similar to those considered in conventional structural engineering calculations. Furthermore, the calculation procedures are formulated to account for the beneficial 'proof-loading' effect of historical traffic loading that has been successfully carried without damage. The results are based on a new type of traffic load model that has been calibrated in relation to Australian traffic load data.

## Disaster and Emergency Management

**Baker, Daniel, and Karen Refsgaard. 2007. Institutional development and scale matching in disaster response management. *Ecological Economics* 63(2-3): 331-343.**

Recent large-scale disasters have challenged institutions to improve the effectiveness of their emergency response strategies. During the 2005 Katrina flood disaster in the United States, institutions utilized different emergency response strategies with varying degrees of success. This paper considers the case of Hurricane Katrina to identify successful strategies that enable institutions to respond effectively and at the appropriate scale. The importance of cross-scale linkages matched to the size and needs of the disaster is discussed as a central component of socio-ecological resilience. A general strategy of adaptive management is proposed that emphasizes the importance of participatory planning with institutional actors where both initial response organizations, as well as institutions involved in longer-term recovery are involved in emergency response exercises. Institutions should develop linkages that promote legitimacy, trust, and the development of social

capital that facilitates integrated and coordinated emergency response. The paper concludes by noting that new threats will require increased coordination, higher levels of institutional flexibility, and greater attention to issues of connectivity in disaster response management.

**Bosher, Lee, Patricia Carrillo, Andrew Dainty, Jacqueline Glass, and Andrew Price. 2007. Realizing a resilient and sustainable built environment: Towards a strategic agenda for the United Kingdom. *Disasters* 31(3): 236-255.**

Recent natural and human-induced emergencies have highlighted the vulnerability of the built environment. Although most emergency events are not entirely unexpected, and the effects can be mitigated, emergency managers in the United Kingdom have not played a sufficiently proactive role in the mitigation of such events. If a resilient and sustainable built environment is to be achieved, emergency management should be more proactive and receive greater input from the stakeholders responsible for the planning, design, construction, and operation of the built environment. This paper highlights the need for emergency management to take a more systematic approach to hazard mitigation by integrating more with professions from the construction sector. In particular, design changes may have to be considered, critical infrastructures must be protected, and planning policies should be reviewed, and resilient and sustainable agendas should be adopted by all stakeholders.

**Denver, Megan, Jaime Perez, and B. E. Aguirre. 2007. Local search and rescue teams in the United States. *Disaster Prevention and Management* 16(4): 503-512.**

This paper provides preliminary information on local search-and-rescue (SAR) teams in the USA. Its purpose is to provide background information on a rarely studied response capability of communities across the United States, local, mostly volunteer SAR teams. Information on local teams was collected from January 2005 until February 2006 through internet searches, online SAR organization lists, and by e-mailing a survey to local teams. A smaller, previously used database was used to verify the final list of teams and 57 new teams were added in this manner. An SPSS database was created using all the fields collated from the survey. It was found that there are 1,150 teams in the United States, which range from one team per state to 79 teams in California. Local SAR teams had a quicker response time than federal teams, while maintaining better equipment and training than emergent volunteers. These teams, unlike the federally funded USAR teams, rely mostly on donations and community fundraisers to continue operating. Missing data were the most consistent problem faced. Web sites, Web links and e-mail addresses often had expired or did not contain the right information, some teams existed without having a Web site (and therefore were not included in the database); also response to the e-mail survey was low. Integrating interested local SAR teams into official multi-organizational disaster and emergency responses could provide valuable additional resources to emergency and incident managers, would allow for better funding for local

SAR, and could facilitate recognition to these often overlooked teams.

**Greenberg, Sheldon F. 2007. Active shooters on college campuses: Conflicting advice, roles of the individual and first responder, and the need to maintain perspective. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incident* 1(s1): s58-s61.**

This article focuses on the importance of preventing active shooters, as well as strategies for coping, common assumptions, dynamics, and various scenarios. It attempts to separate myth, fact, and hyperbole.

**Humphress, Rick. 2007. Building an emergency response competency system: Optimizing emergency personnel mobilization. *Journal of Homeland Security and Emergency Management* 4(3).**

This paper describes the previous attempts at improving the competency levels of first responders, problems with these approaches, and a suggested new approach that focuses on establishing a national emergency response competency system. The analysis focuses on how to derive an improved set of competencies that meet the needs of all stakeholders. It discusses the issue of how to create taxonomies for competencies and their aggregation into clusters, tasks, and roles. It explores the vital linkages between position classification, learning, and performance evaluation. It recommends an approach to performance indexing or scorecarding for ongoing management.

**Ismail-Zadeh, Alik, and Kuniyoshi Takeuchi. 2007. Preventive disaster management of extreme natural events. *Natural Hazards* 42(3): 459-467.**

Several recent extreme natural events resulted in great humanitarian tragedies because of weak preventive disaster management. Here the authors analyze several factors (natural, economical, political, awareness, and preparedness) that brought about the humanitarian tragedies of the early 21st century. They then discuss the role of science in the preventive disaster management of extreme natural events.

**Kapucu, Naim. 2007. Non-profit response to catastrophic disasters. *Disaster Prevention and Management* 16(4): 551-561.**

This article aims to examine the role of non-profit organizations in response to catastrophic disasters. It uses the context of the September 11, 2001 attacks on the World Trade Center in New York City to study the emergence of public non-profit networks in response to an actual event. The case study utilizes the data from content analyses from news reports in *The New York Times*; situation reports from FEMA; interviews with public and non-profit managers; and archival documents. The findings of the study emphasize the importance of well-coordinated collaboration between the public and non-profit sector organizations in effective disaster response operations. This type of network constitutes a field of substantial interest to democratic societies that are seeking to manage problems of public

service delivery with innovative means at reasonable cost. The article's theoretical framework draws upon the literature in interorganizational networks and social capital. The research applies this framework to study the relationships that emerged among public and non-profit organizations following the World Trade Center disaster on September 11, 2001, in New York City.

**Kendra, James. 2007. So are you still active in the field or do you just teach? *Journal of Homeland Security and Emergency Management* 4(3).**

The emergency management field has long been split by an apparent "gap" between academics and practitioners, in spite of efforts over many years to bring these two occupational domains closer together. This paper argues that, while there are differences in the way work is done in these domains, they can actually be seen as part of the same overall profession because they are concerned with the production and application of the same knowledge for the same purpose. The paper bases its argument on the activities considered to be part of Comprehensive Emergency Management, and draws additional support from the relationship between research and practice in other professions. The paper concludes by arguing that the emergency management profession would be strengthened by declaratively closing the gap.

**Lee, Matthew R., Frederick D. Weil, and Edward S. Shihadeh. 2007. The FEMA trailer parks: Negative perceptions and the social structure of avoidance. *Sociological Spectrum* 27(6): 741-766.**

In recent years, negative media attention has fostered the impression that Federal Emergency Management Agency (FEMA) parks are social wastelands filled with criminal elements and other undesirables. FEMA parks have subsequently come to be viewed by some as a major threat to the safety and quality of life of the local communities in which they are situated. This analysis addresses attitudes among Baton Rouge residents toward FEMA trailer parks in Baton Rouge after Hurricane Katrina. Drawing on the Locally Undesirable Land Use/Not in My Backyard (LULU/NIMBY) literature, the contact hypothesis, and a broad paradigm of social status and social control, the authors hypothesize that spatial proximity, contact, and social status will influence negative perceptions of the parks, while these same factors along with the negative perceptions will influence avoidance behaviors. The results indicate that living near a FEMA park is associated with less negative perceptions, while actually seeing trailer park residents is associated with more negative perceptions and a greater odds of avoidance, particularly changing driving routes. Whites are particularly concerned about crime associated with the parks, but interracial trust reduces negative perceptions of the parks and the likelihood of avoidance. Those who are likely to end up in a FEMA park if they were in the same situation are more friendly toward the parks and less likely to use avoidance techniques, and negative

perceptions themselves are strong predictors of avoidance behaviors. The article concludes with a discussion of directions for future research.

**McEntire, David A. 2007. The historical challenges facing emergency management and homeland security. *Journal of Emergency Management* 5(4): 17-22.**

This article discusses 13 challenges facing emergency management and homeland security. These include the tension between national security and the all-hazards approach, apathy, the disconnect between development and disasters, the subsidization of risk, the paper plan syndrome, a reactive approach, a first-responder orientation, limited budgets, insufficient personnel, heavy work loads, political appointees, poor management, and politics. The article concludes with a discussion and recommendations for the future.

**Miyaguchi, Takaaki, and Rajib Shaw. 2007. Corporate community interface in disaster management: A preliminary study of Mumbai, India. *Risk Management* 8(4): 209-222.**

The frequency of natural disasters, particularly in Asia Pacific regions, has drastically increased in the recent years. Responding to this unprecedented frequency and magnitude, the corporate sector has started to play a vital role in lessening the damage and impact after disaster as well as in risk-reduction activities. This study took an exploratory survey among a number of corporate sector companies in Mumbai, India, and studied their attitude and behavior toward community and disaster management by focusing on their risk management, community involvement, and corporate social responsibility practices. It provides a wide range of corporate activities in disaster management field and their tendencies.

**Ray-Bennett, Nibedita S. 2007. Environmental disasters and disastrous policies: An overview from India. *Social Policy and Administration* 41(4): 419-424.**

Though disasters have been important recurring events in South Asia, the policy framework for addressing the issues arising from disaster has been weak. Taking an alternative perspective on the definition of disaster itself, this article attempts to address the cause of the increasing numbers of disasters in India. The article posits that the nation-state still understands disasters as a natural phenomenon, rather than as an intersection between conditions of vulnerability and actual hazards. This is to be observed in the disaster policies adopted. Hence, this article emphasizes the inclusion of 'vulnerability' as paramount.

**Reddick, Christopher G. 2007. Homeland security preparedness and planning in US city governments: A survey of city managers. *Journal of Contingencies and Crisis Management* 15(3): 157-167.**

This article examines homeland security preparedness and planning with the aim of generating some future research themes related to organizational, collaborative, and adaptive management elements of homeland security. It analyzes



survey data from city managers in the United States and their views on the current state of homeland security. The key results indicate that there is a high level of collaboration between and among city government and other levels of government in homeland security preparedness and planning, supporting an element of the adaptive management theory. However, with regard to using performance systems to gain accountability in homeland security this was not commonly occurring. The federal government's color-coded homeland security advisory system is viewed by 32% of city managers who responded to the survey as being ineffective. The largest administrative/management homeland security concerns were lack of money and personnel limitations.

**Rose, Adam, Keith Porter, Nicole Dash, Jawhar Bouabid, Charles Huyck, John Whitehead, Douglas Shaw, Ronald Eguchi, Craig Taylor, Thomas McLane, L. Thomas Tobin, Philip T. Ganderton, David Godschalk, Anne S. Kiremidjian, Kathleen Tierney, and Carol Taylor West. 2007. Benefit-cost analysis of FEMA hazard mitigation grants. *Natural Hazards Review* 8(4): 97-111.** Mitigation decreases the losses from natural hazards by reducing our vulnerability or by reducing the frequency and magnitude of causal factors. Reducing these losses brings many benefits, but every mitigation activity has a cost that must be considered in our world of limited resources. In principle, benefit-cost analysis (BCA) attempts to assess a mitigation activity's expected net benefits (discounted future benefits less discounted costs), but in practice this often proves difficult. This paper reports on a study that applied BCA methodologies to a statistical sample of the nearly 5,500 Federal Emergency Management Agency (FEMA) mitigation grants between 1993 and 2003 for earthquake, flood, and wind hazards. HAZUS-MH was employed to assess the benefits, with and without FEMA mitigation in regions across the country, for a variety of hazards with different probabilities and severities. The results indicate that the overall benefit-cost ratio for FEMA mitigation grants is about 4:1, though the ratio varies from 1.5 for earthquake mitigation to 5.1 for flood mitigation. Sensitivity analysis was conducted and shows these estimates to be quite robust.

**Shores, Elizabeth F., Jamie Heath, Erin Barbaro, Michael C. Barbaro, and Cathy Grace. 2007. Putting young children on disaster maps: The challenges of child care data integration. *Journal of Emergency Management* 5(4): 47-55.** The purpose of this paper is to determine the capacity for and degree of data sharing for the purpose of emergency preparedness of the child care sector, among child care agencies, and between child care agencies and emergency management agencies in 12 states. A survey of federal and state child care agencies; evaluations of federal and state datasets; analysis of hurricane and earthquake risk areas; analysis of U.S. Census Bureau data on population aged 0-4 years in counties (located in Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas); the feasibility of merging five or more early childhood services datasets from

each state. Little data sharing occurs within or between the two sectors in the 12 states under study, putting at least 2 million children under school age at risk of being overlooked in disaster response and effectively excluding the child care sector from state recovery plans. Improved data sharing among agencies within the child care sector and between the childcare sector and the emergency management sector is crucial to mitigate the risks for children aged 0-4 and to include them among vulnerable populations that receive top priority in first response, as well as to include the child care sector in economic redevelopment after major disasters.

**Spennemann, Dirk H. R., and Kristy Graham. 2007. The importance of heritage preservation in natural disaster situations. *International Journal of Risk Assessment and Management* 7(6/7): 993-1001.**

Natural disasters impact the human-created environment. Affected are both the general built environments as well as those few places that a community cherishes as representing their past achievements, aspirations and tribulations—their cultural heritage sites. Natural disasters are localized events and have the ability to cause extensive loss and destruction to a community's cultural heritage. Cultural heritage management ("historic preservation") aspires to protect such places from environmental decay as well as natural disasters, with technical solutions the *modus operandi* of choice. Disaster managers have traditionally always regarded the protection of cultural heritage places as very low on their list of priorities. This paper shows the centrality of cultural heritage to the emotional wellbeing of an affected community in the disaster-recovery phase and argues that the protection of key cultural heritage items should be regarded as akin to the treatment of critical infrastructure.

**Tovia, F. 2007. An emergency logistics response system for natural disasters. *International Journal of Logistics Research and Applications* 10(3): 173-186.**

Natural disasters are a threat to human lives and the world economy, and recent experiences have proven that the current emergency management systems have significant deficiencies. The objective of this research is to develop an Emergency Response Model (ERM) that can be used by offices of emergency preparedness to evaluate response capabilities, to assess the logistics challenges in the event of natural disaster and to perform what-if analysis on the threat of a weather disturbance system. The first step to develop the ERM is to define the mechanisms and coordination that must be in place among the different emergency management agencies in the event of a natural disaster. Then, the logistics (activities and time frame) that have to be implemented are defined. Finally, a simulation model is built and used to evaluate the effectiveness of current emergency preparedness systems as compared with the proposed system.



## Disaster Relief

**Fulmer, Terry, Ian Portelli, George L. Foltin, Rae Zimmerman, Esther Chachkes, and Lewis R. Goldfrank. 2007.**

**Organization-based incident management: Developing a disaster volunteer role on a university campus. *Disaster Management and Response* 5(3): 74-81.**

Catastrophic events are an ongoing part of life, affecting society both locally and globally. Recruitment, development, and retention of volunteers who offer their knowledge and skills in the event of a disaster are essential to ensuring a functional workforce during catastrophes. These opportunities also address the inherent need for individuals to feel necessary and useful in times of crisis. Universities are a particularly important setting for voluntary action, given that they are based in communities and have access to resources and capabilities to bring to bear in an emergency situation. The purpose of the study was to discern how one large private organization might participate and respond in the case of a large-scale disaster. Using a 2-phase random sample survey, 337 unique respondents (5.7%) out of a sample of 6,000 replied to the survey. These data indicate that volunteers in a private organization are willing to assist in disasters and have skills that can be useful in disaster mitigation. Much is to be learned related to the deployment of volunteers during disaster. These findings suggest that volunteers can and will help and that disaster preparedness drills are a logical next step for university-based volunteers.

**Lee, Matthew R., Frederick D. Weil, and Edward S. Shihadeh. 2007. The FEMA trailer parks: Negative perceptions and the social structure of avoidance. *Sociological Spectrum* 27(6): 741-766.**

In recent years, negative media attention has fostered the impression that Federal Emergency Management Agency (FEMA) parks are social wastelands filled with criminal elements and other undesirables. FEMA parks have subsequently come to be viewed by some as a major threat to the safety and quality of life of the local communities in which they are situated. This analysis addresses attitudes among Baton Rouge residents toward FEMA trailer parks in Baton Rouge after Hurricane Katrina. Drawing on the Locally Undesirable Land Use/Not in My Backyard (LULU/NIMBY) literature, the contact hypothesis, and a broad paradigm of social status and social control, the authors hypothesize that spatial proximity, contact, and social status will influence negative perceptions of the parks, while these same factors along with the negative perceptions will influence avoidance behaviors. The results indicate that living near a FEMA park is associated with less negative perceptions, while actually seeing trailer park residents is associated with more negative perceptions and a greater odds of avoidance, particularly changing driving routes. Whites are particularly concerned about crime associated with the parks, but interracial trust reduces negative perceptions of the parks and the likelihood of avoidance. Those who are likely to end up in a FEMA park if they were in the same situation are more friendly toward the parks and less likely to use avoidance techniques, and negative

perceptions themselves are strong predictors of avoidance behaviors. The article concludes with a discussion of directions for future research.

**Michel, Lacie M. 2007. Personal responsibility and volunteering after a natural disaster: The case of Hurricane Katrina. *Sociological Spectrum* 27(6): 633-652.**

This study examines prosocial behavior and volunteerism in the context of Hurricane Katrina. Using interviews from East Baton Rouge Parish residents, results demonstrate that self-efficacy, education, religious attendance, and organizational membership exert significant, positive effects on feeling personally responsible for helping victims. Education, presence of children in the home, organizational membership, and the interaction between religious attendance and personal responsibility exert significant, positive effects on total hours spent volunteering at shelters for victims. These findings suggest that there is not a one-to-one correspondence between the characteristics of the typical volunteer and those who volunteer in a natural disaster.

**Miller, Andrew C., and Bonnie Arquilla. 2007. Disasters, women's health, and conservative society: Working in Pakistan with the Turkish Red Crescent following the South Asian earthquake. *Prehospital and Disaster Medicine* 22(4): 269-273.**

In recent years, numerous catastrophic disasters caused by natural hazards directed worldwide attention to medical relief efforts. These events included the (1) 2003 earthquake in Bam, Iran; (2) 2004 earthquake and tsunami in Southeast Asia; (3) Hurricanes Katrina and Rita in the southern United States in 2005; (4) 2005 South Asian earthquake; and (5) 2006 Indonesian volcanic eruption and earthquakes. Health disparities experienced by women during relief operations were a component of each of these events. This article focuses on the response of the Turkish Red Crescent Society's field hospital in northern Pakistan following the South Asian Earthquake of October 2005, and discusses how the international community has struggled to address women's health issues during international relief efforts. Furthermore, since many recent disasters occurred in culturally conservative South Asia and the local geologic activity indicates similar disaster-producing events are likely to continue, special emphasis is placed on response efforts. Lessons learned in Pakistan demonstrate how simple adjustments in community outreach, camp geography, staff distribution, and supplies can enhance the quality, delivery, and effectiveness of the care provided to women during international relief efforts.

**Naturale, April. 2007. Secondary traumatic stress in social workers responding to disasters: Reports from the field. *Clinical Social Work Journal* 35(3): 173-181.**

Social workers are called to respond to disasters to provide assessment, crisis counseling, and trauma treatment as part of the recovery effort. While research has identified the types of interventions appropriate in assisting trauma survivors, little empirical research exists to help address the distress

responses that social workers experience when exposed to the trauma material of disaster survivors and their families. Case examples can inform social work practice using evidence informed interventions and recording the outcomes. This article presents three case histories of social workers responding to disasters, the course of their secondary traumatic stress responses, and their struggle to overcome the psychological adversity they faced.

**Stromberg, David. 2007. Natural disasters, economic development, and humanitarian aid. *Journal of Economic Perspectives* 21(3): 199-222.**

Natural disasters are one of the major problems facing humankind. Between 1980 and 2004, two million people were reported killed and five billion people cumulatively affected by around 7,000 natural disasters, according to the dataset maintained by the Centre for Research on the Epidemiology of Disasters (CREDE) at University of Louvain (Belgium). The economic costs are considerable and rising. The direct economic damage from natural disasters between 1980 and 2004 is estimated at around \$1 trillion. This paper starts by describing the incidence of natural disasters, where they strike, and their development over time. It then discusses how societal factors act to protect people from or expose them to natural hazards. The final section discusses the determinants and targets of international aid to disaster victims.

## Earthquakes

**Antonioni, Giacomo, Gigliola Spadoni, and Valerio Cozzani. 2007. A methodology for the quantitative risk assessment of major accidents triggered by seismic events. *Journal of Hazardous Materials* 147(1-2): 48-59.**

A procedure for the quantitative risk assessment of accidents triggered by seismic events in industrial facilities was developed. The starting point of the procedure was the use of available historical data to assess the expected frequencies and the severity of seismic events. Available equipment-dependant failure probability models (vulnerability or fragility curves) were used to assess the damage probability of equipment items due to a seismic event. An analytic procedure was subsequently developed to identify, evaluate the credibility, and finally assess the expected consequences of all the possible scenarios that may follow the seismic events. The procedure was implemented in a GIS-based software tool in order to manage the high number of event sequences that are likely to be generated in large industrial facilities. The developed methodology requires a limited amount of additional data with respect to those used in a conventional QRA, and yields with a limited effort a preliminary quantitative assessment of the contribution of the scenarios triggered by earthquakes to the individual and societal risk indexes. The application of the methodology to several case studies evidenced that the scenarios initiated by seismic events may have a relevant influence on industrial risk, both raising the overall expected frequency of single

scenarios and causing specific severe scenarios simultaneously involving several plant units.

**Celebi, Mehmet. 2007. Developments in seismic monitoring for risk reduction. *Journal of Risk Research* 10(5): 715-727.**

This paper presents recent state-of-the-art developments to obtain displacements and drift ratios for seismic monitoring and damage assessment of buildings. In most cases, decisions on safety of buildings following seismic events are based on visual inspections of the structures. Real-time instrumental measurements using GPS or double integration of accelerations, however, offer a viable alternative. Relevant parameters, such as the type of connections and structural characteristics (including storey geometry), can be estimated to compute drifts corresponding to several pre-selected threshold stages of damage. Drift ratios determined from real-time monitoring can then be compared to these thresholds in order to estimate damage conditions drift ratios. This approach is demonstrated in three steel frame buildings in San Francisco, California. Recently recorded data of strong shaking from these buildings indicate that the monitoring system can be a useful tool in rapid assessment of buildings and other structures following an earthquake. Such systems can also be used for risk monitoring, as a method to assess performance-based design and analysis procedures, for long-term assessment of structural characteristics of a building, and as a possible long-term damage detection tool.

**Gisler, Monika, Donat Fah, and Virgilio Masciadri. 2007. "Terrae motus factus est": Earthquakes in Switzerland before A.D. 1000: A critical approach. *Natural Hazards* 43(1): 63-79.**

The authors focus on Swiss earthquakes in antiquity and the early medieval period before A.D. 1000. We have information on less than half a dozen earthquakes within this era, since written records for the first half of the first millennium A.D. are minimal, and there is little hope of finding more written evidence for earthquakes. Furthermore, interpreting the documents at hand is somewhat complex. For the 6th century *Gregory of Tours in Historia Francorum* gives hints of a rockslide near the castle *Tauredunum (Le Grammont)* in the Swiss canton Valais, an event that has been considered in the literature as caused by an earthquake. The *Carolingian* period (ca. 750–950) included the rise of some very important cultural centers in various parts of today's Switzerland. For instance, the ecclesiastical culture in St. Gallen generated a remarkable number of written records, which survived for our use in a unique manner. From the 9th and 10th centuries, we have evidence for earthquakes in the years 849, 867, 902, and 944. However, information on them remains so scarce that their location and intensity are generally difficult to assess. Nevertheless, the finding of a new document—a memoir written by the abbot of Reichenau—offers some insight into the A.D. 849 event and its reportedly aftershocks.

**Hung, Hung-Chih, and Liang-Chun Chen. 2007. The application of seismic risk-benefit analysis to land use planning in Taipei City. *Disasters* 31(3): 256-276.**  
In the developing countries of Asia local authorities rarely use risk analysis instruments as a decision making support mechanism during planning and development procedures. The main purpose of this paper is to provide a methodology to enable planners to undertake such analyses. The authors illustrate a case study of seismic risk-benefit analysis for the city of Taipei, Taiwan, using available land use maps and surveys as well as a new tool developed by the National Science Council in Taiwan—the HAZ-Taiwan earthquake loss estimation system. They use three hypothetical earthquakes to estimate casualties and total and annualized direct economic losses, and to show their spatial distribution. The authors also characterize the distribution of vulnerability over the study area using cluster analysis. A risk-benefit ratio is calculated to express the levels of seismic risk attached to alternative land use plans. This paper suggests ways to perform earthquake risk evaluations and the authors intend to assist city planners to evaluate the appropriateness of their planning decisions.

**Ismail-Zadeh, Alik, Vladimir Sokolov, and Klaus-Peter Bonjer. 2007. Tectonic stress, seismicity, and seismic hazard in the Southeastern Carpathians. *Natural Hazards* 42(3): 493-514.**  
Intermediate-depth earthquakes in the Vrancea region occur in response to stress generation due to descending lithosphere beneath the southeastern Carpathians. In this article, tectonic stress and seismicity are analyzed in the region on the basis of a vast body of observations. The authors show a correlation between the location of intermediate-depth earthquakes and the predicted localization of maximum shear stress in the lithosphere. A probabilistic seismic hazard assessment (PSHA) for the region is presented in terms of various ground motion parameters on the utilization of Fourier amplitude spectra used in engineering practice and risk assessment (peak ground acceleration, response spectra amplitude, and seismic intensity). They review the PSHA carried out in the region, and present new PSHA results for the eastern and southern parts of Romania. Their seismic hazard assessment is based on the information about the features of earthquake ground motion excitation, seismic wave propagation (attenuation), and site effect in the region. Spectral models and characteristics of site-response on earthquake ground motions are obtained from the regional ground motion data, including several hundred records of small and large earthquakes. Results of the probabilistic seismic hazard assessment are consistent with the features of observed earthquake effects in the southeastern Carpathians and show that geological factors play an important part in the distribution of the earthquake ground motion parameters.

**Joshi, A., Kapil Mohan, and R. C. Patel. 2007. A deterministic approach for preparation of seismic hazard maps in North East India. *Natural Hazards* 43(1): 129-146.**  
A method of seismic zonation based on deterministic modeling of rupture plane is presented in this work. This

method is based on the modeling of finite rupture plane along identified lineaments in the region using the semi-empirical technique, of Midorikawa [(1993) *Tectonophysics* 218: 287–295]. The modeling procedure follows  $w^2$  scaling law, directivity effects, and other strong motion parameters. The technique of zonation is applied for techno-economically important northeast part of the Brahmaputra Valley that falls in the seismic gap region of Himalaya. Zonation map prepared for the Brahmaputra Valley for earthquakes of magnitude  $M > 6.0$  show that approximately 90,000 km<sup>2</sup> area fall in the highly hazardous zone IV, which covers regions that can have peak ground accelerations of order more than 250 cm/s<sup>2</sup>. The zone IV covers the Tezu, Tinsukia, Dibrugarh, Ziro, North Lakhimpur, Itanagar, Sibsagar, Jorhat, Golaghat, Wokha, Senapati, Imphal, and Kohima regions. The Pasighat, Daring, Basar, and Seppa region belong to zone III with peak ground accelerations of the order 200–250 cm/s<sup>2</sup>. The seismic zonation map obtained from deterministic modeling of the rupture is consistent with the historical seismicity map and it has been found that the epicenter of many moderate and major earthquakes fall in the identified zones.

**Lopez, Oscar A., Julio J. Hernandez, Gianina Del Re, Jose Puig, and Luis Espinosa. 2007. Reducing seismic risk of school buildings in Venezuela. *Earthquake Spectra* 23(4): 771-790.**  
School buildings have frequently collapsed during earthquakes. The 1997 Cariaco earthquake led to the ruin of four reinforced concrete school buildings that were built several years ago. Failures were the result of structural deficiencies: short columns and low lateral strength, stiffness, and energy dissipation capacity. Seventy percent of Venezuelan schools are in high-hazard regions; about 1,000 are similar to the collapsed schools. With the purpose of developing a national risk reduction program, the expected seismic performance of two typical schools was evaluated: one representing schools built 50 years ago (Old-type) and one representing schools built 20 to 30 years ago (Box-type). These were analyzed utilizing nonlinear pushover techniques and compared with the inventory of schools in Venezuela. Old-type schools were found to need retrofitting in moderate- and above-seismic zones, and Box-type schools in higher zones. Practical retrofitting is achieved with the addition of auxiliary structures to support the seismic loads, leaving the existing structures to support only the gravity loads. This effort has led to a national program, beginning with the initial phase, involving the survey of approximately 28,000 existing schools.

**Miller, Andrew C., and Bonnie Arquilla. 2007. Disasters, women's health, and conservative society: Working in Pakistan with the Turkish Red Crescent following the South Asian earthquake. *Prehospital and Disaster Medicine* 22(4): 269-273.**

In recent years, numerous catastrophic disasters caused by natural hazards directed worldwide attention to medical relief efforts. These events included the (1) 2003 earthquake

in Bam, Iran; (2) 2004 earthquake and tsunami in Southeast Asia; (3) Hurricanes Katrina and Rita in the southern United States in 2005; (4) 2005 South Asian earthquake; and (5) 2006 Indonesian volcanic eruption and earthquakes.

Health disparities experienced by women during relief operations were a component of each of these events. This article focuses on the response of the Turkish Red Crescent Society's field hospital in northern Pakistan following the South Asian Earthquake of October 2005, and discusses how the international community has struggled to address women's health issues during international relief efforts. Furthermore, since many recent disasters occurred in culturally conservative South Asia and the local geologic activity indicates similar disaster-producing events are likely to continue, special emphasis is placed on response efforts. Lessons learned in Pakistan demonstrate how simple adjustments in community outreach, camp geography, staff distribution, and supplies can enhance the quality, delivery, and effectiveness of the care provided to women during international relief efforts.

**Power, William, Gaye Dowens, and Mark Stirling. 2007.**

**Estimation of tsunami hazard in New Zealand due to South American earthquakes. *Pure and Applied Geophysics* 164(2-3): 547-564.**

The authors develop a probabilistic model for estimating the tsunami hazard along the coast of New Zealand due to plate-interface earthquakes along the South American subduction zone. To do this they developed statistical and physical models for several stages in the process of tsunami generation and propagation, and developed a method for combining these models to produce hazard estimates using a Monte-Carlo technique. This process is largely analogous to that used for seismic hazard modeling, but is distinguished from it by the use of a physical model to represent the tsunami propagation, as opposed to the use of empirical attenuation models for probabilistic seismic hazard analysis.

**Tobita, Tetsuo, Masakatsu Miyajima, Abdolhossein Fallahi, Reza Alaghebandian, and Mohanmad Reza Ghayamghamian. 2007. Seismic intensity estimation through questionnaire survey and collapse rates of various building types in the 2003 Bam, Iran, earthquake. *Earthquake Spectra* 23(4): 841-865.**

Seismic intensity in the epicentral area of the 2003 Bam, Iran, earthquake is estimated using a questionnaire survey conducted two months after the earthquake. The estimated average seismic intensity on the Japan Meteorological Agency (JMA) scale is 6.1 (VIII to IX in the MMI scale). The peak frequency of the horizontal-to-vertical spectral ratio derived from microtremor measurements conducted during reconnaissance is also compared with the seismic intensity. Collapse rates for various structure types, such as adobe, unreinforced/reinforced masonry, steel-frame, and reinforced concrete, are obtained by counting the number of demolished buildings within a 50-meter radius around an observation point. Results show large differences in collapse rates between unreinforced and reinforced masonry, and

suggest the upper limit of seismic intensity that unreinforced masonry can sustain. This fact can be utilized for an initial damage assessment within affected areas after large earthquakes.

## Floods

**Artan, Guleid, Hussein Gadain, Jodie L. Smith, Kwabena Asante, Christina J. Bandaragoda, and James P. Verdin. 2007. Adequacy of satellite derived rainfall data for stream flow modeling. *Natural Hazards* 43(2): 167-185.**

Floods are the most common and widespread climate-related hazard on Earth. Flood forecasting can reduce the death toll associated with floods. Satellites offer effective and economical means for calculating areal rainfall estimates in sparsely gauged regions. However, satellite-based rainfall estimates have had limited use in flood forecasting and hydrologic stream flow modeling because the rainfall estimates were considered to be unreliable. In this study the authors present the calibration and validation results from a spatially distributed hydrologic model driven by daily satellite-based estimates of rainfall for sub-basins of the Nile and Mekong Rivers. The results demonstrate the usefulness of remotely sensed precipitation data for hydrologic modeling when the hydrologic model is calibrated with such data. However, the remotely sensed rainfall estimates cannot be used confidently with hydrologic models that are calibrated with rain gauge measured rainfall, unless the model is recalibrated.

**Barredo, J. J., A. de Roo, and C. Lavallo. 2007. Flood risk mapping at European scale. *Weather Science and Technology* 56(4): 11-17.**

The aim of this article is to illustrate a framework for flood risk mapping at the pan-European scale produced by the Weather-Driven Natural Hazards (WDNH) action of the EC-JRC-IES. Early results are presented in the form of flood risk index maps. The authors assess several flood risk factors that contribute to the occurrence of flood disasters. Among the causal factors of a flood disaster is triggering a natural event in the form of extreme precipitation and consequently extreme river discharge and extreme flood water levels. The threatening natural event represents the hazard component in the assessment. Furthermore, exposure and vulnerability are anthropogenic factors that also contribute to flood risk. In the proposed approach, flood risk is considered in the light of exposure, vulnerability, and hazard. The authors use a methodology with a marked territorial approach for the assessment of the flood risk. Hence, based on mathematical calculations, risk is the product of hazard, exposure, and vulnerability. Improvements on datasets availability and spatial scale are foreseen in the next phases of this study. This study is also a contribution to the discussion about the need for communication tools between the natural hazard scientific community and the political and decision making players in this field.

**Curtis, Scott, Thomas W. Crawford, and Scott A. Lecce. 2007. A comparison of TRMM to other basin-scale estimates of rainfall during the 1999 Hurricane Floyd flood. *Natural Hazards* 43(2): 187-198.**

The volumetric rainfall attributed to Hurricane Floyd in 1999 was computed for the bulk of the Tar, Neuse, and Cape Fear River Basins in eastern North Carolina, USA, from the Tropical Rainfall Measuring Mission (TRMM) Multi-Satellite Precipitation Analysis (TMPA) research product, and compared with volumes computed using kriged gauge data and one centrally located radar. TMPA showed similar features in the band of heaviest rainfall with kriged and radar data, but was higher in the basin-scale integrations. Furthermore, Floyd's direct runoff volumes were computed and divided by the volumetric rainfall estimates to give runoff coefficients for the three basins. The TMPA, having the larger storm totals, would suggest greater infiltration during Floyd than would the gauge and radar estimates. Finally, the authors discuss a concept for adjusting the United States Department of Agriculture Natural Resources Conservation Service rainfall-runoff model when predicting discharge values from real-time TMPA in ungauged river basins.

**Demeritt, David, Hannah Cloke, Florian Pappenberger, Jutta Thielen, Jens Bartholmes, and Maria-Helena Ramos. 2007. Ensemble predictions and perceptions of risk, uncertainty, and error in flood forecasting. *Environmental Hazard - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 115-127.**

Under the auspices of the World Meteorological Organization, there are a number of international initiatives to promote the development and use of so-called ensemble prediction systems (EPS) for flood forecasting. The campaign to apply these meteorological techniques to flood forecasting raises important questions about how the probabilistic information these systems provide can be used for what in operational terms is typically a binary decision of whether or not to issue a flood warning. To explore these issues, the article reports on the results of a series of focus group discussions conducted with operational flood forecasters from across Europe on behalf of the European Flood Alert System. Working in small groups to simulate operational conditions, forecasters engaged in a series of carefully designed forecasting exercises using various different combinations of actual data from real events. Focus group data was supplemented by a follow-up questionnaire survey exploring how flood forecasters understand risk, uncertainty, and error. Results suggest that flood forecasters may not instinctively use ensemble predictions in the way that promoters of EPS perhaps think they should. The paper concludes by exploring the implications of these divergent 'epistemic cultures' for efforts to apply ensemble prediction techniques developed in the context of weather forecasting to the rather different one of flood forecasting.

**Diagne, Khady. 2007. Governance and natural disasters: Addressing flooding in Saint Louis, Senegal. *Environment and Urbanization* 19(2): 552-562.**

This paper describes an initiative to develop responses to flooding in the city of Saint Louis that focuses both on reducing risks and on better preparedness in a city with very limited investment capacity. The initiative was developed by ENDATiers Monde, an international NGO whose headquarters are in Senegal. It focused on building responses that drew on local knowledge and on supporting the engagement of all stakeholders in identifying causes and local solutions both to reduce risks and to reduce people's vulnerability to them.

**Grabs, W., A. C. Tyagi, and M. Hyodo. 2007. Integrated flood management. *Weather Science and Technology* 56(4): 97-103.**

While there have been a number of international initiatives centered around hydrological sciences and technical approaches, the social, economic, environmental, and legal and institutional aspects of flood management have been dealt with sporadically and in a limited manner. The World Meteorological Organization and the Global Water Partnership established the Associated Program on Flood Management (APFM) to address these issues and developed a concept of Integrated Flood Management (IFM) in 2002. This article is the result of the integrated flood management approaches through pilot projects and multidisciplinary approaches launched by the initiative since the establishment of the IFM concept. This approach seeks to integrate land and water-resources development in a river basin, within the context of Integrated Water Resources Management (IWRM) and aims at maximizing the benefits from floodplains and at the same time reducing loss of life from flooding. This approach identified the key elements of IFM and recommended that these can be put in place by: adopting a basin approach to flood management; adopting a multi-disciplinary approach in flood management; reducing vulnerability to and risks from flooding; enabling community participation; and preserving ecosystems; addressing climate change and variability, supported by enabling mechanism through appropriate legislation and regulations.

**Hong, Yang, Robert F. Adler, Andrew Negri, and George J. Huffman. 2007. Flood and landslide applications of near real-time satellite rainfall products. *Natural Hazards* 43(2): 285-294.**

Floods and associated landslides account for the largest number of natural disasters and affect more people than any other type of natural disaster. With the availability of satellite rainfall analyses at fine time and space resolution, it has also become possible to mitigate such hazards on a near-global basis. In this article, a framework to detect floods and landslides related to heavy rain events in near-real-time is proposed. Key components of the framework are: a fine resolution precipitation acquisition system; a comprehensive land surface database; a hydrological modeling component; and landslide and debris flow model components. A key precipitation input dataset for the integrated applications is

the NASA TRMM-based multi-satellite precipitation estimates. This dataset provides near-real-time precipitation at a spatial-temporal resolution of 3 hour and  $0.25^\circ \times 0.25^\circ$ . In combination with global land surface datasets it is now possible to expand regional hazard modeling components into a global identification/monitoring system for flood/landslide disaster preparedness and mitigation.

**Hossain, Faisal, Nitin Katiyar, Yang Hong, and Aaron Wolf. 2007. The emerging role of satellite rainfall data in improving the hydro-political situation of flood monitoring in the under-developed regions of the world. *Natural Hazards* 43(2): 199-210.**

The systematic decline of in situ networks for hydrologic measurements has been recognized as a crucial limitation to advancing hydrologic monitoring in medium to large basins, especially those that are already sparsely instrumented. As a collective response, sections of the hydrologic community have recently forged partnerships for the development of space-borne missions for cost-effective, yet global, hydrologic measurements by building upon the technological advancements since the last two decades. In this article, the authors review the state-of-the-art on flood monitoring in medium and large ungauged basins where satellite remote sensing can facilitate development of a cost-effective mechanism. They present their review in the context of the current hydro-political situation of flood monitoring in flood-prone developing nations situated in international river basins (IRB's). Given the large number of such basins and the difficulty in acquisition of multi-faceted geophysical data, they argue that the conventional data-intensive implementation of physically based hydrologic models that are complex and distributed is time-consuming for global assessment of the utility of proposed global satellite hydrologic missions. A more parsimonious approach is justified at the tolerable expense of accuracy before such missions begin operation. Such a parsimonious approach can subsequently motivate the identified international basins to invest greater effort in conventional and detailed hydrologic studies to design a prototype flood forecasting system in an effort to overcome the hydro-political hurdles to flood monitoring. Through a modeling exercise involving an open-book watershed concept, the authors demonstrate the value of a parsimonious approach in understanding the utility of NASA-derived satellite rainfall products. It is critical now that real-world operational flood forecasting agencies in the under-developed world come forward to collaborate with the research community in order to leverage satellite rainfall data for greater societal benefit for inhabitants in IRB's.

**McCarthy, Simon S. 2007. Contextual influences on national level flood risk communication. *Environmental Hazards-Topical Issue: Environmental Hazards and Risk Communication* 7(2): 128-140.**

With high profile flooding events and increasing risk and probable damages of flooding, the future flood risk management (FRM) in England and Wales has undergone substantial changes over the last decade. The contextual

influences on flood risk communication in the areas of flood forecasting, warning and response, spatial planning, and development control and flood insurance at a national level are investigated in this paper. Research is based on qualitative interviews with 21 representatives of key organizations and activities at a national level of FRM. Drawing on communication theory, the research highlights the key contextual features at play: the characteristics of communication flow through organizations, the importance of policy as a communication tool informed and constrained by flood events, organizational agendas, communication approaches, and the development of knowledge and technology. The paper describes the influence of clear policy guidance on activities in certain government FRM communication initiatives and the commercial imperative driving the insurance industry activities.

**Pender, Gareth, and Sylvain Neelz. 2007. Use of computer models of flood inundation to facilitate communication in flood risk management. *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 106-114.**

It is now widely recognized that good communication between multidisciplinary stakeholders is central to effective flood risk management. Recent developments in Geographical Information Systems, increased availability of accurate digital terrain models from remotely sensed data sources, and improved graphical computer interfaces have made the outputs from computer models of flood inundation easily accessible to the stakeholder community. As a consequence, predictions from such models are now being used routinely as a means of communication between engineers and other stakeholders in flood risk management. This paper provides a review of the modeling methods most appropriate for flood risk communication. These are one-dimensional models that are suitable for simulating flood risk at a catchment or sub-catchment scale and appropriate for communicating the impact of strategic flood management decisions, and two-dimensional models that can be applied across a range of scales but are now being regularly applied at the relatively small scale, where they have the potential to inform and communicate disaster management decisions. The role of such models in communicating between modelers and non-modelers by providing a means for immediate visualization of "the future" is discussed and illustrated by application to two case studies.

**Waldner, Leora S. 2007. Floodplain creep and beyond: An assessment of next-generation floodplain problems. *Journal of Emergency Management* 5(4): 39-46.**

Since the 1970s, local jurisdictions have made great strides in protecting their floodplains through land use ordinances. Jurisdictions that joined the National Flood Insurance Program have prohibited structures in the regulatory floodway, and several jurisdictions have gone a step further, prohibiting structures in the 100-year floodplain. What next? If local governments are successfully keeping structures away from floodplains, have they adequately addressed

floodplain issues—or do other problems remain unaddressed? This research examines Atlanta-region counties, and uncovers four potential next-generation problems, including the following: (1) floodplain creep (expansion of the floodplain) resulting from increased impervious surfaces and development; (2) the unrestricted development of homes in the 100-year floodplain of small dams; (3) cumulative riparian effects of cut and fill practices; and (4) lack of information for prospective homeowners of floodplain-burdened property.

In contrast to an earlier comparative analysis of the three global disaster-risk indicator programs by Mark Pelling in 2004, which focused primarily on the methodologies used, this paper places more emphasis on aspects of applicability and policy implications and outlines challenges and limitations of the different approaches. Since the assessment and mapping of human vulnerability is less developed than hazard assessment work, this paper focuses in greater depth on how the approaches capture vulnerability. Conclusions will be formulated on how to further enhance vulnerability identification, particularly at the sub-national level.

**Winterscheid, A. 2007. Application of scenario technique in flood risk management. *Weather Science and Technology* 56(4): 87-95.**

It is now commonly accepted that the management of flood risks has to be fulfilled within an integrated framework. About two decades ago flood risk was managed from a limited perspective predominantly by means of structural measures aimed at flood control. In contrast, integrated flood risk management incorporates the complete management cycle consisting of the phases of prevention, protection, and preparedness. In theory it is a well-described concept. In the stage of implementation, however, there is often a lack of support, although a consistent policy framework exists. Consequently, the degree of implementation must be rated as inadequate in many cases. In particular this refers to the elements that focus on preparedness and prevention. The study to which this paper refers emphasizes the means and potentials of scenario technique to foster the implementation of potentially appropriate measures and new societal arrangements when applied in the framework of integrated flood risk management. A literature review is carried out to reveal the state-of-the-art and the specific problem framework within which scenario technique is generally being applied. Subsequently, it is demonstrated that scenario technique is transferable to a policy making process in flood risk management that is integrated, sustainable, and interactive. The study concludes with a recommendation for three applications in which the implementation of measures of flood damage prevention and preparedness is supported by scenario technique.

**Brandenburg, Mark A., Sue M. Watkins, Karin L. Brandenburg, and Christoph Schieche. 2007. Operation child-ID: Reunifying children with their legal guardians after Hurricane Katrina. *Disasters* 31(3): 277-287.**

Children constitute a vulnerable population and special considerations are necessary in order to provide proper care for them during disasters. After disasters such as Hurricane Katrina, the rapid identification and protection of separated children and their reunification with legal guardians is necessary in order to minimize secondary injuries (i.e., physical and sexual abuse, neglect and abduction). At Camp Gruber, an Oklahoma shelter for Louisianans displaced by Hurricane Katrina, a survey tool was used to identify children separated from their guardians. Of the 254 children at the camp, 36 (14.2 %) were separated from their legal guardians. Answering 'no' to the question of whether the accompanying adult was the guardian of the child prior to Hurricane Katrina was a strong predictor (27.8 % versus 3.2 %) of being listed as 'missing' by the National Center for Missing and Exploited Children (NCMEC). All the children at Camp Gruber who were listed as 'missing' by the NCMEC were subsequently reunited with their guardians.

**Gaillard, Jean-Christophe. 2007. Resilience of traditional societies in facing natural hazards. *Disaster Prevention and Management* 16(4): 522-544.**

It is important to perceive local variations of factors to better anticipate the capability of traditional societies to overcome the damage caused by the occurrence of natural hazards and therefore predict eventual cultural change. This article takes off from the previous vulnerability-driven literature by emphasizing the resilience of traditional societies and sets out to address the response of traditional societies in facing natural hazards through the lens of the concept of resilience. The article considers that resilient societies are those able to overcome the damage caused by the occurrence of natural hazards, either through maintaining their pre-disaster social fabric, or through accepting marginal or larger change in order to survive. The discussion is based on a review of the corpus of case studies available in the literature. It suggests that the capacity of resilience of traditional societies and the concurrent degree of cultural change rely on four factors, namely: the nature of the hazard, the pre-disaster socio-cultural context and capacity of resilience of the community, the geographical setting, and the rehabilitation policy set up by the authorities. These factors significantly vary in time and space, from one disaster to another.

## Gender and Vulnerable Populations

**Birkmann, Joern. 2007. Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications. *Environmental Hazards* 7(1): 20-31.**

This paper outlines selected approaches to measuring risk and vulnerability to hazards of natural origin using indicators and indices. It discusses their applicability, usefulness, and policy implications. Indicators and indices have been developed on different scales and for different purposes. The paper will briefly introduce three global approaches to disaster-risk identification and will juxtapose them with one local approach in order to examine the differences concerning the functions and the purpose of the assessment as well as their impact for policy development.



**James, Xanthia, Anita Hawkins, and Randy Rowel. 2007. An assessment of the cultural appropriateness of emergency preparedness communication for low income minorities. *Journal of Homeland Security and Emergency Management* 4(3).**

Effective methods of communication are vital to preparing the public for emergency events. Hurricane Katrina was an unfortunate example of the devastating consequences that can occur from inadequate communication prior to and during emergency events. The presence of health disparities exacerbates these consequences for vulnerable populations such as low-income minorities. To address the need for more research within this realm of public health, the Morgan State University School of Public Health and Policy implemented the Special Populations Bioterrorism Initiative to assess the experiences and needs of low income minorities affected by natural disasters in Maryland. As an extension of this initiative, a content analysis of Web-based emergency preparedness risk communication materials collected from the 26 county and municipal emergency management offices in Maryland was conducted to determine their appropriateness in reaching low income African Americans and Latinos. The results illustrated a significant disparity in the amount of culturally tailored information available for these populations, as well as the need for improvement in developing and disseminating culturally appropriate emergency risk communication designed to reach low income minorities.

**Kano, Megumi, and Linda B. Borque. 2007. Experiences with and preparedness for emergencies and disasters among public schools in California. *NASSP Bulletin* 91(3): 201-218.**

This study assesses schools' experiences with, and preparedness for, emergencies and disasters. Data are collected by mail survey from 157 public schools in California. The majority of schools have experienced emergencies in recent years. Although respondents generally feel their school is well prepared for future emergencies, limitations are identified in their disaster plans, availability of emergency supplies, training, and interagency coordination, with some differences between primary and secondary schools.

**Liu, Ai Zhing, Hongzhuan Tan, Jia Zhou, Shuoqi Li, Tubao Yang, Zhenqiu Sun, and Shi Wu Wen. 2007. Brief screening instrument of posttraumatic stress disorder for children and adolescents 7 to 15 years of age. *Journal of Psychiatry and Human Development* 38(3): 195-202.**

The objective of this paper is to develop a brief screening instrument of posttraumatic stress disorder (PTSD) for young victims of natural disasters. Data were derived from flood victims in 1998 and 1999 in Hunan, China. A representative population sample of 6,852 subjects 7 to 15 years of age was selected. Among them, 6,073 (88.6%) were interviewed. Multistage sampling was used to select the subjects and PTSD was ascertained with Diagnostic and Statistical Manual of Mental Disorders: 4th Edition (DSM-IV). Researchers randomly assigned 80% (4,851) of the study subjects to construct the screening instrument (construct

model) and the remaining 20% (1,222) of subjects to examine the model (validation model). Logistic regression analysis and receiver operating characteristics curves were utilized to select a subset of symptoms and cutoff point from the prestructured questionnaires. A seven-symptom instrument for PTSD screening was selected. Scores of 3 or more on this instrument were employed to define positive cases of PTSD with a sensitivity of 96.9%, specificity 99.0%, positive predictive value (PPV) 82.6%, and negative predictive value (NPV) 99.8%. The brief screening instrument developed in this study is highly valid, reliable, and predictable.

**Masozera, Michel, Melissa Bailey, and Charles Kerchner. 2007. Distribution of impacts of natural disasters across income groups: A case study of New Orleans. *Ecological Economics* 63(2-3): 229-306.**

This paper explores elements of vulnerability to natural disasters in the context of Hurricane Katrina. It examines whether neighborhoods in New Orleans were impacted differently by Hurricane Katrina based on pre-existing social, physical, and economic vulnerabilities, and evaluates the degree to which the initial impacts of Hurricane Katrina were distributed among the New Orleans' residents. Geographic Information System (GIS) technology was used to perform analyses using household income, housing values, and elevation and flood levels. The paper further investigates whether particular socio-economic groups in the city were more vulnerable during the response and recovery phases. Findings indicate that Hurricane Katrina caused severe flood damages in the majority of New Orleans neighborhoods, regardless of income, elevation, and other social factors. However, findings do suggest that pre-existing socio-economic conditions play a significant role in the ability for particular economic classes to respond immediately to the disaster and to cope with the aftermath of Hurricane Katrina. The paper concludes with policy recommendations to reduce social and economic vulnerabilities to natural disasters, as well as suggestions for future research.

**Miller, Andrew C., and Bonnie Arquilla. 2007. Disasters, women's health, and conservative society: Working in Pakistan with the Turkish Red Crescent following the South Asian earthquake. *Prehospital and Disaster Medicine* 22(4): 269-273.**

In recent years, numerous catastrophic disasters caused by natural hazards directed worldwide attention to medical relief efforts. These events included the (1) 2003 earthquake in Bam, Iran; (2) 2004 earthquake and tsunami in Southeast Asia; (3) Hurricanes Katrina and Rita in the southern United States in 2005; (4) 2005 South Asian earthquake; and (5) 2006 Indonesian volcanic eruption and earthquakes. Health disparities experienced by women during relief operations were a component of each of these events. This article focuses on the response of the Turkish Red Crescent Society's field hospital in northern Pakistan following the south Asian Earthquake of October 2005, and discusses how the international community has struggled to address

women's health issues during international relief efforts. Furthermore, since many recent disasters occurred in culturally conservative South Asia and the local geologic activity indicates similar disaster-producing events are likely to continue, special emphasis is placed on response efforts. Lessons learned in Pakistan demonstrate how simple adjustments in community outreach, camp geography, staff distribution, and supplies can enhance the quality, delivery, and effectiveness of the care provided to women during international relief efforts.

**Neumayer, Eric, and Thomas Plumper. 2007. The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981-2002. *Annals of the Association of American Geographers* 97(3): 551-566.**

Natural disasters do not affect people equally. In fact, a vulnerability approach to disasters would suggest that inequalities in exposure and sensitivity to risk as well as inequalities in access to resources, capabilities, and opportunities systematically disadvantage certain groups of people, rendering them more vulnerable to the impact of natural disasters. In this article the authors address the specific vulnerability of girls and women with respect to mortality from natural disasters and their aftermath. Biological and physiological differences between the sexes are unlikely to explain large-scale gender differences in mortality rates. Social norms and role behaviors provide some further explanation, but what is likely to matter most is the everyday socioeconomic status of women. In a sample of up to 141 countries over the period 1981 to 2002, the authors analyze the effect of disaster strength and its interaction with the socioeconomic status of women on the change in the gender gap in life expectancy. They find, first, that natural disasters lower the life expectancy of women more than that of men. In other words, natural disasters (and their subsequent impact) on average kill more women than men or kill women at an earlier age than men. Since female life expectancy is generally higher than that of males, for most countries natural disasters narrow the gender gap in life expectancy. Second, the stronger the disaster (as approximated by the number of people killed relative to population size), the stronger the effect on the gender gap in life expectancy. That is, major calamities lead to more severe impacts on female life expectancy (relative to that of males) than do smaller disasters. Third, the higher women's socioeconomic status, the weaker is this effect on the gender gap in life expectancy. Taken together the results show that it is the socially constructed gender-specific vulnerability of females built into everyday socioeconomic patterns that lead to the relatively higher female disaster mortality rates compared to men.

**Picou, J. Steven, and Brent K. Marshall. 2007. Social impacts of Hurricane Katrina on displaced K-12 students and educational institutions in coastal Alabama counties: Some preliminary observations. *Sociological Spectrum* 27(6): 767-780.**

Hurricane Katrina devastated communities along the Louisiana, Mississippi, and Alabama Gulf coasts. Over 300,000 students were displaced and evacuees relocated throughout the United States. K-12 schools in Mobile and Baldwin counties, situated along coastal Alabama, hosted 3,681 students from the devastated areas. From an analysis of quantitative data and qualitative information obtained from school personnel, this article summarizes problems and issues that characterized displaced students, families, and host schools. Suggestions for immediate and long-term support for host K-12 schools and displaced families are provided, along with suggestions for future research.

**Shiwaku, Koichi, Rajib Shaw, Ram Chandra Kandel, Surya Narayan, and Amod Mani Dixit. 2007. Future perspective of school disaster education in Nepal. *Disaster Prevention and Management* 16(4): 576-587.**

This article focuses on the direction of disaster education for schoolchildren. The findings are of significant importance for school teachers and education departments tasked with designing the curriculum for disaster education. Disaster education to schoolchildren offers the most vital answer to this grave concern. The objective of this article is to identify the factors which enhance students' awareness and promote the actual action for disaster reduction. This article is based on a questionnaire survey in six selected schools of Katmandu, Nepal. Different awareness levels have been established to identify effective educational factors at each level. The analysis showed the way to implement the education program. Results showed that current school disaster education, which is based on lectures, can raise risk perception, but it cannot enable students to know the importance of pre-disaster measures and to take actual action for disaster reduction. Self-education is effective for realizing the importance of implementing measures. Community plays the essential role for promoting students' actual actions for disaster reduction. Future disaster education in school should be active learning for students. Continuous community involvement is the most important factor for school disaster education. The findings and recommendations are field-tested in Nepal and hence offer higher possibilities of adaptation, particularly in developing countries.

**Shores, Elizabeth F., Jamie Heath, Erin Barbaro, Michael C. Barbaro, and Cathy Grace. 2007. Putting young children on disaster maps: The challenges of child care data integration. *Journal of Emergency Management* 5(40): 47-55.**

The purpose of this paper is to determine the capacity for and degree of data sharing for the purpose of emergency preparedness of the child care sector, among child care agencies, and between child care agencies and emergency management agencies in 12 states. A survey of federal and state child care agencies; evaluations of federal and state

datasets; analysis of hurricane and earthquake risk areas; analysis of U.S. Census Bureau data on population aged 0-4 years in counties (located in Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas); the feasibility of merging five or more early childhood services datasets from each state. Little data sharing occurs within or between the two sectors in the 12 states under study, putting at least 2 million children under school age at risk of being overlooked in disaster response and effectively excluding the child care sector from state recovery plans. Improved data sharing among agencies within the child care sector and between the childcare sector and the emergency management sector is crucial to mitigate the risks for children aged 0-4 and to include them among vulnerable populations that receive top priority in first response, as well as to include the child care sector in economic redevelopment after major disasters.

## Homeland Security and Terrorism

**Al-Damkhi, Ali Mohamed. 2007. Planning to rescue Kuwait's oil wells: An environmental issue. *Disaster Prevention and Management* 16(4): 513-521.**

This paper addresses the underestimation of Kuwait's oil disaster. The conflagration in Kuwait demonstrated the danger in conducting large-scale modern combat in an environmentally fragile area, and shows how exposed all oil-producing nations are to this type of environmental and economic disaster in the future. The paper seeks to review the reasons for which Saddam Hussein's regime intended to destroy and eliminate Kuwait's entire oil infrastructure before and after the Iraqi invasion of Kuwait. The underestimation of oil wells that would be torched by Iraqi forces is also discussed in this paper. To approach the scope of this paper, the intentions and the practical evidence of such sabotage are pointed out. Efforts to rescue Kuwait's oil wells in addition to planning for the expected catastrophe are highlighted. The plausible reasons that made such underestimation unclear are elaborated. The instructions included in the Iraqi documents showed undoubtedly that the sabotage operation was not a random last-minute attempt to destroy the oil wells, but it was a carefully supervised and well-planned endeavor to completely destroy Kuwait's oil infrastructure. Owing to those efforts and planning, more than 100 oil wells were rescued throughout Kuwait. Thanks to such underestimation Kuwait suffered severe losses both to its oil industry and to its ecological system. Since the reasons for the lower estimates of oil wells, torched by Iraqi troops, to a maximum of 100-150 wells were unclear, this paper attributes Kuwait's economic losses and environmental degradation to such underestimation and suggests more investigations on this issue. Kuwait's catastrophe brought the attention to environmental concerns that should receive immediate consideration, while the scorched-earth tactic applied in Kuwait and the resulting environmental disaster led to a positive reaction by the international community and spawned a new environmental treaty at the regional level.

**Coleman, Les, and Ira Helsloot. 2007. On the need for quantifying corporate crises and other man-made disasters. *Journal of Contingencies and Crisis Management* 15(3): 119-122.**

**Colton, David P., Thane J. Hendricks, and Steven R. Riedhauser. 2007. Aerial radiological systems, measurements and analysis. *International Journal of Emergency Management* 4(3): 356-375.**

This document describes data collection systems and procedures used by the U.S. Department of Energy Aerial Measuring System (AMS) in response to a radiological emergency. The discussion is split into two parts: (1) those systems used on the fixed-wing aircraft and (2) those systems used on the helicopters. This split is principally caused by the final use of the data from each system. The fixed-wing system is designed to produce data for areas of high radioactivity (areas where the natural background radiation can be ignored). The helicopter systems are used for radiation measurements closer to the natural background levels.

**De Cort, Marc. 2007. Monitoring radioactivity in nuclear and radiological emergency in a European perspective: Aims and means. *International Journal of Emergency Management* 4(3): 319-338.**

After the Chernobyl nuclear power plant accident, European countries have further enhanced their capacity and infrastructure for monitoring radioactivity in their environment. This paper gives a summary of the most commonly used techniques relevant to routine and nuclear and/or radiological emergency conditions, followed by a discussion of the various network types (routine, emergency preparedness, mobile monitoring) and some suggestions on how homogeneity of the monitoring information can be improved.

**De Cort, Marc, Gerhard de Vries, and Stefano Galmarini. 2007. European Commission international data and information exchange systems to assist EU Member States in case of radiological and nuclear emergencies. *International Journal of Emergency Management* 4(3): 442-454.**

Shortly after the Chernobyl nuclear power plant accident, the European Commission (EC) initiated various activities in order to make early notification and reliable radiological information available to the European Union (EU) Member States in case of nuclear accidents. The Radioactivity Environmental Monitoring (REM) group at the Institute for Environment and Sustainability (IES) of the Joint Research Centre (JRC) in Ispra, Italy, is responsible for the scientific and technical development of three closely related projects that should be a valuable source of information for decision support in Europe during major radiological accidents, i.e., the European Community Urgent Radiological Information Exchange (ECURIE), the European Radiological Data Exchange Platform (EURDEP) and ENSEMBLE. Starting from the legal background, the authors describe these information systems in detail with an emphasis on the current status, the gained experience and the planned future developments.

Dubois, Gregoire, Edzar J. Pebesma, and Peter Bossew. 2007.

**Automatic mapping in emergency: A geostatistical perspective.** *International Journal of Emergency Management* 4(3): 455-467.

In the case of a severe nuclear accident, radionuclides may be released into the atmosphere and contaminate large areas. Radiological maps are obtained after converting local measurements into continuous information in space. Ideally, the mapping process should be fully automatic and provide information in real time. This paper presents the results obtained from two statistical exercises that addressed the issue of automating the spatial interpolation step both in routine and emergency situations. The first exercise addressed mainly the current state-of-the-art of spatial interpolation and explored the impact of human factors on the results obtained. The second exercise dealt specifically with the automation issue. To further address the response of these mapping algorithms in emergency situations, simulated data have also been used to explore the impact of extreme values on the process. It is shown that, independently of the choice of algorithms, many obstacles still remain before we can rely on fully automatic mapping systems in emergency situations, especially during the early and critical stages of an accident when measurements on the contamination are sparse.

Eleveld, Harry, Yvo S Kok, and Chris J. W. Twenhofel. 2007.

**Data assimilation, sensitivity and uncertainty analyses in the Dutch nuclear emergency management system: A pilot study.** *International Journal of Emergency Management* 4(3): 551-563.

To investigate the possibilities to improve the Dutch nuclear emergency management system, a pilot study was carried out on a data assimilation method for the authors' atmospheric dispersion model. By means of the data assimilation method, the prediction of potentially contaminated areas in the early and late phases of a nuclear accident can significantly be improved. In the early phase, results of the radiological monitoring network are still sparse and the method focuses on a generic improvement of the model forecast by optimization of a limited number of input parameters. Prior to the study on data assimilation, sensitivity and uncertainty analysis were performed to identify the most important parameters. For this pilot study, only two parameters were fitted to demonstrate the working of their data assimilation technique. The technique was successfully applied to an inconsistent part of a famous data set giving a reasonable agreement between the observed and modeled results.

French, Simon, Emma Carter, and Carmen Niculae. 2007.

**Decision support in nuclear and radiological emergency situations: Are we too focused on models and technology?** *International Journal of Emergency Management* 4(3): 421-441.

The last 20 years have seen enormous advances in mathematical modeling and computing techniques. In the aftermath of the Chernobyl Accident, many of these have been incorporated in Decision Support Systems (DSS) to aid

nuclear emergency management. This paper reviews what has been achieved; but it also reflects on how the tools fit into emergency management processes and discusses whether too much emphasis is being placed on the technological aspects of what is a complex, socio-technical issue.

Hardeman, Frank, Carlos Rojas-Palma, Alain Sohier, Klaas van der Meer, and Khadija Bendman. 2007. **Monitoring in case of emergency situations related to orphaned sources.**

*International Journal of Emergency Management* 4(3): 376-393.

Orphaned sources may cause serious accidents, as history has shown, and in the past few years, attention for malevolent use of radioactivity has grown considerably. Firstly, this paper describes the context of the problem. It proposes to introduce a scheme for the prevention of loss or abuse of sources. This program includes administrative measures for strong sources, controlling mechanisms and aspects of waste management. Secondly, it addresses basic requirements in regards to monitoring given, lost or stolen sources or if a contamination of unknown origin is identified. This paper pleads for well-trained emergency staff, for the presence of advanced equipments and expertise at national or regional level and for international collaboration where necessary. The main steps in an adequate response scheme are discussed and illustrated and the aftermath of the crisis (clean-up actions) is also discussed. Finally, the paper stresses the importance of measurements in a context of information and openness.

Lahtinen, Juhani, Harri Toivonen, and Riitta Hanninen. 2007. **Effective use of radiation monitoring data and dispersion calculations in an emergency.**

*International Journal of Emergency Management* 4(3): 468-480.

An essential prerequisite for the proper management of a radiation emergency is that measurement data and calculation prognoses are available and that they are produced in an efficient manner. This paper reviews some of the factors contributing to the practice of performing radiation measurements and atmospheric-dispersion-model calculations effectively and discusses the issues related to the uncertainties and interpretation of results. It stresses the importance of various advance analyses and prepared strategies and recommends a database architecture for the management of dispersion-model calculation results.

McEntire, David A. 2007. **The historical challenges facing emergency management and homeland security.** *Journal of Emergency Management* 5(4): 17-22.

This article discusses thirteen challenges facing emergency management and homeland security. These include the tension between national security and the all-hazards approach, apathy, the disconnect between development and disasters, the subsidization of risk, the paper plan syndrome, a reactive approach, a first-responder orientation, limited budgets, insufficient personnel, heavy work loads, political appointees, poor management, and politics. The article concludes with a discussion and recommendations for the future.

Nasstrom, J. S., G. Sugiyama, Ronald L. Baskett, S. C. Larsen, and M. M. Bradley. 2007. The National Atmospheric Release Advisory Center modeling and decision-support system for radiological and nuclear emergency preparedness and response. *International Journal of Emergency Management* 4(3):524-550.

This paper describes the tools and services provided by a national center for modeling the environmental and health impacts of airborne hazardous materials. This center can provide emergency decision support information within minutes for a wide range of radiological, nuclear, chemical, and biological hazards from fires, industrial and transportation accidents, radiation dispersal device explosions, hazardous material spills, nuclear power plant accidents and nuclear detonations. Web- and internet-based software provide quick access to advanced modeling tools, as well as expert analyses from the center. Model predictions include the 3D spatial and time-varying effects of weather, land use, and terrain on scales from the local to regional to global. Tools provide displays of plume predictions with affected population counts, detailed maps, and reports describing model assumptions, contamination and dose levels. On-scene information and measurements are used to refine model predictions.

Riland, Carson A. 2007. Instrument selection and use for measurements in a radiological emergency. *International Journal of Emergency Management* 4(3): 394-407.

A discussion of monitoring during a radiological emergency response is presented. This paper focuses on a response for the USA, but many principles would also apply for other countries. It starts with a discussion on instrument selection and preparation. Different scenarios based on materials involved and responder levels are presented with equipment concerns for each. This paper discusses field monitoring for both environmental concerns and public screening. It ends with a brief summary of respondent health and safety issues.

Savkin, Mikhail N., and Sergey M. Shinkarev. 2007. Prospective use of individual emergency monitoring of the public – lessons from Chernobyl. *International Journal of Emergency Management* 4(3): 408-420.

Experience in individual dosimetric and radiometric surveys of the public during the early phase of the Chernobyl accident has been considered. Delay in implementation of individual measurements was the reason why such results were not used in emergency management. Analysis of the estimates of thyroid doses based on the results of individual monitoring showed that 30–50% of small children residing in areas adjacent to the Chernobyl Nuclear Power Plant received doses higher than the upper guide value, which was for urgent protective actions. General principles of individual monitoring of the public, namely, voluntariness, representativeness, and specificity have been considered for screening, complex research, and special research in Emergency Monitoring programs. In addition, procedures and techniques of rapid monitoring of public under

dispersing plutonium due to explosion have been recommended.

Solana-Ortega, Alberto, and Vicente Solana. 2007. What comes after the *Prestige* disaster? An entropic approach to modeling the recurrence of major oil tanker spills in Galicia. *Risk Analysis* 27(4): 901-920.

A methodology is presented to investigate the recurrence of extraordinary events. The approach is fully general and complies with a canon of inference establishing a set of basic rationality requirements scientific reasoning should satisfy. In particular, the authors apply it to model the interarrival time between disastrous oil spills on the Galician coast in the northwest of Spain, one of the greatest risk areas in the world, as confirmed by the *Prestige* accident of November 2002. They formulate the problem within the logical probability framework, using plausible logic languages with observations to allow the appropriate expression of evidences. Therein, inference is regarded as the joint selection of a pair of reference and inferred probability distributions, which better encode the knowledge about potential times between incidents provided by the available evidences and other higher-order information at hand. To solve it, the authors employ the REF relative entropy method with fractile constraints. Next, they analyze the variability of the joint entropic solution, as knowledge that a time has elapsed since the last recorded spill is added, by conditioning the evidences. Attention is paid to the variability of two representative parameters: the average reference recurrence time and an inferred characteristic probability fractile for the time to an event. In contrast with classical results, the salient consequence is their nonconstancy with the elapsed time and the appearance of a variability pattern indicating an observational memory, even under the assumption of one-parameter exponential models, traditionally regarded as memoryless. Tanker accidentality is therefore dynamic, changing as time goes on with no further accidents. Generality of the methodology entails that identical conclusions would apply to hazard modeling of any other kind of extraordinary phenomena. This should be considered in risk assessment and management.

Wilber, Debbie, Donald Daigler, Erik C. Nielsen, Steven R. Riedhauser, Arthur Shanks, Roger C. Thompson, and John S. Nasstrom. 2007. Nuclear/radiological emergency response in the USA. *International Journal of Emergency Management* 4(3): 339-355.

The U.S. Consequence Management (CM) response element uses specific methodologies for dealing with the release of nuclear/radioactive material into the environment and has identified the potential impacts to the public and the environment. This paper will describe the history of how CM evolved, an overview of the current methods and response structure, and will include technical sections describing the federal response following a nuclear/radiological incident.

**Wolf, Frederick, and Paul Sampson. 2007. Evidence of an interaction involving complexity and coupling as predicted by normal accident theory. *Journal of Contingencies and Crisis Management* 15(3): 123-133.**

This paper describes a test of the principle hypothesis of Normal Accident Theory. It posits and tests for the existence of an interaction involving interactive complexity and coupling associated within an important class of manufacturing organizations. Ninety four (n=94) petroleum refineries located in the United States during the five-year period 1993–97 were examined. The dependent variable in this test was the ratio of Reportable Quantity accidental hazardous chemical releases per unit of production. Refinery capacity and age were included as control variables. This study identified a statistically significant interaction involving interactive complexity and coupling, as predicted by Normal Accident Theory. The interaction appears to be consistent with an important core hypothesis of Normal Accident Theory over a significant portion of its domain. The nature of this interaction and its potential relevance to organizational sense making is discussed. Additional opportunities for quantitative research involving Normal Accident Theory are identified.

**Yatsalo, Boris I. 2007. Decision support system for risk-based land management and rehabilitation of radioactively contaminated territories: PRANA approach. *International Journal of Emergency Management* 4(3): 504-523.**

Description of the approaches to a decision support system on Risk Based Land Management (RBLM) and rehabilitation of radioactively contaminated territories on the basis of integrating monitoring data, Geographic Information Systems (GIS), models, and decision support tools is presented in this paper. The key blocks of the PRANA DSS, developed for scientific and practical needs for model assessments and decision making support within the rehabilitation of radioactively contaminated territories of Bryansk region (Russia) after the Chernobyl accident, are described. Examples of PRANA implementation for applied assessments are considered.

**Zahringer, Matthias, and Erich Wirth. 2007. The interaction between off-site decision making, decision support systems, modeling and monitoring in a nuclear emergency situation. *International Journal of Emergency Management* 4(3): 564-572.**

The interaction and inter-dependence between decision making, decision support systems (DSS), and measurements in a radiological emergency situation is discussed. Data and DSS products of importance are identified in different phases of an accident. Planning of decision making must focus on comprehensible and clear concepts. In the early phase, clear and unambiguous model prognoses are needed for fast decision making. However, the input data are highly uncertain and disputable. During cloud passage the options for decision making are limited. After cloud passage, decision making and monitoring are highly interactive, and the efficacy of countermeasures requires that both DSS and measurement programs be well tailored. Data must be

representative and of sufficient number where decisions refer to Derived Emergency Reference Levels (DERL for food and feed). In the late phase, the DSS should enable decision makers to balance cost, environmental impact, averted dose, and adverse psychological effects.

## Hurricanes and Coastal Hazards

**Baade, Robert A., Robert Baumann, and Victor Matheson. 2007. Estimating the economic impact of natural and social disasters, with an application to Hurricane Katrina. *Urban Studies* 44(11): 2061-2076.**

This paper examines taxable sales in the Los Angeles and Miami metropolitan areas to find evidence of the short- and long-run effects of the Rodney King riots and Hurricane Andrew on their respective economies. The comparison of these two events shows that the King riots had a long-term negative effect on Los Angeles' economy, while Hurricane Andrew had a short-term positive effect on the Miami economy. The paper also applies the contrasting experiences of Los Angeles and Miami to New Orleans following Hurricane Katrina. In some ways, Katrina is a hybrid of these two events since it combines elements of both a natural disaster and a social disaster. The paper examines how Katrina is similar to each of the previous incidents and how these similarities might affect the recovery of New Orleans following the storm.

**Baker, Daniel, and Karen Refsgaard. 2007. Institutional development and scale matching in disaster response management. *Ecological Economics* 63(1-2): 331-343.**

Recent large-scale disasters have challenged institutions to improve the effectiveness of their emergency response strategies. During the 2005 Katrina flood disaster in the United States, institutions utilized different emergency response strategies with varying degrees of success. This paper considers the case of Hurricane Katrina to identify successful strategies that enable institutions to respond effectively and at the appropriate scale. The importance of cross-scale linkages matched to the size and needs of the disaster is discussed as a central component of socio-ecological resilience. A general strategy of adaptive management is proposed that emphasizes the importance of participatory planning with institutional actors where both initial response organizations, as well as institutions involved in longer term recovery, are involved in emergency response exercises. Institutions should develop linkages that promote legitimacy, trust, and the development of social capital that facilitates integrated and coordinated emergency response. The paper concludes by noting that new threats will require increased coordination, higher levels of institutional flexibility, and greater attention to issues of connectivity in disaster response management.

**Brandenburg, Mark A., Sue M. Watkins, Karin L. Brandenburg, and Christoph Schieche. 2007. Operation child-ID: Reunifying children with their legal guardians after Hurricane Katrina. *Disasters* 31(3): 277-287.**

Children constitute a vulnerable population and special considerations are necessary in order to provide proper care for them during disasters. After disasters such as Hurricane Katrina, the rapid identification and protection of separated children and their reunification with legal guardians is necessary in order to minimize secondary injuries (i.e. physical and sexual abuse, neglect and abduction). At Camp Gruber, an Oklahoma shelter for Louisianans displaced by Hurricane Katrina, a survey tool was used to identify children separated from their guardians. Of the 254 children at the camp, 36 (14.2 per cent) were separated from their legal guardians. Answering 'no' to the question of whether the accompanying adult was the guardian of the child prior to Hurricane Katrina was a strong predictor (27.8 per cent versus 3.2 per cent) of being listed as 'missing' by the National Center for Missing and Exploited Children (NCMEC). All the children at Camp Gruber who were listed as 'missing' by the NCMEC were subsequently reunited with their guardians.

**Burnside, Randolph, DeMond Shondell Miller, and Jason D. Rivera. 2007. The impact of information and risk perception on the hurricane evacuation decision-making of greater New Orleans residents. *Sociological Spectrum* 27(6): 727-740.**

This article contributes to the current discussion on how residents living in vulnerable areas make the decision to evacuate when they are in harm's way. Key in this discussion is the question, what role do information and risk play in shaping evacuation behavior? This study used a sample of respondents from the greater New Orleans region (Orleans, Jefferson, and St. Bernard Parishes) of the Twelve Parish Survey (N = 1,207) conducted prior to Hurricane Katrina. The findings indicate that information sources are vitally important in the evacuation process. By examining the role of information from authorities, family, and friends; visual imagery; and the media the authors found that individuals use a variety of sources when they decide to evacuate. Further, the importance of visual imagery in the evacuation process is discussed. The article concludes with a discussion of the implications of information dissemination and its importance to members of the media and public policy makers.

**Campbell, Laura. 2007. Utilizing compassion fatigue education in Hurricanes Ivan and Katrina. *Clinical Social Work Journal* 35(3): 165-171.**

Compassion fatigue is a state that includes the symptoms of Post-Traumatic Stress Disorder. This article reviews events following the Hurricane Ivan and Katrina disasters and how compassion fatigue education helped to identify and ameliorate symptoms of the problem. The author worked in a community center in the Pensacola area for one week following Hurricane Ivan and in a shelter in her hometown of Houma, Louisiana, for two months following Katrina.

Examples of traumatic stories and coping with her own secondary stress are given. Implications include education regarding compassion fatigue for all mental health professionals, especially during and following work in disasters or with populations of the traumatized.

**Chua, Alton Y. K. 2007. A tale of two hurricanes: Comparing Katrina and Rita through a knowledge management perspective. *Journal of the American Society for Information Science and Technology* 58(10): 1518-1528.**

This study compares the preparation and response efforts to Katrina and Rita through a knowledge management (KM) perspective. To achieve this objective, a theoretical KM framework is developed to examine the KM processes that underpin disaster management activities. The framework is then used to identify different dimensions along which the two disasters can be compared. The data, totaling some 500 documents, were drawn from a wide variety of news, congressional, and Internet sources. The findings show that the nonchalance towards the disaster's imminence, grossly inadequate preparations, and the chaotic responses seen in Katrina stood in stark contrast to the colossal scale of precautionary measures and response operations primed for Rita. The article concludes by highlighting three KM implications for managing large-scale natural disasters.

**Cossmann, Ronald E., Sandra H. Harpole, and Colin G. Scanes. 2007. Lessons for researchers and funding agencies from Hurricane Katrina: A research note from Mississippi. *Sociological Spectrum* 27(6): 781-787.**

The authors surveyed National Science Foundation (NSF)-funded research in Mississippi to determine the economic extent of research damage and delays due to Hurricane Katrina. While several facilities were physically damaged, the authors found that the largest effects were time delays and missed opportunities. While psychological factors were not part of the original economic impact study, it became clear that they played an important role. Specifically, the principal investigator's (PI's) attitude of "just another delay" was one cultural barrier to fully accounting for the cost of these research delays. The authors concluded that principal investigators, with the assistance of funding agencies, should be better trained to measure time and opportunity costs associated with their research, so future disaster recovery efforts can more fully address those needs.

**Curtis, Scott, Thomas W. Crawford, and Scott A. Lecce. 2007. A comparison of TRMM to other basin-scale estimates of rainfall during the 1999 Hurricane Floyd flood. *Natural Hazards* 43(2): 187-198.**

The volumetric rainfall attributed to Hurricane Floyd in 1999 was computed for the bulk of the Tar, Neuse, and Cape Fear River Basins in eastern North Carolina, USA, from the Tropical Rainfall Measuring Mission (TRMM) Multi-Satellite Precipitation Analysis (TMPA) research product, and compared with volumes computed using kriged gauge data and one centrally located radar. TMPA showed similar features in the band of heaviest rainfall with kriged and radar data, but was higher in the basin-scale integrations.



Furthermore, Floyd's direct runoff volumes were computed and divided by the volumetric rainfall estimates to give runoff coefficients for the three basins. The TMPA, having the larger storm totals, would suggest greater infiltration during Floyd than would the gauge and radar estimates. Finally, the article discusses a concept for adjusting the United States Department of Agriculture Natural Resources Conservation Service rainfall-runoff model when predicting discharge values from real-time TMPA in ungauged river basins.

**De Marchi, Bruna. 2007. Not just a matter of knowledge. The Katrina debacle. *Environmental Hazards- Topical Issue: Environmental Hazards and Risk Communication* 7(2): 141-149.**

The paper deals with Hurricane Katrina, which hit the Gulf coast of the United States at the end of August 2005 with disastrous consequences. The paper sketches the chronicle of the main events and deals with preparation and response in New Orleans, exploring the connection between knowledge and disaster management policies, in particular communication policy. The main failures in applying and sharing available information for preventing and limiting damage are attributed to lack of coordination between elected officials, authorities, and agencies at all levels. The critical role of the media in shaping the perception of the event and the immediate response to it is also highlighted.

**Duxbury, Jane, and Sarah Dickinson. 2007. Principles for sustainable governance of the coastal zone: In the context of coastal disasters. *Ecological Economics* 63(2-3): 319-330.** As increasing numbers of the global population gravitate toward the coasts, pressure mounts on ecosystems and the infrastructure at coastal locations. In the coastal zone many problems have arisen, including coastal population growth and degradation of natural capital, from the neglect of the four capitals that enhance sustainability: natural, built, social, and human. New strategies need to be devised that will allow coastal communities to continue to live in these regions without further degrading natural capital. The Brundtland Report initiated the idea of sustainability, which was further advanced at United Nations meetings in Stockholm (1972) and Rio de Janeiro (1992). Following these meetings and the adoption of Agenda 21, concern about growing pressures on the oceans led to an Independent World Commission on the Oceans (IWCO) workshop where a number of Principles for Sustainable Governance of the Oceans were developed. In the light of recent coastal disasters such as the Indonesian Tsunami (2004) and Hurricanes Katrina and Rita (2005), this paper examines the current problems inherent in the coastal zone and attempts to develop new principles for sustainability using the IWCO-derived principles as a springboard.

**Gaddis, Erica Brown, Brian Miles, Stephanie Morse, and Debby Lewis. 2007. Full-cost accounting of coastal disasters in the United States: Implications for planning and preparedness. *Ecological Economics* 63(2-3): 307-318.** As coastal disasters become more frequent and costly, a full assessment of costs becomes more important. This paper aims to identify costs of coastal disasters to human, social, built, and natural capital and their associated services at the local site of a disaster and in the regions and nations that respond for relief and recovery. The spatial and temporal magnitude and scale of costs is captured differently in typical cost accounting and a more comprehensive approach, full-cost accounting. The difference between these approaches will be demonstrated using Hurricane Katrina (2005) as a case study, though the authors do not attempt to perform a full-cost accounting of this actual event. They examine how disaster planning and preparedness becomes more cost effective when the full cost of disasters is calculated. A full-cost accounting of coastal disasters sets the stage for rigorous comparisons of strategies for post-disaster development. The rudimentary analysis of this paper indicates that continued population development, as well as the maintenance of current settlements, in particular regions along the coasts may not be in the national interest. In this way, full-cost accounting could help reduce vulnerability to future disasters.

**Gill, Duane A. 2007. Secondary trauma or secondary disaster? Insights from Hurricane Katrina. *Sociological Spectrum* 27(6): 613-632.**

Hurricane Katrina is destined to become one of the most studied disasters in U.S. history. This manuscript offers a sociology of disaster framework in which to situate past, ongoing, and future research on this event. By examining Katrina on a continuum of natural and technological disasters, we are able to gain insights into the different paths of impact and recovery taken by New Orleans and the rest of the disaster-stricken region. Specifically, this disaster has produced a series of secondary traumas that continue to thwart recovery efforts. Understanding these secondary traumas can lead to amelioration of their effects and development of responses to diminish their occurrence in future disasters.

**Kelman, Ilan. 2007. Hurricane Katrina disaster diplomacy. *Disasters* 31(3): 288-309.**

Hurricane Katrina struck the United States at the end of August 2005. The consequent devastation appeared to be beyond the U.S. government's ability to cope, and aid was offered by several states in varying degrees of conflict with the U.S. Hurricane Katrina therefore became a potential case study for 'disaster diplomacy', which examines how disaster-related activities do and do not yield diplomatic gains. A review of past disaster diplomacy work is provided. The literature's case studies are then categorized using a new typology: propinquity, aid relationship, level, and purpose. Hurricane Katrina and its aftermath are then placed in the context of the U.S. government's foreign policy, the international response to the disaster, and the U.S.

government's reaction to these responses. The evidence presented is used to discuss the potential implications of Hurricane Katrina disaster diplomacy, indicating that factors other than disaster-related activities generally dominate diplomatic relations and foreign policy.

natural disasters. The four capital types, natural, human, social, and built, will be used as a frame of reference from which to evaluate media texts. This paper shows that natural capital received relatively less attention in the media coverage of these recent disasters. The paper's authors apply the Elaboration Likelihood Model (ELM) to argue that future perceptions of risk due to natural hazards will reflect the attention paid to each capital in media coverage.

**Masozera, Michel, Melissa Bailey, and Charles Kerchner. 2007.**

**Distribution of impacts of natural disasters across income groups: A case study of New Orleans. *Ecological Economics* 63(2-3): 229-306.**

This paper explores elements of vulnerability to natural disasters in the context of Hurricane Katrina. It examines whether neighborhoods in New Orleans were impacted differently by Hurricane Katrina based on pre-existing social, physical, and economic vulnerabilities and evaluates the degree to which the initial impacts of Hurricane Katrina were distributed among New Orleans' residents. Geographic Information System (GIS) technology was used to perform analyses using household income, housing values, and elevation and flood levels. The paper further investigates whether particular socio-economic groups in the city were more vulnerable during the response and recovery phases. Findings indicate that Hurricane Katrina caused severe flood damages in the majority of New Orleans neighborhoods, regardless of income, elevation, and other social factors. However, findings do suggest that pre-existing socio-economic conditions play a significant role in the ability for particular economic classes to respond immediately to the disaster and to cope with the aftermath of Hurricane Katrina. The paper concludes with policy recommendations to reduce social and economic vulnerabilities to natural disasters, as well as suggestions for future research.

**Perez-Maqueo, O., A. Intralawan, and M. L. Martinez. 2007.**

**Coastal disasters from the perspective of ecological economics. *Ecological Economics* 63(2-3): 273-284.**

Natural hazards are recurrent events that frequently result in high death tolls and large economic losses. Because of their large impact, they have concerned the international community for a long time. In spite of the efforts, the impact of natural hazards has increased. Oftentimes, the role of natural ecosystems and the ecosystem services they provide to human societies are not considered in risk reduction programs. How relevant are ecosystems? What are the consequences of the depletion of natural ecosystems and the loss of ecosystem services provided by them? Would the alternative vision of ecological economics, in which development and economy are seen as the whole ecosystem is helpful in reducing disaster risk? In this paper the authors test whether a holistic approach from the perspective of ecological economics is helpful to clarify and reduce the impact of natural hazards. They focus on hurricanes because they are the most frequently reported events of all natural disasters. The authors analyze the relationship between the components of human, built, social, and natural capitals and the damage caused by hurricanes in terms of mortality rate and then generate a conceptual model to help envision the complexity of the system. A stepwise (back and forth steps) linear regression analysis revealed that mortality rate was significantly and positively affected by hurricane frequency ( $p < 0.01$ ) while areas covered by semi-altered ecosystems (a mosaic of natural and human-altered ecosystems) ( $p < 0.01$ ) and GDP ( $p < 0.05$ ) negatively affected mortality rate ( $R^2 = 0.81$ ). The proportion of natural/altered ecosystems yielding the best protection results needs to be determined. Natural capital alone does not decrease number of deaths. Rather, its complex interactions with the other capitals and the many feedback loops that are involved need to be considered to achieve effective disaster risk reduction. No single capital is enough to reduce the impact and intensity of a natural hazard. A balance between human, built, social, and natural capitals and an increasing awareness of the consequences of different development decisions will help human societies to live with rather than cope with coastal hazards.

**Michel, Lacie M. 2007. Personal responsibility and volunteering after a natural disaster: The case of Hurricane Katrina. *Sociological Spectrum* 27(6): 633-652.**

This study examines prosocial behavior and volunteerism in the context of Hurricane Katrina. Using interviews from East Baton Rouge Parish residents, results demonstrate that self-efficacy, education, religious attendance, and organizational membership exert significant, positive effects on feeling personally responsible for helping victims. Education, presence of children in the home, organizational membership, and the interaction between religious attendance and personal responsibility exert significant, positive effects on total hours spent volunteering at shelters for victims. These findings suggest that there is not a one-to-one correspondence between the characteristics of the typical volunteer and those who volunteer in a natural disaster.

**Picou, J. Steven, and Brent K. Marshall. 2007. Social impacts of Hurricane Katrina on displaced K-12 students and educational institutions in coastal Alabama counties: Some preliminary observations. *Sociological Spectrum* 27(6): 767-780.**

Hurricane Katrina devastated communities along the Louisiana, Mississippi, and Alabama Gulf coasts. Over 300,000 students were displaced and evacuees relocated

**Miles, Brian, and Stephanie Morse. 2007. The role of news media in natural disaster risk and recovery. *Ecological Economics* 63(2-3): 365-373.**

This paper explores the role of the news media in constructing public perceptions of risk associated with natural hazards. Hurricanes Katrina and Rita of 2005 provide a useful case study for exploring the social construction of risk that results from media coverage of

throughout the United States. K-12 schools in Mobile and Baldwin counties, situated along coastal Alabama, hosted 3,681 students from the devastated areas. From an analysis of quantitative data and qualitative information obtained from school personnel, this article summarizes problems and issues that characterized displaced students, families, and host schools. Suggestions for immediate and long-term support for host K-12 schools and displaced families are provided, along with suggestions for future research.

victimization. The purpose of this study is to examine the relations between collective efficacy, rumors, and fear during this trying time for Baton Rouge. The results are based on telephone interviews with Baton Rouge residents conducted two months after Katrina. As predicted, collective efficacy fosters the transmission of rumors. These rumors then lead to increased personal and altruistic fear of victimization; therefore, collective efficacy indirectly increases fear through its effect on rumors. The implications of these findings for public and emergency management policy are discussed, as are concrete suggestions for future research.

**Spence, Patric R., Kenneth A. Lachlan, and Jennifer M. Burke. 2007. Adjusting to uncertainty: Coping strategies among the displaced after Hurricane Katrina. *Sociological Spectrum* 27(6): 653-678.**

This study examined the coping strategies of individuals displaced after Hurricane Katrina. Following the evacuation of New Orleans, surveys were administered to those individuals displaced by Katrina and relocated to shelters or in disaster centers in Cape Cod, Massachusetts; Lansing, Michigan; different parts of Indiana and Kentucky; and federal aid distribution centers throughout Texas. Results indicated that talking, staying informed, and praying emerged as predictors of changes in psychological stress during relocation. Differences emerged in coping strategies based on gender, race, and income; however, age did not emerge as a factor. Recommendations are made to use these results for post-crisis response and coordination.

**Wang, Philip S., Michael J. Gruber, Richard E. Powers, Michael Schoenbaum, Anthony H. Speier, Kenneth B. Wells, and Ronald C. Kessler. 2007. Mental health service use among Hurricane Katrina survivors in the eight months after the disaster. *Psychiatric Services* 58(11): 1403-1411.**

This study examined use of mental health services among adult survivors of Hurricane Katrina in order to improve understanding of the impact of disasters on persons with mental disorders. A geographically representative telephone survey was conducted between January 19 and March 31, 2006, with 1,043 displaced and nondisplaced English-speaking Katrina survivors aged 18 and older. Survivors who reported serious and mild-moderate mood and anxiety disorders in the past 30 days and those with no such disorders were identified by using the K6 scale of nonspecific psychological distress. Use of services, system sectors, treatments, and reasons for not seeking treatment or dropping out were recorded. Correlates of using services and dropping out were examined. An estimated 31% of respondents (N=319) had evidence of a mood or anxiety disorder at the time of the interview. Among these, only 32% had used any mental health services since the disaster, including 46% of those with serious disorders. Of those who used services, 60% had stopped using them. The general medical sector and pharmacotherapy were most commonly used, although the mental health specialty sector and psychotherapy played important roles, especially for respondents with serious disorders. Many treatments were of low intensity and frequency. Undertreatment was greatest among respondents who were younger, older, never married, members of racial or ethnic minority groups, uninsured, and of moderate means. Structural, financial, and attitudinal barriers were frequent reasons for not obtaining care. Few Katrina survivors with mental disorders received adequate care; future disaster responses will require timely provision of services to address the barriers faced by survivors.

**Stock, Paul V. 2007. Katrina and anarchy: A content analysis of a new disaster myth. *Sociological Spectrum* 27(6): 705-726.**

Hurricane Katrina ranks among the worst natural catastrophes in United States history. In addition to the physical damage to the city and the levees, Katrina will also be remembered for the posthurricane suffering, the lack of coordinated government response, and memorable reporting in the media. The media, here characterized as newspaper coverage, utilized anarchy to frame the reported postdisaster lack of government presence, the perceived threat of, and actual violence and looting in the immediate wake of the catastrophe. Ethnographic content analysis of 59 newspaper articles yielded a typology of the three different connotations of anarchy. Finally, a comparison is offered between the media's use of anarchy in the post-Katrina coverage and the sociopolitical theory of anarchy. The article concludes that although the media mischaracterized the postdisaster reality by using an anarchy frame, their coverage is consistent with the disaster mythology literature, while conflating typical disaster myths within the anarchy frame.

**Thomas, Shaun A. 2007. Lies, damn lies, and rumors: An analysis of collective efficacy, rumors, and fear in the wake of Katrina. *Sociological Spectrum* 27(6): 679-703.**

In the days following Hurricane Katrina, many displaced residents from New Orleans evacuated to the Baton Rouge area. As a result, many Baton Rougians became increasingly concerned about crime in their community. This concern, coupled with a lack of official information, led to the widespread dissemination of rumors of criminal

## Information and Spatial Technology

Aitkenhead, Matthew J., Parivash Lumsdon, and David R.

**Miller. 2007. Remote sensing-based neural network mapping of tsunami damage in Aceh, Indonesia. *Disasters* 31(3): 217-226.**

In addition to the loss of human life, the tsunami event of December 26, 2004 caused extensive damage to coastal areas. The scale of the disaster was such that remote sensing may be the only way to determine its effects on the landscape. This paper presents the results of a neural network-based mapping of part of the region of Aceh, Sumatra. Before-and-after satellite imagery, combined with a novel neural network methodology, enabled a characterization of landscape change. The neural network technique used a threshold of acceptance for identification, in combination with a bootstrapped identification method for identifying problem pixels. Map analysis allowed identification of urban areas that were inaccessible by road, and which aid agencies could therefore only reach by air or sea. The methods used provide a rapid and effective mapping ability and would be a useful tool for aid agencies, insurance underwriters, and environmental monitoring.

**Antonioni, Giacomo, Gigliola Spadoni, and Valerio Cozzani.**

**2007. A methodology for the quantitative risk assessment of major accidents triggered by seismic events. *Journal of Hazardous Materials* 147(1-2): 48-59.**

A procedure for the quantitative risk assessment of accidents triggered by seismic events in industrial facilities was developed. The starting point of the procedure was the use of available historical data to assess the expected frequencies and the severity of seismic events. Available equipment-dependant failure probability models (vulnerability or fragility curves) were used to assess the damage probability of equipment items due to a seismic event. An analytic procedure was subsequently developed to identify, evaluate the credibility of, and assess the expected consequences of all the possible scenarios that may follow the seismic events. The procedure was implemented in a GIS-based software tool in order to manage the high number of event sequences that are likely to be generated in large industrial facilities. The developed methodology requires a limited amount of additional data with respect to those used in a conventional QRA, and yields with a limited effort a preliminary quantitative assessment of the contribution of the scenarios triggered by earthquakes to the individual and societal risk indexes. The application of the methodology to several case studies evidenced that the scenarios initiated by seismic events may have a relevant influence on industrial risk, both raising the overall expected frequency of single scenarios and causing specific severe scenarios simultaneously involving several plant units.

**Hong, Yang, Robert Adler, and George Huffman. 2007. Use of satellite remote sensing data in the mapping of global landslide susceptibility. *Natural Hazards* 43(2): 245-256.**

Satellite remote sensing data have significant potential use in analysis of natural hazards such as landslides. Relying on the recent advances in satellite remote sensing and geographic information system (GIS) techniques, this paper aims to map landslide susceptibility over most of the globe using a GIS-based weighted linear combination method. First, six relevant landslide-controlling factors are derived from geospatial remote sensing data and coded into a GIS system. Next, continuous susceptibility values from low to high are assigned to each of the six factors. Second, a continuous scale of a global landslide susceptibility index is derived using GIS-weighted linear combination based on each factor's relative significance to the process of landslide occurrence (e.g., slope is the most important factor, soil types and soil texture are also primary-level parameters, while elevation, land cover types, and drainage density are secondary in importance). Finally, the continuous index map is further classified into six susceptibility categories. Results show the hot spots of landslide-prone regions include the Pacific Rim, the Himalayas and South Asia, Rocky Mountains, Appalachian Mountains, Alps, and parts of the Middle East and Africa. India, China, Nepal, Japan, the USA, and Peru are shown to have landslide-prone areas. This first-cut global landslide susceptibility map forms a starting point to provide a global view of landslide risks and may be used in conjunction with satellite-based precipitation information to potentially detect areas with significant landslide potential due to heavy rainfall.

**Jin, Menglin, Marshall Shepherd, and Christa Peters-Lidard. 2007. Development of a parameterization for simulating the urban temperature hazard using satellite observations in climate model. *Natural Hazards* 43(2):257-271.**

Urban surface temperature is hazardously higher than surrounding regions (so-called urban heat island effect UHI). Accurately simulating urbanization-induced temperature hazard is critical for realistically representing urban regions in the land surface-atmosphere climate system. However, inclusion of urban landscapes in regional or global climate models has been overlooked due to the coarse spatial resolution of these models, as well as the lack of observations for urban physical properties. The National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) observations illustrate important urban physical properties, including skin temperature, surface albedo, surface emissivity, and leaf area index. It is possible to identify the unique urban features globally and thus simulate global urban processes. An urban scheme is designed to represent the urban-modified physical parameters (albedo, emissivity, land cover, roughness length, thermal and hydraulic properties) and to include new, unique physical processes that exist in urban regions. The urban scheme is coupled with the National Center for Atmospheric Research (NCAR) Community Land Model Version 2 (CLM2) and single

column coupled NCAR Community Atmosphere Model CAM2/CLM2 to assess the mechanisms responsible for UHI. There are two steps in our model development. First, satellite observations of albedo, emissivity, LAI, and *in situ* observed thermal properties are updated in CLM2 to represent the first-order urban effects. Second, new terms representing the urban anthropogenic heat flux, storage heat flux, and roughness length are calculated in the model. Model simulations suggest that human activity-induced surface temperature hazard results in overlying atmosphere instability and convective rainfall, which may enhance the possibility of urban flood hazard.

**Lee, Jiyeong. 2007. A three-dimensional navigable data model to support emergency response in microspatial built-environments. *Annals of the Association of American Geographers* 97(3): 512-529.**

Since the September 11, 2001 attacks in the United States and the July 7, 2005 London bombings, geospatial researchers have attempted to utilize GIS technologies in response to disasters occurring in the microspace of multilevel structures (such as the interior of buildings) in urban areas. Such applications require 3D (GIS) functionalities to represent the three-dimensional structures of urban environments and to conduct 3D GIS-based spatial analyses. These requirements motivate this study to represent the complex internal structure of buildings at a three-dimensional subunit level so as to analyze human behavior in an emergency situation. This article discusses the development of a 3D Navigable Data Model (3D NDM) based on the 3D Geometric Network Data Model and representing pedestrian access within buildings or urban built environments, which can be modeled as a network of walkway sections and connections. Additionally, this article discusses the design of a geospatial database created to manage the physical and environmental factors of disaster sites that are essential for emergency response. To improve planning and facilitate rescue operations in a decision support system, this article presents (1) a 3D geo-coding method to locate rescue personnel and disaster sites within the reference data (a network representation of a building), (2) a 3D map matching method to define the correlation between the location of bottlenecks or disaster sites and the nearest location on the 3D NDM, which represents the internal structure of the built-environment as a network representation, and (3) an indoor navigation model, based on the Dijkstra algorithm, to identify optimal routes within a multilevel structure by measuring relative pedestrian accessibility and to provide navigation guidance for rescue personnel. Lastly, this article presents the results of an experimental implementation of the 3D NDM using GIS data for a section of the University of North Carolina at Charlotte campus.

**Lu, George Y., Long S. Chiu, and David W. Wong. 2007. Vulnerability assessment of rainfall-induced debris flows in Taiwan. *Natural Hazards* 43(2): 223-244.**

A GIS-based decision support system, which incorporates local topographic and rainfall effects on debris flow vulnerability, was developed. Rainfall at a scale compatible

with the digital elevation model resolution was obtained using a neural network with a wind-induced topographic effect and rainfall derived from satellite rain estimates and an adaptive inverse distance weight method (WTNN). The technique was tested using data collected during the passage of typhoon Tori-Ji on July 2001 over central Taiwan. Numerous debris flows triggered by the typhoon were used as control for the study. Results show that the WTNN technique outperforms other interpolation techniques, including adaptive inversed distance weight (AIDW), simple kriging (SK), co-kriging, and multiple linear regression using gauge and topographic parameters. Multiple remotely-sensed, fuzzy-based debris-flow susceptibility parameters were used to describe the characteristics of watersheds. Non-linear, multi-variant regressions using the WTNN derived rainfall and topography factors were derived using self-organizing maps (SOM) for the debris flow vulnerability assessment. An index of vulnerability representing the degrees of hazard can be implemented in a GIS-based decision support system by which a decision maker can assess debris flow vulnerability.

**Nasstrom, John S., Gayle Sugiyama, Ronald L. Baskett, Shawn C. Larsen, and Michael M. Bradley. 2007. The National Atmospheric Release Advisory Center modeling and decision-support system for radiological and nuclear emergency preparedness and response. *International Journal of Emergency Management* 4(3): 524-550.**

This paper describes the tools and services provided by a national center for modeling the environmental and health impacts of airborne hazardous materials. This center can provide emergency decision support information within minutes for a wide range of radiological, nuclear, chemical, and biological hazards from fires, industrial and transportation accidents, radiation dispersal device explosions, hazardous material spills, nuclear power plant accidents, and nuclear detonations. Web- and Internet-based software provide quick access to advanced modeling tools, as well as expert analyses from the center. Model predictions include the 3D spatial and time-varying effects of weather, land use, and terrain on scales from the local to regional to global. Tools provide displays of plume predictions with affected population counts, detailed maps, and reports describing model assumptions, contamination, and dose levels. On-scene information and measurements are used to refine model predictions.

**Pender, Gareth, and Sylvain Neelz. 2007. Use of computer models of flood inundation to facilitate communication in flood risk management. *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 106-114.**

It is now widely recognized that good communication among multi-disciplinary stakeholders is central to effective flood risk management. Recent developments in geographic information systems, increased availability of accurate digital terrain models from remotely sensed data sources, and improved graphical computer interfaces have made the outputs from computer models of flood inundation easily

accessible to the stakeholder community. As a consequence, predictions from such models are now being used routinely as a means of communication between engineers and other stakeholders in flood risk management. This paper provides a review of the modeling methods most appropriate for flood risk communication. These are one-dimensional models that are suitable for simulating flood risk at a catchment or sub-catchment scale and appropriate for communicating the impact of strategic flood management decisions, and two-dimensional models that can be applied across a range of scales but are now being regularly applied at the relatively small scale, where they have the potential to inform and communicate disaster management decisions. The role of such models in communicating between modelers and non-modelers by providing a means for immediate visualization of “the future” is discussed and illustrated by application to two case studies.

Applied Systems Analysis (IIASA). The rationale for a government to insure its contingent liabilities is presented, along with the fiscal, legal, and institutional context of the Mexican transaction. Using publicly available data, the paper scrutinizes the choice the authorities faced between two different risk-transfer instruments: reinsurance and a catastrophe bond. Making use of IIASA’s catastrophe simulation model (CATSIM), this financial risk management decision is analyzed within the context of a public investment decision.

## Insurance and Economic Impacts

**Baade, Robert A., Robert Baumann, and Victor Matheson. 2007. Estimating the economic impact of natural and social disasters with an application to Hurricane Katrina. *Urban Studies* 44(11): 2061-2076.**

This paper examines taxable sales in the Los Angeles and Miami metropolitan areas to find evidence of the short- and long-run effects of the Rodney King riots and Hurricane Andrew on their respective economies. The comparison of these two events shows that the King riots had a long-term negative effect on Los Angeles’ economy, while Hurricane Andrew had a short-term positive effect on the Miami economy. The paper also applies the contrasting experiences of Los Angeles and Miami to New Orleans following Hurricane Katrina. In some ways, Katrina is a hybrid of these two events since it combines elements of both a natural disaster and a social disaster. The paper examines how Katrina is similar to each of the previous incidents and how these similarities might affect the recovery of New Orleans.

**Cardenas, Victor, Stefan Hochrainer, Reinhard Mechler, Georg Pflug, and Joanne Linnerooth-Bayer. 2007. Sovereign financial disaster risk management: The case of Mexico. *Environmental Hazards* 7(1): 40-53.**

In 2006, Mexico became the first transition country to transfer part of its public-sector natural catastrophe risk to the international reinsurance and capital markets. The Mexican case is of considerable interest to highly exposed transition and developing countries, many of which are considering similar transactions. Risk financing instruments can assure governments of sufficient post-disaster capital to provide emergency response and disaster relief to the affected population and repair public infrastructure. The costs of financial instruments, however, can greatly exceed expected losses, and for this reason it is important to closely examine their benefits and alternatives. This paper analyzes the Mexican case from the perspective of the risk ceding (the Ministry of Finance and Public Credit), which was informed by analyses provided by the International Institute for

**Ibarra, Hector, and Jerry Skees. 2007. Innovation in risk transfer for natural hazards impacting agriculture.**

*Environmental Hazards* 7(1): 62-69.

Agricultural income from growing crops is susceptible to a variety of risks—the price of output and the actual amount of output are generally the largest risk variables. This article focuses on yield risk rather than price risk by reviewing innovation in risk transfer for natural hazard risk in agriculture. While many higher-income countries have long-standing crop insurance programs, these programs are not appropriate for lower-income countries. Lower-income countries can ill-afford the subsidies that are used in most multiple peril crop insurance programs throughout the world. Still, lower-income countries have large numbers of small farms, increasing the need for agricultural insurance to protect against common problems that create disastrous losses for many individual farm households.

**Linnerooth-Bayer, Joanne, and Reinhard Mechler. 2007.**

**Disaster safety nets for developing countries: Extending public-private partnerships. *Environmental Hazards* 7(1): 54-61.**

In developed countries, public-private partnerships involving insurance companies and governments often provide security against the human and economic losses of disasters. These partnerships, however, are neither available nor affordable in most highly exposed developing countries. In this paper the authors examine recent innovations in financial risk management that extend traditional public-private partnerships to include NGOs, international financial institutions, and other donors. Importantly, these partnerships provide secure financial arrangements to low-income communities before disasters strike and thus relieve the uncertainty and anxiety of depending on ad hoc post-disaster aid for recovery and even survival. The authors examine three examples of extended partnerships: the Turkish Catastrophe Insurance Pool, the Andhra Pradesh microinsurance program, and an index-based weather derivative for farmers facing drought in Malawi.

**Perez-Maqueo, O., A. Intralawan, and M. L. Martinez. 2007.**

**Coastal disasters from the perspective of ecological economics. *Ecological Economics* 63(2-3): 273-284.**

Natural hazards are recurrent events that frequently result in high death tolls and large economic losses. Because of their large impact, they have concerned the international community for a long time. In spite of the efforts, the impact of natural hazards has increased. Oftentimes, the role of

natural ecosystems and the ecosystem services they provide to human societies are not considered in risk reduction programs. How relevant are ecosystems? What are the consequences of the depletion of natural ecosystems and the loss of ecosystem services provided by them? Would the alternative vision of ecological economics, in which development and economy are seen as the whole the ecosystem be helpful in reducing disaster risk? In this paper the authors test whether a holistic approach from the perspective of ecological economics is helpful to clarify and reduce the impact of natural hazards. They focus on hurricanes because they are the most frequently reported events of all natural disasters. The authors analyze the relationship between the components of human, built, social, and natural capitals and the damage caused by hurricanes in terms of mortality rate and then generate a conceptual model to help envision the complexity of the system. A stepwise (back and forth steps) linear regression analysis revealed that mortality rate was significantly and positively affected by hurricane frequency ( $p < 0.01$ ) while area covered by semi-altered ecosystems (a mosaic of natural and human-altered ecosystems) ( $p < 0.01$ ) and GDP ( $p < 0.05$ ) negatively affected mortality rate ( $R^2 = 0.81$ ). The proportion of natural/altered ecosystems yielding the best protection results needs to be determined. Natural capital alone does not decrease number of deaths. Rather, its complex interactions with the other capitals and the many feedback loops that are involved need to be considered to achieve effective disaster risk reduction. No single capital is enough to reduce the impact and intensity of natural hazard. A balance between human, built, social, and natural capitals and an increasing awareness of the consequences of different development decisions, will help human societies to live with rather than cope with coastal hazards.

## Landslides and Avalanches

**Holler, Peter. 2007. Avalanche hazards and mitigation in Austria: A review. *Natural Hazards* 43(1): 81-101.**

Natural hazards like torrents or avalanches pose a threat to settlements and infrastructures in the Austrian Alps. Since 1950 more than 1,600 persons have been killed by avalanches in Austria, which is on average approximately 30 fatalities per year. In particular, the winter periods 1950/1951 and 1953/1954 stand out with more than 100 fatalities. Those events led to an increase of avalanche control programs in the following decades. While from the 1950s to the 1970s emphasis was placed on permanent measures (technical structures, afforestations, hazard zoning) additional programs such as avalanche warning and forecasting have supplemented avalanche control measures in the last decades. Current research is focused on avalanche simulation, risk management, and the influence of the forest on avalanche formation. An important area of future research is to develop improved methods for avalanche forecasting and to intensify the investigation of the dynamics of avalanches.

**Hong, Yang, Robert F. Adler, and George Huffman. 2007. Use of satellite remote sensing data in the mapping of global landslide susceptibility. *Natural Hazards* 43(2): 245-256.** Satellite remote sensing data have significant potential use in analysis of natural hazards such as landslides. Relying on the recent advances in satellite remote sensing and geographic information system (GIS) techniques, this paper aims to map landslide susceptibility over most of the globe using a GIS-based weighted linear combination method. First, six relevant landslide-controlling factors are derived from geospatial remote sensing data and coded into a GIS system. Next, continuous susceptibility values from low to high are assigned to each of the six factors. Second, a continuous scale of a global landslide susceptibility index is derived using GIS-weighted linear combination based on each factor's relative significance to the process of landslide occurrence (e.g., slope is the most important factor, soil types and soil texture are also primary-level parameters, while elevation, land cover types, and drainage density are secondary in importance). Finally, the continuous index map is further classified into six susceptibility categories. Results show the hot spots of landslide-prone regions include the Pacific Rim, the Himalayas and South Asia, Rocky Mountains, Appalachian Mountains, Alps, and parts of the Middle East and Africa. India, China, Nepal, Japan, the USA, and Peru are shown to have landslide-prone areas. This first-cut global landslide susceptibility map forms a starting point to provide a global view of landslide risks and may be used in conjunction with satellite-based precipitation information to potentially detect areas with significant landslide potential due to heavy rainfall.

**Hong, Yang, Robert F. Adler, Andrew Negri, and George J. Huffman. 2007. Flood and landslide applications of near real-time satellite rainfall products. *Natural Hazards* 43(2): 285-294.**

Floods and associated landslides account for the largest number of natural disasters and affect more people than any other type of natural disaster. With the availability of satellite rainfall analyses at fine time and space resolution, it has become possible to mitigate such hazards on a near-global basis. In this article, a framework to detect floods and landslides related to heavy rain events in near-real-time is proposed. Key components of the framework are: a fine resolution precipitation acquisition system; a comprehensive land surface database; a hydrological modeling component; and landslide and debris flow model components. A key precipitation input dataset for the integrated applications is the NASA TRMM-based multi-satellite precipitation estimates. This dataset provides near real-time precipitation at a spatial-temporal resolution of 3 hour and  $0.25^\circ \times 0.25^\circ$ . In combination with global land surface datasets, it is now possible to expand regional hazard modeling components into a global identification/monitoring system for flood/landslide disaster preparedness and mitigation.



**Lu, George Y., Long S. Chiu, and David W. Wong. 2007. Vulnerability assessment of rainfall-induced debris flows in Taiwan. *Natural Hazards* 43(2): 223-244.**

A GIS-based decision support system, which incorporates local topographic and rainfall effects on debris flow vulnerability was developed. Rainfall at a scale compatible with the digital elevation model resolution was obtained using a neural network with a wind-induced topographic effect and rainfall derived from satellite rain estimates and an adaptive inverse distance weight method (WTNN). The technique was tested using data collected during the passage of typhoon Tori-Ji on July 2001 over central Taiwan. Numerous debris flows triggered by the typhoon were used as control for the study. Our results show that the WTNN technique outperforms other interpolation techniques, including adaptive inversed distance weight (AIDW), simple kriging (SK), co-kriging, and multiple linear regression using gauge, and topographic parameters. Multiple remotely-sensed, fuzzy-based debris-flow susceptibility parameters were used to describe the characteristics of watersheds. Non-linear, multi-variant regressions using the WTNN derived rainfall and topography factors are derived using self-organizing maps (SOM) for the debris flow vulnerability assessment. An index of vulnerability representing the degrees of hazard can be implemented in a GIS-based decision support system by which a decision maker can assess debris flow vulnerability.

**Pande, Ravindra K., and A. Uniyal. 2007. The fury of nature in Uttarakhand: Uttarkashi landslide of the year 2003. *Disaster Prevention and Management* 16(4): 562-575.**

The study aims to highlight fundamental causes and effects of disasters in the northern district of Uttarkashi, which lies in the fragile mountains of Himalaya. Disasters such as the 1991 Uttarkashi earthquake, the flash floods of the Bhagirathi River and the devastation caused by the Gyansu landslide are discussed. The following approach was used for this study: precise geographical location of the various landslides was marked through Global Positioning System Receivers (GPS); landslide types were identified based on activity (active or old) and debris flow slide and rock fall were marked based on the sliding material and slope condition; the land use/land cover pattern of Varunawat Parvat was assessed; the vulnerability of population, houses, and infrastructure, etc., was listed; the condition of existing stability measures, e.g., check dams and drains, was assessed; and slide-specific mitigation measures were suggested. The Himalayan state of Uttarakhand has been witnessing the fury of nature for a long time. In recent years there has been an increase in the frequency of natural disasters. Earthquakes, landslides, cloudbursts, and flash floods have caused great damage to life and property in various parts of the state. The Himalayan orogenic belt is tectonically active and subject to modifications by natural processes. Adding further to the fragility of this belt are the anthropogenic activities like the unplanned cutting of slope for construction activity, blasting of highly jointed rock mass for road construction, and unplanned disposal of the slope cut debris material. The study is based on the

data/information collected during the monsoon season from 15 June to 15 September 2003. The period is short for developing any hypothesis, but sufficient care has been taken to consider vital factors. A calamity of rare severity requires a high level of recovery and management. Sound mitigation mechanism helps the government and the community tackle the problem immediately and efficiently. The study highlights fundamental causes and effects of the landslide and suggests steps to overcome them.

**Petley, David N., Gareth J. Hearn, Andrew Hart, Nicholas J. Rosser, Stuart A. Dunning, Katie Oven, and Wishart A. Mitchell. 2007. Trends in landslide occurrence in Nepal. *Natural Hazards* 43(1): 23-44.**

Nepal is a mountainous, less developed kingdom that straddles the boundary between the Indian and Himalayan tectonic plates. In Nepal, landslides represent a major constraint on development, causing high levels of economic loss and substantial numbers of fatalities each year. There is a general consensus that the impacts of landslides in countries such as Nepal are increasing with time, but until now there has been little or no quantitative data to support this view or to explain the causes of the increases. In this paper, a database of landslide fatalities in Nepal has been compiled and analyzed for the period 1978–2005. The database suggests that there is a high level of variability in the occurrence of landslides from year to year, but that the overall trend is upward. Analyses of the trends in the data suggest that there is a cyclicity in the occurrence of landslide fatalities that strongly mirrors the cyclicity observed in the SW (summer) monsoon in South Asia. Perhaps surprisingly, the relationship is inverse, but this is explained through an inverse relationship between monsoon strength and the amount of precipitation in the Hill District areas of Nepal. It is also clear that in recent years the number of fatalities has increased dramatically over and above the effects of the monsoon cycle. Three explanations are explored for this: land-use change, the effects of the ongoing civil war in Nepal, and road building. It is concluded that a major component of the generally upward trend in landslide impact probably results from the rural road-building program, and its attendant changes to physical and natural systems.

## Near Earth Objects

**Koenig, Jesse D., and Christopher F. Chyba. 2007. Impact deflection of potentially hazardous asteroids using current launch vehicles. *Science and Global Security* 15(1): 57-83.**

Nuclear explosions, and a wide variety of technologies not yet realized, have been proposed to deflect asteroids away from collision with Earth. In contrast, this article presents realistic models for simple kinetic energy impact deflection, using the actual orbital elements of 795 catalogued Potentially Hazardous Asteroids, and impactor masses launched to intercept trajectories by Atlas V HLV rockets or equivalent. The authors take asteroid diameter, density, cratering characteristics, and Earth-collision lead time as

parameters whose influence is to be investigated. Assuming asteroids of rocklike density, the article finds deflection off of Earth-collision to be achievable given a 5-year lead time with a single kinetic energy intercept for 100% of 250 m diameter PHAs, 20-year lead with a single intercept for 93% of 500 m PHAs, 20-year lead with 5 and 10 intercepts, respectively, for 55% and 94% of 1 km PHAs, or 100-year lead with 1 and 2 intercepts, respectively, for 55% and 94% of 1 km PHAs. Considering likely future lead times for near-earth objects, simple impact deflection using current launch vehicles is therefore a viable strategy for up to kilometer-diameter asteroids. This method has important advantages over other proposals: it requires no new technologies, would not require development or testing of nuclear warheads, and would likely be the least costly, least risky, and fastest to effect.

healthcare workers were included in these hospital plans; however, the gaps identified here may have serious implications for employee health and safety and overall response during a large-scale infectious disease outbreak. The authors provide a number of recommendations for consideration in infectious disease pandemic plan development to better support the healthcare workers in their roles as first responders.

## Public Health, Mental Health, and Emergency Medicine

**Amaratunga, Carol A., Tracey L. O'Sullivan, Karen P. Phillips, Louise Lemyre, Eileen O'Connor, Darcie Dow, and Wayne Corneil. 2007. Ready, aye ready? Support mechanisms for healthcare workers in emergency planning: A critical gap analysis of three hospital emergency plans. *Journal of Emergency Management* 5(4): 23-38.**

In response to the 2003 global outbreak of severe acute respiratory syndrome (SARS) and the threat of pandemic influenza, Canadian hospitals have been actively developing and revising their emergency plans. Healthcare workers are a particularly vulnerable group at risk of occupational exposure during infectious disease outbreaks, as seen during SARS and as documented/reported in the recent National Survey of the Work and Health of Nurses (Statistics Canada, 2006). Approximately one-third of Canadian nurses identified job strain and poor health related to their work environment. Three years after SARS, this article presents a critical analysis of the gaps of three hospital pandemic influenza plans in the context of established organizational supports for healthcare workers. Hospital pandemic influenza plans were obtained from institutional representatives in three Ontario cities. Qualitative gap analysis of these plans was conducted using a checklist of 11 support categories, developed from a review of existing literature and findings from a previous study of focus groups with emergency and critical nurses. Support mechanisms were identified in the plans; however, gaps were evident in preparation for personal protective equipment, education, informational support, and support during quarantine. Hospital emergency planning could be more robust by including additional organizational supports such as emotional/psychological support services, delineating management responsibilities, human resources, vaccine/anti-viral planning, recognition/compensation, media strategies, and professional development. Since the 2003 SARS outbreak, hospitals have invested in pandemic planning, as evidenced by the comprehensive plans examined here. Organizational support mechanisms for

**Andrulis, Dennis P., Nadia J. Siddiqui, and Jenna L. Gantner. 2007. Preparing Racially And Ethnically Diverse Communities For Public Health Emergencies. *Health Affairs* 26(50): 1269-1279.**

The tragedy of Hurricane Katrina in New Orleans confirmed that effective implementation of public health preparedness programs and policies will require compliance from all racial and ethnic populations. This study reviews current resources and limitations and suggests future directions for integrating diverse communities into related strategies. It documents research and interventions, including promising models and practices that address preparedness for minorities. However, findings reveal a general lack of focus on diversity and suggest that future preparedness efforts need to fully integrate factors related to race, culture, and language into risk communication, public health training, measurement, coordination, and policy at all levels.

**Campbell, Laura. 2007. Utilizing compassion fatigue education in Hurricanes Ivan and Katrina. *Clinical Social Work Journal* 35(3): 165-171.**

Compassion fatigue is a state that includes the symptoms of Post-Traumatic Stress Disorder. This article reviews events following the Hurricane Ivan and Katrina disasters and how compassion fatigue education helped to identify and ameliorate symptoms of the problem. The author worked in a community center in the Pensacola area for one week following Hurricane Ivan and in a shelter in her hometown of Houma, Louisiana, for two months following Katrina. Examples of traumatic stories and coping with her own secondary stress are given. Implications include education regarding compassion fatigue for all mental health professionals, especially during and following work in disasters or with populations of the traumatized.

**Comer, Jonathon S., and Philip C. Kendall. 2007. Terrorism: The psychological impact on youth. *Clinical Psychology: Science and Practice* 14(3): 179-212.**

Research on the psychological impact of terrorism on youth is reviewed and evaluated. Children having proximal contact with terrorism show elevated posttraumatic stress, separation anxiety, and/or other symptoms. Following a terrorist attack, youth proximal and distal to the attack are exposed to a vast amount of attack-related media coverage, and exposure to such media coverage is associated with post-attack posttraumatic stress disorder (PTSD) symptomatology. However, the research is incomplete, including an insufficient scope and methodological limitations. Research has yet to examine the impact that exposure to an extended context of threat, expectation, and

alert has on child development. Importantly, how are children influenced by secondhand terrorism, the context in which cultural influences disproportionately attend to the possibilities, rather than probabilities, of future terrorism? Research is needed to evaluate the impact of terrorism on psychopathology (beyond PTSD), functional impairment, and ethnic stereotyping in youth, and to examine the efficacy of psychological programs that strive to redress the problems of youth affected by terrorism.

**Ebi, K. L. 2007. Towards an early warning system for heat events. *Journal of Risk Research* 10, (5): 729-744.**

Severe and sustained episodes of hot weather during the summer season are associated with marked short-term increases in morbidity and mortality in the United States and Europe. The death toll in an unprepared region can be substantial, as was evidenced in the 2003 heat event in Western Europe. There is growing interest in developing early warning systems to advise the public when weather conditions pose risks to health. These systems link meteorological forecasts of dangerous weather with public health actions. The principal components of an early warning system include identification and forecasting of the event (including consistent, standardized weather criteria for when warnings are activated and deactivated), prediction of possible health outcomes that could occur, an effective and timely response plan that targets high-risk populations, and an ongoing evaluation and revision of the system and its components. A particular challenge is the development of effective communication of the behavioral changes needed to prevent adverse health impacts.

**Gebhart, Mark E., and Robert Pence. 2007. START triage: Does it work? *Disaster Management and Response* 5(3): 68-73.**

A mass casualty incident (MCI) demands rapid and efficient triage of victims. The Simple Triage and Rapid Treatment (START) protocol has been proposed to identify salvageable victims from those with imminent mortality. This study evaluates the efficacy of START triage to predict likelihood of mortality of an MCI trauma victim. Trauma patients were randomly selected using the trauma database at a local Level II trauma center. Survival was defined as a discharge from the hospital with the primary endpoint being death. For respiratory rate  $\geq 10$ , pulse  $\geq 100$ , and Glasgow Coma Scale score  $\geq 14$ , one point was given to the victim for each category. Persons who did not meet these criteria were given a score of zero. The scores were then tabulated and analyzed with respect to the primary endpoint. Of the 355 persons analyzed, 341 (96%) survived and 14 (3.9%) were categorized as deceased. For patients with a tabulated score  $\geq 1$ , the positive predictive value (PPV) and negative predictive value (NPV) were 0.4 and 0.98, respectively. For patients with a tabulated score of 2, the PPV and NPV were 0.08 and 0.99, respectively. Of the total victims, 75.77% with a respiratory rate  $\geq 10$ , palpable radial pulse, and intact mental status survived. The deceased victims with tabulated scores of 1, 2, and 3 had mortalities of 50%, 28%, and 21%, respectively. The trend toward lower tabulated scores in the deceased victims suggests efficacy with START triage.

**Gill, Duane A. 2007. Secondary trauma or secondary disaster? Insights from Hurricane Katrina. *Sociological Spectrum* 27(6): 613-632.**

Hurricane Katrina is destined to become one of the most studied disasters in U.S. history. This manuscript offers a sociology of disaster framework in which to situate past, on-going, and future research on this event. By examining Katrina on a continuum of natural and technological disasters, we are able to gain insights into the different paths of impact and recovery taken by New Orleans and the rest of the disaster-stricken region. Specifically, this disaster has produced a series of secondary traumas that continue to thwart recovery efforts. Understanding these secondary traumas can lead to amelioration of their effects and development of responses to diminish their occurrence in future disasters.

**Gold, Laura S., Leslee B. Kane, Nona Sotoodehnia, and Thomas Rea. 2007. Disaster events and the risk of sudden cardiac death: A Washington state investigation. *Prehospital and Disaster Medicine* 22(4): 313-317.**

Psychological distress following disaster events may increase the risk of sudden cardiac death. In 2001, the Nisqually earthquake and the September 11 terrorist attacks profoundly affected Washington state residents. This research investigated the theory that the incidence of sudden cardiac death would increase following these disaster events. Death certificates were abstracted using a uniform case definition to determine the number of sudden cardiac deaths for the 48-hour and one-week periods following the two disaster events. Using t-tests, the number of sudden cardiac deaths for the periods following the disaster events was compared to those of the control periods. In total, 32 sudden cardiac deaths occurred in the four counties affected by the Nisqually earthquake during the 48 hours after the event. No difference was observed in the number of sudden deaths in the 48-hours or one-week following the terrorist attacks compared to control periods. A local disaster caused by a naturally occurring hazard, but not a geographically remote human disaster, was associated with an increased risk of sudden cardiac death. A better understanding of the underlying mechanisms may have implications for prevention of sudden cardiac death.

**Hupert, Nathaniel, Eric Hollingsworth, and Wei Xiong. 2007. Is overtriage associated with increased mortality? Insights from a simulation model of mass casualty trauma care. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incident* 1(s1): s14-s24.**

The purpose of this article is to examine the relationship between overtriage and critical mortality after a mass casualty incident (MCI) using a simulation model of trauma system response. The authors created a discrete event simulation model of trauma system management of MCIs involving individual patient triage and treatment. Model variables include triage performance, treatment capability, treatment time, and time-dependent mortality of critically injured patients. They model triage as a variable selection

process applied to a hypothetical population of critically and noncritically injured patients. Treatment capability is represented by staffed emergency department trauma bays with associated staffed operating rooms that are recycled after each use. They estimated critical and noncritical patient treatment times and time-dependent mortality rates from the trauma literature. In this simulation model, overtriage, the proportion of noncritical patients among all of those labeled as critical, has a positive, negative, or variable association with critical mortality depending on its etiology (i.e., related to changes in triage sensitivity or to changes in the prevalence and total number of critical patients). In all of the modeled scenarios, the ratio of critical patients to treatment capability has a greater impact on critical mortality than overtriage level or time-dependent mortality assumption. Increasing overtriage may have positive, negative, or mixed effects on critical mortality in this trauma system simulation model. These results, which contrast with prior analyses describing a positive linear relationship between overtriage and mortality, highlight the need for alternative metrics to describe trauma system response after MCIs. The authors explore using the relative number of critical patients to available and staffed treatment units, or the critical surge to capability ratio, which exhibits a consistent and nonlinear association with critical mortality in this model.

**Kaplowitz, Lisa, Morris Reece, Jody Henry Hershey, Carol M. Gilbert, and Italo Subbarao. 2007. Regional health system response to the Virginia Tech mass casualty incident. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incident 1(s1): s10-s13.***

On April 16, 2007, a mass shooting occurred on the campus of Virginia Polytechnic Institute and State University (Virginia Tech). Due to both distance and weather, air transport of the injured directly to a Level-1 trauma center was not possible. The injured received all of their care or were initially stabilized at three primary hospitals that either had a Level-3 trauma center designation or no trauma center designation. This article is a retrospective analysis of the regional health system (prehospital, hospital, regional hospital emergency operations center, and public health local and state) response. Data records from all of the regional responding emergency medical services, hospitals, and coordinating services were reviewed and analyzed. Records for all 26 patients were reviewed and analyzed using triage designations, injury severity scores (ISS), and critical mortality. Twenty-five of the 26 patients were triaged in the field. Excluding 1 patient (asthma), the average ISS for victims presented was 8.2. Twelve patients had an ISS of  $\geq 9$ , and 5 had an ISS score of  $\geq 15$ . Ten of the 26 patients (38%) required urgent intervention and surgery in the first 24 hours. The overall regional health system mortality of victims received was 3.8% (1 death [excluding 1 dead on arrival {DOA}]/ 26 victims from scene). The regional health system critical mortality rate (excluding 1 victim who was DOA) was 20% (1/5). The outcomes of the Virginia Tech mass casualty incident, as evidenced by the low overall regional health system mortality of victims received at 3.8%

(1/26) and low critical mortality rate (excluding 1 victim who was DOA) of 20%, coupled with a need to treat a significant amount of moderately injured victims 46% (12/26 with ISS  $\geq 9$ ) gives credence to the successful response. The successful response occurred as a consequence of regional collaborative planning, training, and exercising, which resulted not only in increased expertise and improved communications but also in essential relationships and a sense of trust forged among all of the responders.

**Kazdin, Alan E. 2007. Child reactions to terrorism: Cautions and next steps for research. *Clinical Psychology: Science and Practice* 14(3): 213-218.**

Comer and Kendall (2007) have provided an excellent review of what is known about the effects of terrorism on children. They have identified correlates, outcomes, and the many gaps in our current knowledge. This article presents comment focusing on two main issues. First, there are many correlates and risk factors that predict deleterious outcomes following exposure to terrorist acts. The field of psychology occasionally moves quickly to intervention work by altering malleable risk factors as if they played a causal role in the outcome or its amelioration. More work is needed to analyze these correlates and the precise role they play, if any, in the outcome. Second, in a relatively new area of research, there are very many gaps in our knowledge. The author discusses the need to prioritize and limit the focus of our studies. Priorities highlighted include evaluating the similarities between natural and human-made disasters and evaluating mechanisms of action among correlates that might bear an important role in child outcomes. Apart from the consequences of terrorist acts on children and families, our field must turn to the broader issue. What can our science do alone and in conjunction with other fields to understand and combat the precursors and origins of terrorism? Theory will be wonderful but we will need to have this grounded or tested to ensure we move beyond reasonable ideas or a lavish buffet of untestable interpretations.

**Liu, Ai Zhing, Hongzhuan Tan, Jia Zhou, Shuoqi Li, Tubao Yang, Zhenqiu Sun, and Shi Wu Wen. 2007. Brief screening instrument of posttraumatic stress disorder for children and adolescents 7 to 15 years of age. *Journal of Psychiatry and Human Development* 38(3): 195-202.**

The objective of this paper is to develop a brief screening instrument of posttraumatic stress disorder (PTSD) for young victims of natural disasters. Data were derived from flood victims in 1998 and 1999 in Hunan, China. A representative population sample of 6,852 subjects 7 to 15 years of age was selected. Among them, 6,073 (88.6%) were interviewed. Multistage sampling was used to select the subjects and PTSD was ascertained with Diagnostic and Statistical Manual of Mental Disorders: 4th Edition (DSM-IV). Researchers randomly assigned 80% (4,851) of the study subjects to construct the screening instrument (construct model) and the remaining 20% (1,222) of subjects to examine the model (validation model). Logistic regression analysis and receiver operating characteristics curves were utilized to select a subset of symptoms and cutoff point from the

prestructured questionnaires. A seven-symptom instrument for PTSD screening was selected. Scores of 3 or more on this instrument were employed to define positive cases of PTSD with a sensitivity of 96.9%, specificity 99.0%, positive predictive value (PPV) 82.6%, and negative predictive value (NPV) 99.8%. The brief screening instrument developed in this study is highly valid, reliable, and predictable.

**Lyznicki, James, Italo Subbarao, Georges C. Benjamin, and James J. James. 2007. Developing a consensus framework for an effective and efficient disaster response health system: A national call to action. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incidents 1(s1): s51-s54.***

Eighteen national organizations, representing medicine, dentistry, nursing, hospital systems, public health, and emergency medical services, have worked together to create a framework for a national and regional disaster response health system that is scalable, multidisciplinary, and seamless, and based on an all-hazards approach. In July 2005 and June 2006 the American Medical Association (AMA) and the American Public Health Association (APHA) convened the AMA/APHA Linkages Leadership Summit, with funding from the Centers for Disease Control and Prevention under the Terrorism Injuries: Information Dissemination and Exchange (TIIDE) program. As cofacilitators, James J. James, MD, DrPH, MHA, director of the AMA Center for Public Health Preparedness and Disaster Response, and Georges Benjamin, MD, FACP, FACEP(E), APHA executive director, met with leaders from 16 national medical, dental, hospital, nursing, hospital systems, public health, and emergency medical services organizations in Chicago (2005) and New Orleans (2006) to deliberate the deficiencies in the medical and public health disaster response system and the lack of necessary linkages between key components of this system: the health care, emergency medical services, and public health sectors. The goal was to reach consensus on a set of overarching recommendations to improve and sustain health system preparedness and to combine each organization's advocacy expertise and experience to promote a shared policy agenda. The full summit report contains 53 consensus-based recommendations, which will serve as the framework for a coordinated national agenda for strengthening health system preparedness for terrorism and other disasters. The nine most overarching critical recommendations from the report are highlighted. Although the summit report presents important perspectives on the subject of preparedness for public health emergencies, we must understand that preparedness is a process and that these recommendations must be reviewed and refined continually over time.

**Miller, Andrew C., and Bonnie Arquilla. 2007. Disasters, women's health, and conservative society: Working in Pakistan with the Turkish Red Crescent following the South Asian earthquake. *Prehospital and Disaster Medicine 22(4): 269-273.***

In recent years, numerous catastrophic disasters caused by natural hazards directed worldwide attention to medical relief efforts. These events included the (1) 2003 earthquake in Bam, Iran; (2) 2004 earthquake and tsunami in Southeast Asia; (3) Hurricanes Katrina and Rita in the southern United States in 2005; (4) 2005 South Asian earthquake; and (5) 2006 Indonesian volcanic eruption and earthquakes. Health disparities experienced by women during relief operations were a component of each of these events. This article focuses on the response of the Turkish Red Crescent Society's field hospital in northern Pakistan following the South Asian Earthquake of October 2005, and discusses how the international community has struggled to address women's health issues during international relief efforts. Furthermore, since many recent disasters occurred in culturally conservative South Asia and the local geologic activity indicates similar disaster-producing events are likely to continue, special emphasis is placed on response efforts. Lessons learned in Pakistan demonstrate how simple adjustments in community outreach, camp geography, staff distribution, and supplies can enhance the quality, delivery, and effectiveness of the care provided to women during international relief efforts.

**Naturale, April. 2007. Secondary traumatic stress in social workers responding to disasters: Reports from the field. *Clinical Social Work Journal 35(3): 173-181.***

Social workers are called to respond to disasters to provide assessment, crisis counseling, and trauma treatment as part of the recovery effort. While research has identified the types of interventions appropriate in assisting trauma survivors, little empirical research exists to help address the distress responses that social workers experience when exposed to the trauma material of disaster survivors and their families. Case examples can inform social work practice using evidence informed interventions and recording the outcomes. This article presents three case histories of social workers responding to disasters, the course of their secondary traumatic stress responses, and their struggle to overcome the psychological adversity they faced.

**Nordboe, Diana J., Edward M. Kantor, Harvey Barker, Amie Ware, and Bill Armistead. 2007. Immediate behavioral health response to the Virginia Tech shootings. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incidents 1(s1): s31-s32.***

**Nucifora, Frederick, Alan M. Langlieb, Everett Siegal, George S. Everly, and Michael Kaminsky. 2007. Building resistance, resilience, and recovery in the wake of school and workplace violence. *Disaster Medicine and Public Health Preparedness - Special Issue: Virginia Tech: Implications for Response to Mass Casualty Incidents 1(s1): s33-s37.***

Incidents of school and workplace violence are rare but devastating events that can result in significant psychological consequences in communities. The majority of people in the United States will experience some type of traumatic event in their lifetime, but most of them will have no disruption or only transient disruption in functioning. They are resistant to the development of symptoms or resilient, able to bounce back quickly. By enhancing resistance and promoting resilience, even fewer individuals may develop mental disorders. This article takes a closer look at the concepts of resistance, resilience, recovery, and the need for research on interventions that promote them, in the hope of applying the concepts and interventions to schools and the workplace.

**Peterka, Ann. 2007. Pandemic preparedness and response: The role of medical interventions. *Journal of Emergency Management 5(4): 13-16.***

**Pinkert, Moshe, Adi Leiba, Eilon Zaltsman, Onn Erez, Amir Blumenfeld, Shkolnick Avinoam, Daniel Laor, Dagan Schwartz, Avishay Goldberg, Yehezkel Levi, and Yaron Bar-Dayan. 2007. The significance of a small, Level-3 'semi evacuation' hospital in a terrorist attack in a nearby town. *Disasters 31(3): 227-235.***

Terrorist attacks can occur in remote areas causing mass-casualty incidents (MCIs) far away from Level-1 trauma centers. This study draws lessons from an MCI pertaining to the management of primary and secondary evacuation and the operational mode practiced. Data was collected from formal debriefings during and after the event, and the medical response, interactions, and main outcomes analyzed using Disastrous Incidents Systematic Analysis through Components, Interactions, and Results (DISAST-CIR) methodology. A total of 112 people were evacuated from the scene—66 to the nearby Level-3 Laniado hospital, including the eight critically and severely injured patients. Laniado hospital was instructed to act as an evacuation hospital but the flow of patients ended rapidly and it was decided to admit moderately injured victims. The authors introduce a novel concept of a 'semi-evacuation hospital.' This mode of operation should be selected for small-scale events in which the evacuation hospital has hospitalization capacity and is not geographically isolated. They suggest that Level-3 hospitals in remote areas should be prepared and drilled to work in semi-evacuation mode during MCIs.

**Reilly, Michael J., David Markenson, and Charles DiMaggio. 2007. Comfort level of emergency medical service providers in responding to weapons of mass destruction events: Impact of training and equipment. *Prehospital and Disaster Medicine 22(4): 297-303.***

Numerous studies have suggested that emergency medical services (EMS) providers are ill-prepared in the areas of training and equipment for response to events due to weapons of mass destruction (WMD) and other public health emergencies. A nationally representative sample of basic and paramedic EMS providers in the United States was surveyed to assess whether they had received training in WMD and/or public health emergencies as part of their initial provider training and as continuing medical education within the past 24 months. Providers also were surveyed as to whether their primary EMS agency had the necessary specialty equipment to respond to these specific events. More than half of EMS providers had some training in WMD response. Hands-on training was associated with EMS provider comfort in responding to chemical, biological, and/or radiological events and public health emergencies. Only 18.1% of providers surveyed indicated that their agencies had the necessary equipment to respond to a WMD event. Emergency medical service providers who only received WMD training reported higher comfort levels than those who had equipment, but no training. Lack of training and education as well as the lack of necessary equipment to respond to WMD events is associated with decreased comfort among emergency medical services providers in responding to chemical, biological, and/or radiological incidents. Better training and access to appropriate equipment may increase provider comfort in responding to these types of incidents.

**Ruter, Anders, Per Ortenwall, and Tore Vikstrom. 2007. Staff procedure skills in management groups during exercises in disaster medicine. *Prehospital and Disaster Medicine 22(4): 318-321.***

In stressful situations such as the management of major incidents and disasters, the ability to work in a structured way is important. Medical management groups initially are formed by personnel from different operations that are on-call when the incident or disaster occurs. The aim of this study was to test if performance indicators for staff procedure skills in medical management groups during simulations could be used as a quality control tool for finding areas that require improvement. A total of 44 management groups were evaluated using performance indicators in which results could be expressed numerically during simulations. The lowest scores were given to documentation and to the introduction of new staff members. The highest score was given to the utilization of technical equipment. Staff procedure skills can be measured during simulations exercises. A logging system may lead to enhancing areas requiring improvement.

**Sadique, M. Zia, W. John Edmunds, Richard D. Smith, William Jan Meering, Onno de Zwart, Johannes Brug, and Philippe Beutels. 2007. Precautionary behavior in response to perceived threat of pandemic influenza. *Emerging Infectious Diseases* 13(9): 1307-1313.**

Faced with an epidemic of an infectious disease, persons may take precautionary actions to try to reduce their risk. Such actions include avoiding situations that persons perceive to be risky, which can have negative health and economic effects. Therefore, the authors conducted a population-based survey of persons' precautionary actions in response to a hypothetical influenza pandemic. For the five European and three Asian regions that had been affected by severe acute respiratory syndrome, the pattern of reported precautionary action was broadly similar across the regions; approximately 75% of respondents reported that they would avoid public transportation and 20% to 30% would try to stay indoors. Some regional differences were noted; Europeans were more likely than Asians to avoid places of entertainment, and Asians were more likely to avoid seeing physicians. This international survey provides insight into what might be expected during an influenza pandemic.

**Spence, Patric R., Kenneth A. Lachlan, and Jennifer M. Burke. 2007. Adjusting to uncertainty: Coping strategies among displaced after Hurricane Katrina. *Sociological Spectrum* 27(6): 653-678.**

This study examined the coping strategies of individuals displaced after Hurricane Katrina. Following the evacuation of New Orleans, surveys were administered to those individuals displaced by Katrina and relocated to shelters or in Disaster Centers in Cape Cod, Massachusetts; Lansing, Michigan; different parts of Indiana and Kentucky; and federal aid distribution centers throughout Texas. Results indicated that talking, staying informed, and praying emerged as predictors of changes in psychological stress during relocation. Differences emerged in coping strategies based on gender, race, and income; however, age did not emerge as a factor. Recommendations are made to use these results for post-crisis response and coordination.

**Spranger, Cathy B., Dorian Villegas, Michael J. Kazda, Ann Marie Harris, Shane Mathew, and Witold Migala. 2007. Assessment of physician preparedness and response capacity to bioterrorism or other public health emergency events in a major metropolitan area. *Disaster Management and Response* 5(3): 82-86.**

The role of physicians in the detection, reporting, and response to infectious disease outbreaks, anomalous biologic events, or other public health emergencies is critical to the community's safety. In an effort to assess the level of preparedness of local physicians to respond to such events, the City of Fort Worth Public Health Department, the Fort Worth/Tarrant County Health Authority, and the Tarrant County Medical Society collaborated in designing and administering a cross-sectional study in spring 2006. The results serve as a baseline of the local clinical community's preparedness, with 91% of local physicians reporting their

knowledge as "fair-poor," 80% desiring more information, and 83% favoring more training opportunities. Information obtained through this assessment is used to help cultivate educational interventions that will enhance the participation, integration, and mobilization of clinicians in the event of a community emergency.

**Wang, Philip S., Michael J. Gruber, Richard E. Powers, Michael Schoenbaum, Anthony H. Speier, Kenneth B. Wells, and Ronald C. Kessler. 2007. Mental health service use among Hurricane Katrina survivors in the eight months after the disaster. *Psychiatric Services* 58(11): 1403-1411.**

This study examined the use of mental health services among adult survivors of Hurricane Katrina in order to improve understanding of the impact of disasters on persons with mental disorders. A geographically representative telephone survey was conducted between January 19 and March 31, 2006, with 1,043 displaced and nondisplaced English-speaking Katrina survivors aged 18 and older. Survivors who reported serious and mild-moderate mood and anxiety disorders in the past 30 days and those with no such disorders were identified by using the K6 scale of nonspecific psychological distress. Use of services, system sectors, treatments, and reasons for not seeking treatment or dropping out were recorded. Correlates of using services and dropping out were examined. An estimated 31% of respondents (N=319) had evidence of a mood or anxiety disorder at the time of the interview. Among these only 32% had used any mental health services since the disaster, including 46% of those with serious disorders. Of those who used services, 60% had stopped using them. The general medical sector and pharmacotherapy were most commonly used, although the mental health specialty sector and psychotherapy played important roles, especially for respondents with serious disorders. Many treatments were of low intensity and frequency. Undertreatment was greatest among respondents who were younger, older, never married, members of racial or ethnic minority groups, uninsured, and of moderate means. Structural, financial, and attitudinal barriers were frequent reasons for not obtaining care. Few Katrina survivors with mental disorders received adequate care; future disaster responses will require timely provision of services to address the barriers faced by survivors.

## Risk Management

**Ayyub, Bilal M., William L. McGill, and Mark Kaminsky. 2007. Critical asset and portfolio risk analysis: An all-hazards framework. *Risk Analysis* 27(4): 789-801.**

This article develops a quantitative all-hazards framework for critical asset and portfolio risk analysis (CAPRA) that considers both natural and human-caused hazards. Following a discussion on the nature of security threats, the need for actionable risk assessments, and the distinction between asset and portfolio-level analysis, a general formula for all-hazards risk analysis is obtained that resembles the traditional model based on the notional product of

consequence, vulnerability, and threat, though with clear meanings assigned to each parameter. Furthermore, a simple portfolio consequence model is presented that yields first-order estimates of interdependency effects following a successful attack on an asset. Moreover, depending on the needs of the decisions being made and available analytical resources, values for the parameters in this model can be obtained at a high level or through detailed systems analysis. Several illustrative examples of the CAPRA methodology are provided.

**Birkmann, Joern. 2007. Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications. *Environmental Hazards* 7(1): 20-31.**

This paper outlines selected approaches to measuring risk and vulnerability to hazards of natural origin using indicators and indices. It discusses their applicability, usefulness, and policy implications. Indicators and indices have been developed on different scales and for different purposes. The paper will briefly introduce three global approaches to disaster-risk identification and will juxtapose them with one local approach in order to examine the differences concerning the functions and the purpose of the assessment as well as their impact for policy development. In contrast to an earlier comparative analysis of the three global disaster-risk indicator programs by Mark Pelling in 2004, which focused primarily on the methodologies used, this paper places more emphasis on aspects of applicability and policy implications and outlines challenges and limitations of the different approaches. Since the assessment and mapping of human vulnerability is less developed than hazard assessment work, this paper focuses in greater depth on how the approaches capture vulnerability. Conclusions will be formulated on how to further enhance vulnerability identification, particularly at the sub-national level.

**Briggs, David, and Richard Stern. 2007. Risk response to environmental hazards to health: Towards an ecological approach. *Journal of Risk Research* 10(5): 593-622.**

Response to risks can be seen as an ecological process, involving a community of actors whose perceptions and actions play off each other, and whose responses help to determine the way in which risk events play out. Risk governance thus needs to take account of how the many different stakeholders caught up in the event respond to the perceived risks. The NATO-MoD funded MERREA project was aimed at exploring these processes of risk response through a series of case studies, as a basis for developing more effective risk governance strategies. This paper describes the study and summarizes results from a cross-cutting analysis of the case studies. It highlights five key issues: the inadequate identification and characterization of stakeholders that occurs in many risk situations; the importance of given and self-adopted roles in determining stakeholders' understanding and expectations of risk; the importance of recognizing both formal and informal channels of risk communication in any risk situation, requiring the establishment of effective and open channels of communication well in advance of any event; the need to

recognize, admit, and communicate uncertainty in risk situations if trust is to be maintained; and the importance of establishing lead organizations for risk governance who carry the trust of all the stakeholders concerned.

**Burnside, Randolph, DeMond Shondell Miller, and Jason D. Rivera. 2007. The impact of information and risk perception on the hurricane evacuation decision-making of greater New Orleans residents. *Sociological Spectrum* 27(6): 727-740.**

This article contributes to the current discussion on how residents living in vulnerable areas make the decision to evacuate when they are in harms way. Key in this discussion is the question, what role does information and risk play in shaping evacuation behavior? This study used a sample of respondents from the greater New Orleans region (Orleans, Jefferson, and St. Bernard Parishes) of the Twelve Parish Survey (N = 1,207) conducted prior to Hurricane Katrina. The findings indicate that information sources are vitally important in the evacuation process. By examining the role of information from authorities, family, and friends; visual imagery; and the media, the authors found that individuals use a variety of sources when they decide to evacuate. Further, the importance of visual imagery in the evacuation process is discussed. The article concludes with a discussion of the implications of information dissemination and its importance to members of the media and public policy makers.

**Cardenas, Victor, Stefan Hochrainer, Reinhard Mechler, Georg Pflug, and Joanne Linnerooth-Bayer. 2007. Sovereign financial disaster risk management: The case of Mexico. *Environmental Hazards* 7(1): 40-53.**

In 2006, Mexico became the first transition country to transfer part of its public-sector natural catastrophe risk to the international reinsurance and capital markets. The Mexican case is of considerable interest to highly exposed transition and developing countries, many of which are considering similar transactions. Risk financing instruments can assure governments of sufficient post-disaster capital to provide emergency response, disaster relief to the affected population, and repair public infrastructure. The costs of financial instruments, however, can greatly exceed expected losses, and for this reason it is important to closely examine their benefits and alternatives. This paper analyzes the Mexican case from the perspective of the risk cedent (the Ministry of Finance and Public Credit), which was informed by analyses provided by the International Institute for Applied Systems Analysis (IIASA). The rationale for a government to insure its contingent liabilities is presented along with the fiscal, legal, and institutional context of the Mexican transaction. Using publicly available data, the paper scrutinizes the choice the authorities faced between two different risk-transfer instruments: reinsurance and a catastrophe bond. Making use of IIASA's catastrophe simulation model (CATSIM), this financial risk management decision is analyzed within the context of a public investment decision.



**Corotis, Ross B. 2007. An overview, history and context for the consideration of risk in the built environment.**

*International Journal of Risk Assessment and Management* 7(6/7): 759-772.

Especially since the terrorist attacks in the USA in 2001, the public has become much more enlightened regarding the trade-off of risk and security among choices of investment in communities. This introductory paper suggests that this is an important time to share the broader, comparative issues of structural safety with respect to risk assessment and management in the built environment (i.e., the civil constructions that constitute the physical structures and infrastructure of communities). The particular aim is to share with the larger risk community the significant context of current risk views that are the culmination of research that began about 50 years ago on the safety of individual structures and infrastructure systems.

**deBoer, J. 2007. Framing climate change and spatial planning: How risk communication can be improved.** *Weather Science and Technology* 56(4): 71-78.

Taking the role of frames into account may significantly add to the tools that have been developed for communication and learning on complex risks and benefits. As part of a larger multidisciplinary study into climate-related forms of sensemaking this paper explores which frames are used by the citizens of Western European countries and, in particular, the Netherlands. Three recent multi-national public opinion surveys were analyzed to examine beliefs about climate change in the context of beliefs about energy technology and concerns about other environmental issues, such as natural disasters. It appeared that many citizens had only vague ideas about the energy situation and that these do not constitute an unequivocal frame for climate issues. In contrast, the results suggest that the long-lasting rainfall and severe floods in Central Europe have had a significant impact. Climate change was often framed in a way that articulates its associations with rain- and river-based problems. This result is important for risk communication because, especially in the Netherlands with its vulnerable coastal zones, climate change may produce many more consequences than rain- and river-based problems only.

**Eiser, J. Richard, Tom Stafford, John Henneberry, and Philip Catney. 2007. Risk perception and trust in the context of urban brownfields.** *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 150-156.

Data is reported from a postal questionnaire completed by 747 residents of two urban local authority areas within which there were sites of brownfield land with significant levels of contamination. Respondents rated their perceptions of the extent to which their neighborhood and own homes were relatively vulnerable to contamination, their concern about possible effects of contamination, their satisfaction with their council in terms of consultation with residents on housing and development issues, and their trust in their council with respect to contaminated land risks. Satisfaction with, and trust in, the council was generally low in both

areas, and especially so among those who perceived themselves to be more vulnerable to contamination. Nonetheless, dissatisfaction was less marked in the area where the local authority, according to background information, had pursued a more open and proactive style of risk communication and consultation with residents. The main predictors of trust, across both areas, were perceptions that the council was openly prepared to tell residents what they knew, and that the council had residents' interests at heart. Implications are discussed for the impact of different modes of risk communication on trust.

**Etienne, Julien. 2007. Reorganizing public oversight of high-risk industries in France: A reliability analysis of permitting.** *Journal of Contingencies and Crisis Management* 15(3): 143-156.

In the aftermath of the AZF accident which occurred in Toulouse, France on September 21, 2001, several initiatives have been taken to reform French industrial risk policy. The reorganization of control agencies has been a crucial aspect of these efforts. In this paper, the author produces a reliability diagnosis regarding the delivery of operating permits by these agencies, in order to answer the following question: Did the reorganization improve or undermine the reliability of the agencies' decisions? Based on Larry Heimann's analytical framework, the empirical analysis combines counterfactuals and interviews, and transfers causal arguments from post-accident studies to normal operational agencies. This method yields interesting insights regarding the reliability gains and losses that could ensue from the various organizational transformations that the agencies experienced. Mostly, it emphasizes why some aspects of the reform are likely to have consequences contrary to those that were anticipated by policymakers. Beyond the French case, the analysis also sheds new light on the advantages and drawbacks of using third party reviewers for the public control of risk-laden private activities.

**Ewert, John W. 2007. System for ranking relative threats of U.S. volcanoes.** *Natural Hazards Review* 8(4): 112-124.

A methodology to systematically rank volcanic threat was developed as the basis for prioritizing volcanoes for long-term hazards evaluations, monitoring, and mitigation activities. A ranking of 169 volcanoes in the United States and the Commonwealth of the Northern Mariana Islands is presented based on scores assigned for various hazard and exposure factors. Fifteen factors define the hazard: volcano type; maximum known eruptive explosivity; magnitude of recent explosivity within the past 500 and 5,000 years; average eruption-recurrence interval, presence or potential for a suite of hazardous phenomena (pyroclastic flows, lahars, lava flows, tsunami, flank collapse, hydrothermal explosion, primary lahar); and deformation, seismic, or degassing unrest. Nine factors define exposure: a measure of ground-based human population in hazard zones; past fatalities and evacuations; a measure of airport exposure; a measure of human population on aircraft; the presence of power, transportation, and developed infrastructure; and

whether or not the volcano forms a significant part of a populated island. The hazard score and exposure score for each volcano are multiplied to give its overall threat score. Once scored, the ordered list of volcanoes is divided into five overall threat categories from very high to very low.

**Faulkner, H., and D. Ball. 2007. Environmental hazards and risk communication. *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 72-78.**

**Ibarra, Hector, and Jerry Skees. 2007. Innovation in risk transfer for natural hazards impacting agriculture. *Environmental Hazards* 7(1): 62-69.**

Agricultural income from growing crops is susceptible to a variety of risks—the price of output and the actual amount of output are generally the largest risk variables. This article focuses on yield risk rather than price risk by reviewing innovation in risk transfer for natural hazard risk in agriculture. While many higher-income countries have long-standing crop insurance programs, these programs are not appropriate for lower-income countries. Lower-income countries can ill-afford the subsidies that are used in most multiple peril crop insurance programs throughout the world. Still, lower-income countries have large numbers of small farms increasing the need for agricultural insurance to protect against common problems that create disastrous losses for many individual farm households.

**Kemp, Roger L. 2007. Assessing the vulnerability of buildings. *Disaster Prevention and Management* 16(4): 611-618.**

The purpose of this paper is to set forth a rigorous methodology for building owners and managers to conduct a vulnerability assessment of their facilities. Such a process would facilitate the use of remediation measures to limit the loss of life and property during a disaster, whether natural or man-made. The author sets forth nine criteria to conduct a vulnerability assessment, along with a six-point rating system. The criteria selected are: the level of visibility, the criticality of the site to the jurisdiction in which it is located, the impact of the site outside of the jurisdiction in which it is located, access to the site, size hazards, building height, type of construction, site population capacity, and the potential for collateral mass casualties. This evaluative process leads to five site vulnerability ratings, ranked as follows: negligible, low, medium, high, and critical. Property owners and building managers can use this process to assess the vulnerability of their facilities and, based on this process and the resulting vulnerability rating, initiate common-sense remediation measures to limit the loss of life and property, should a disaster occur.

**Lind, Niels. 2007. Turning life into life expectancy: the efficiency of life-saving interventions. *International Journal of Risk Assessment and Management* 7(6/7): 884-894.**

A life-saving intervention, if truly it is to save lives, should yield more life expectancy in good health than the amount of work time it takes to pay for it. Together with available cost-effectiveness data, this 'Time Principle' permits a separation

of the efficient from the inefficient options among all life-saving interventions. The majority of known options for intervention are efficient according to the Time Principle.

**Maes, Marc A., and Michael H. Faber. 2007. Preferences, utility and risk perception in engineering decision making. *International Journal of Risk Assessment and Management* 7(6/7): 813-827.**

The present paper focuses on the role and the modeling of preferences in risk-based decision making for engineering systems, with special emphasis on the dislike of severe consequences. This involves the use of appropriate utility models and a proper understanding of the many aspects of risk perception. The basic premise of this paper is that the risk aversion intrinsic to nonlinear utility functions can almost always be explained by the non-inclusion of indirect and 'follow-up' consequences. Several aspects of risk perception and preference ranking can be interpreted as the result of the decision maker's voluntary or involuntary unwillingness to account for consequences that are triggered by extreme losses, such as excessive business losses, loss of reputation, or other indirect or so-called intangible losses.

**Miles, Brian, and Stephanie Morse. 2007. The role of news media in natural disaster risk and recovery. *Ecological Economics* 63(2-3): 365-373.**

This paper explores the news media's role in constructing public perceptions of risk associated with natural hazards. Hurricanes Katrina and Rita provide a useful case study for exploring the social construction of risk that results from media coverage of natural disasters. The four capital types, natural, human, social, and built, will be used as a frame of reference from which to evaluate media texts. This paper shows that natural capital received relatively less attention in the media coverage of these recent disasters. The paper's authors apply the elaboration likelihood model (ELM) to argue that future perceptions of risk due to natural hazards will reflect the attention paid to each capital in media coverage.

**Nilsen, Aud Solveig, and Odd Einar Olsen. 2007. Resistance or acceptance? Mitigation strategies in risk management. *Risk Management* 8(4): 255-270.**

The tasks of a supervisory authority (SA) are to guide and inspect municipalities in mitigation and risk and emergency management. Two municipalities that have shown different responses to the work of SA are compared. Klepp municipality resisted inspections by SA and created its own solution to risk management. Time municipality regarded governmental guidelines as a facilitator to their work and accepted inspections. Despite its negative attitude, Klepp contributed to a mutual learning process between the municipality and the SA by introducing a new strategy and tool (mini risk analysis, MRA) in risk management. MRA is a tool which may lay the foundations for empowerment and involvement in local risk management. It is specially designed for municipal contexts, focusing on daily risks in working processes. Time, on the other hand, passively accepted SA inspections and did not actively contribute to the learning process.

**Paterson, John. 2007. Sustainable development, sustainable decisions and the precautionary principle. *Natural Hazards* 42(3): 515-528.**

One of the key foundations of sustainable development is the precautionary principle, a concept that has given rise to a considerable amount of controversy. For some, it is a barrier to technological progress and development, for others a means of preventing potentially harmful applications of science. What does this principle actually mean? What is its contribution to sustainable development in general and to decision making in response to natural hazards in particular? How should it be applied? This paper will consider whether an examination of the relationship between science and law can assist in answering questions such as these, and thus provide some greater clarity about this important principle.

**Rackwitz, Rudiger. 2007. Recent developments in risk acceptability for technical facilities. *International Journal of Risk Assessment and Management* 7(6/7): 922-944.**

Recent developments in risk acceptance for technical facilities exposed to man-made and natural hazards are reviewed and discussed. Present value lifetime utilities involving the utility from consumption, discounting, and survival probabilities by predictive cohort life tables are derived. Suitable parameters for the utility function are based on the so-called work-leisure optimization principle. Intergenerationally acceptable, time-dependent discount rates are proposed. A risk acceptability criterion involving the increments in costs to reduce risks, the associated reductions in the failure rate, and a constant defining of the societal value of a statistical life and the corresponding willingness-to-pay is given. These values are computed for a number of countries for two mortality reduction schemes. An example illustrates the results.

**Rayner, Steve. 2007. The rise of risk and the decline of politics. *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 165-172.**

This paper argues that the rise of risk and formal risk assessment has contributed to the demise of representative democratic politics by displacing public discourses about values with technical justifications for decision making. Furthermore, risk plays a central role in the displacement of governmental responsibility to private sector and NGO actors at the same time as facilitating government control over citizens—the Janus faces of governance and governmentality. Arguing that the turn to public participation cannot be the panacea for the present situation, the paper concludes by calling for revitalization of representative institutions, the development of real-time technology assessment, and development of popular connoisseurship of science and technology.

**Roberts, Patrick. 2007. Toward a national hazards risk assessment. *Journal of Homeland Security and Emergency Management* 4(3).**

The Department of Homeland Security (DHS) uses a particular kind of vulnerability approach to allocate many of

its disaster preparedness resources but it should allocate a greater number of resources using a risk-based approach in order to reduce future disaster losses. A true risk-based strategy of resource allocation demands the development of a national risk assessment that is too expensive, wide-ranging, and technically complex for states and localities to develop on their own. A risk-based approach would allocate more money toward more frequent but less catastrophic or visible disasters that, over time, may cost more than low probability, high consequence disasters. This paper explores the virtues and vices of both vulnerability and risk-based planning approaches, examines recent efforts in the DHS to plan for catastrophes, and analyzes the challenges in developing a national risk assessment.

**Sjoberg, Lennart. 2007. Emotions and risk perception. *Risk Management* 84: 223-237.**

The role of emotions in risk perception has been held to be important, based mainly on findings in applications of the Psychometric Model and the notion of an "affect heuristic". These conclusions are criticized because the work on "dread" in the tradition of the Psychometric Model has been based mainly on items measuring severity of consequences. Only one emotion item was included. Furthermore, "affect" is a word denoting emotions but in the concrete applications to the "affect heuristic" studies have been made not of emotions, but of attitudes and evaluations. In the present paper, actual data on emotions are investigated and it is found that emotions do indeed play an important role in risk perception and related attitudes. In one study, it was found that interest in a hazard (a positive emotion) was positively correlated with perceived risk. Interest was an important explanatory factor in models of demand for risk mitigation. Much recent work on emotions and attitudes suggests a three-step process, where initial cognitive processing gives rise to emotions, which in turn guide the further, more elaborate, cognitive processing. The notion of the primacy of a primitive initial emotional reaction governing belief contents is rejected. Risk communication based on such a simplistic neurophysiological model is likely to fail.

**Warner, Koko, Laurens M. Bouwer, and Walter Ammann. 2007. Financial services and disaster risk finance: Examples from the community level. *Environmental Hazards* 7(1): 32-39.**

Increased attention has recently been given to the possible role of financial services in the management of natural disaster risk. Local communities have been at the forefront of developing innovative disaster risk finance strategies and implementing risk-oriented incentive programs. In view of increasing risks, including the impacts of climate change, such programs will become more important. This paper examines four models and some recent experiences in using financial services at the community level. The paper offers an overview of advantages and limitations of each model to manage disaster risk in communities. Examples include a federal government initiated scheme of social protection funds, a local government risk reduction scheme, an insurance product provided by a non-governmental organization, and a micro-insurance scheme. Finally, the

paper offers some directions about specific ways that the public and private sectors, in collaboration with other partners, can improve finance alternatives for disaster management at the community level. It appears that a range of follow-up studies and further dialogue is needed, in order to expand the knowledge on what types of risk finance models can help manage and reduce the financial impacts of natural disasters.

**Wenzel, Friedmann, Fouad Bendimerad, and Ravi Sinha. 2007. Megacities - megarisks. *Natural Hazards* 42(3): 481-491.**

This article reviews the definitions, population trends, and characteristics of megacities. Characteristics of megacities are, apart from their size, their complexity in terms of administration, infrastructure, traffic, etc., and at the same time the speed of change. Vulnerabilities and risk potential are discussed using the examples of Mexico City and Mumbai. It presents the experience accumulated in the 6 years work of the Earthquakes and Megacities Initiative with more than 20 large cities around the world, mostly located in the developing world. On this background we analyze obstacles that keep megacities from developing an efficient approach towards disaster mitigation and define a strategy that might overcome these problems. The key element of this strategy is the development of a Disaster Risk Management Master Plan (DRMMP) for cities. Currently the Istanbul Earthquake Master Plan (IEMP) serves as best example for an appropriate strategy for disaster reduction in megacities.

## Technological Hazards

**Al-Damkhi, Ali Mohamed. 2007. Planning to rescue Kuwait's oil wells: An environmental issue. *Disaster Prevention and Management* 16(4): 513-521.**

This paper addresses the underestimation of Kuwait's oil disaster. The conflagration in Kuwait demonstrated the danger in conducting large-scale modern combat in an environmentally fragile area, and shows how exposed all oil-producing nations are to this type of environmental and economic disaster in the future. The paper seeks to review the reasons for which Saddam Hussein's regime intended to destroy and eliminate Kuwait's entire oil infrastructure before and after the Iraqi invasion of Kuwait. The underestimation of oil wells that would be torched by Iraqi forces is also discussed in this paper. To approach the scope of this paper, the intentions and the practical evidence of such sabotage are pointed out. Efforts to rescue Kuwait's oil wells in addition to planning for the expected catastrophe are highlighted. The plausible reasons that made such underestimation unclear are elaborated. The instructions included in the Iraqi documents showed undoubtedly that the sabotage operation was not a random last-minute attempt to destroy the oil wells, but it was a carefully supervised and well-planned endeavor to completely destroy Kuwait's oil infrastructure. Owing to those efforts and planning, more than 100 oil wells were rescued throughout Kuwait. Thanks to such underestimation Kuwait suffered severe losses both to its oil industry and to its

ecological system. Since the reasons for the lower estimates of oil wells, torched by Iraqi troops, to a maximum of 100-150 wells were unclear, this paper attributes Kuwait's economic losses and environmental degradation to such underestimation and suggests more investigations on this issue. Kuwait's catastrophe brought the attention to environmental concerns that should receive immediate consideration, while the scorched-earth tactic applied in Kuwait and the resulting environmental disaster led to a positive reaction by the international community and spawned a new environmental treaty at the regional level.

**Coleman, Les, and Ira Helsloot. 2007. On the need for quantifying corporate crises and other man-made disasters. *Journal of Contingencies and Crisis Management* 15(3): 119-122.**

**Colton, David P., Thane J. Hendricks, and Steven R. Riedhauser. 2007. Aerial radiological systems, measurements and analysis. *International Journal of Emergency Management* 4(3): 356-375.**

This document describes data collection systems and procedures used by the U.S. Department of Energy Aerial Measuring System (AMS) in response to a radiological emergency. The discussion is split into two parts: (1) those systems used on the fixed-wing aircraft and (2) those systems used on the helicopters. This split is principally caused by the final use of the data from each system. The fixed-wing system is designed to produce data for areas of high radioactivity (areas where the natural background radiation can be ignored). The helicopter systems are used for radiation measurements closer to the natural background levels.

**De Cort, Marc. 2007. Monitoring radioactivity in nuclear and radiological emergency in a European perspective: Aims and means. *International Journal of Emergency Management* 4(3): 319-338.**

After the Chernobyl nuclear power plant accident, European countries have further enhanced their capacity and infrastructure for monitoring radioactivity in their environment. This paper gives a summary of the most commonly used techniques relevant to routine and nuclear and/or radiological emergency conditions, followed by a discussion of the various network types (routine, emergency preparedness, mobile monitoring) and some suggestions on how homogeneity of the monitoring information can be improved.

**De Cort, Marc, Gerhard de Vries, and Stefano Galmarini. 2007. European Commission international data and information exchange systems to assist EU Member States in case of radiological and nuclear emergencies. *International Journal of Emergency Management* 4(3): 442-454.**

Shortly after the Chernobyl nuclear power plant accident the European Commission (EC) initiated various activities in order to make early notification and reliable radiological information available to the European Union (EU) Member States in case of nuclear accidents. The Radioactivity

Environmental Monitoring (REM) group at the Institute for Environment and Sustainability (IES) of the Joint Research Centre (JRC) in Ispra, Italy, is responsible for the scientific and technical development of three closely related projects that should be a valuable source of information for decision support in Europe during major radiological accidents (i.e.: the European Community Urgent Radiological Information Exchange (ECURIE), the European Radiological Data Exchange Platform (EURDEP), and ENSEMBLE). Starting from the legal background, we describe these information systems in detail with an emphasis on the current status, the gained experience, and the planned future developments.

**Dubois, Gregoire, Edzar J. Pebesma, and Peter Bossew. 2007. Automatic mapping in emergency: A geostatistical perspective. *International Journal of Emergency Management* 4(3): 455-467.**

In the case of a severe nuclear accident, radionuclides may be released into the atmosphere and contaminate large areas. Radiological maps are obtained after converting local measurements into continuous information in space. Ideally, the mapping process should be fully automatic and provide information in real time. This paper is presenting the results obtained from two statistical exercises that addressed the issue of automating the spatial interpolation step both in routine and emergency situations. The first exercise addressed mainly the current state-of-the-art of spatial interpolation and explored the impact of human factors on the results obtained. The second exercise was dealing specifically with the automation issue. To further address the response of these mapping algorithms in emergency situations, simulated data have also been used to explore the impact of extreme values on the process. It is shown that, independently of the choice of algorithms, many obstacles still remain before we can rely on fully automatic mapping systems in emergency situations, especially during the early and critical stages of an accident when measurements on the contamination are sparse.

**Eleveld, Harry, Yvo S. Kok, and Chris J. W. Twenhofel. 2007. Data assimilation, sensitivity and uncertainty analyses in the Dutch nuclear emergency management system: A pilot study. *International Journal of Emergency Management* 4(3): 551-563.**

To investigate the possibilities to improve the Dutch nuclear emergency management system, a pilot study was carried out on a data assimilation method for our atmospheric dispersion model. By means of the data assimilation method, the prediction of potentially contaminated areas in the early and late phases of a nuclear accident can significantly be improved. In the early phase, results of the radiological monitoring network are still sparse and the method focuses on a generic improvement of the model forecast by optimization of a limited number of input parameters. Prior to the study on data assimilation, sensitivity and uncertainty analysis were performed to identify the most important parameters. For this pilot study, only two parameters were fitted to demonstrate the working of our data assimilation

technique. The technique was successfully applied to an inconsistent part of a famous data set giving a reasonable agreement between the observed and modeled results.

**French, Simon, Emma Carter, and Carmen Niculae. 2007. Decision support in nuclear and radiological emergency situations: Are we too focused on models and technology? *International Journal of Emergency Management* 4(3): 421-441.**

The last 20 years has seen enormous advances in mathematical modeling and computing techniques. In the aftermath of the Chernobyl accident, many of these have been incorporated in Decision Support Systems (DSS) to aid nuclear emergency management. This paper reviews what has been achieved, but it also reflects on how the tools fit into emergency management processes and discusses whether too much emphasis is being placed on the technological aspects of what is a complex, socio-technical issue.

**Hardeman, Frank, Carlos Rojas-Palma, Alain Sohier, Klaas van der Meer, and Khadija Bendman. 2007. Monitoring in case of emergency situations related to orphaned sources. *International Journal of Emergency Management* 4(3): 376-393.**

Orphaned sources may cause serious accidents as history has shown and in the past few years, attention for malevolent use of radioactivity has grown considerably. Firstly, this paper describes the context of the problem. We propose to introduce a scheme for the prevention of loss or abuse of sources. This program includes administrative measures for strong sources, controlling mechanisms, and aspects of waste management. Secondly, we address basic requirements as regards monitoring given lost or stolen sources or if a contamination of unknown origin is identified. This paper pleads for well-trained emergency staff, for the presence of advanced equipments and expertise at national or regional level, and for international collaboration where necessary. The main steps in an adequate response scheme are discussed and illustrated and the aftermath of the crisis (clean-up actions) is also discussed. Finally, we stress the importance of measurements in a context of information and openness.

**Lahtinen, Juhani, Harri Toivonen, and Riitta Hanninen. 2007. Effective use of radiation monitoring data and dispersion calculations in an emergency. *International Journal of Emergency Management* 4(3): 468-480.**

An essential prerequisite for the proper management of a radiation emergency is that measurement data and calculation prognoses are available and that they are produced in an efficient manner. This paper reviews some of the factors contributing to the practice of performing radiation measurements and atmospheric-dispersion-model calculations effectively and discusses the issues related to the uncertainties and interpretation of results. It stresses the importance of various advance analyses and prepared strategies and recommends a database architecture for the management of dispersion-model calculation results.

Nasstrom, John S., Gayle Sugiyama, Ronald L. Baskett, Shawn C. Larsen, and Michael M. Bradley. 2007. **The National Atmospheric Release Advisory Center modeling and decision-support system for radiological and nuclear emergency preparedness and response.** *International Journal of Emergency Management* 4(3):524-550.

This paper describes the tools and services provided by a national center for modeling the environmental and health impacts of airborne hazardous materials. This center can provide emergency decision support information within minutes for a wide range of radiological, nuclear, chemical, and biological hazards from fires, industrial and transportation accidents, radiation dispersal device explosions, hazardous material spills, nuclear power plant accidents, and nuclear detonations. Web- and Internet-based software provide quick access to advanced modeling tools, as well as expert analyses from the center. Model predictions include the 3D spatial and time-varying effects of weather, land use, and terrain, on scales from the local to regional to global. Tools provide displays of plume predictions with affected population counts, detailed maps, and reports describing model assumptions, contamination, and dose levels. On-scene information and measurements are used to refine model predictions.

Riland, Carson A. 2007. **Instrument selection and use for measurements in a radiological emergency.** *International Journal of Emergency Management* 4(3): 394-407.

A discussion of monitoring during a radiological emergency response is presented. This paper focuses on a response for the United States, but many principles would also apply for other countries. It starts with a discussion on instrument selection and preparation. Different scenarios based on materials involved and responder levels are presented with equipment concerns for each. This paper discusses field monitoring for both environmental concerns and public screening. It ends with a brief summary of respondent health and safety issues.

Savkin, Mikhail N., and Sergey M. Shinkarev. 2007.

**Prospective use of individual emergency monitoring of the public – lessons from Chernobyl.** *International Journal of Emergency Management* 4(3): 408-420.

Experience in individual dosimetric and radiometric surveys of the public during the early phase of the Chernobyl accident has been considered. Delay in implementation of individual measurements was the reason why such results were not used in emergency management. Analysis of the estimates of thyroid doses based on the results of individual monitoring showed that 30–50% of small children residing in areas adjacent to the Chernobyl Nuclear Power Plant (ChNPP) received doses higher than the upper guide value (2.5 Gy), which was for urgent protective actions. General principles of individual monitoring of the public, namely, voluntariness, representativeness, and specificity, have been considered for screening, complex research, and special research in Emergency Monitoring (EM) programs. In addition, procedures and techniques of rapid monitoring of

public under dispersing plutonium due to explosion have been recommended.

Solana-Ortega, Alberto, and Vicente Solana. 2007. **What comes after the *Prestige* disaster? An entropic approach to modeling the recurrence of major oil tanker spills in Galicia.** *Risk Analysis* 27(4): 901-920.

A methodology is presented to investigate the recurrence of extraordinary events. The approach is fully general and complies with a canon of inference establishing a set of basic rationality requirements scientific reasoning should satisfy. In particular, the authors apply it to model the interarrival time between disastrous oil spills on the Galician coast in the northwest of Spain, one of the greatest risk areas in the world, as confirmed by the *Prestige* accident of November 2002. They formulate the problem within the logical probability framework, using plausible logic languages with observations to allow the appropriate expression of evidences. Therein, inference is regarded as the joint selection of a pair of reference and inferred probability distributions, which better encode the knowledge about potential times between incidents provided by the available evidences and other higher-order information at hand. To solve it, we employ the REF relative entropy method with fractile constraints. Next, the authors analyze the variability of the joint entropic solution, as knowledge that a time has elapsed since the last recorded spill is added, by conditioning the evidences. Attention is paid to the variability of two representative parameters: the average reference recurrence time and an inferred characteristic probability fractile for the time to an event. In contrast with classical results, the salient consequence is their nonconstancy with the elapsed time and the appearance of a variability pattern indicating an observational memory, even under the assumption of one-parameter exponential models, traditionally regarded as memoryless. Tanker accidentality is therefore dynamic, changing as time goes on with no further accidents. Generality of the methodology entails that identical conclusions would apply to hazard modeling of any other kind of extraordinary phenomena. This should be considered in risk assessment and management.

Wilber, Debbie, Donald Daigler, Erik C. Nielsen, Steven R. Riedhauser, Arthur Shanks, Roger C. Thompson, and John S. Nasstrom. 2007. **Nuclear/radiological emergency response in the USA.** *International Journal of Emergency Management* 4(3): 339-355.

The U.S. Consequence Management (CM) response element uses specific methodologies for dealing with the release of nuclear/radioactive material into the environment and has identified the potential impacts to the public and the environment. This paper will describe the history of how CM evolved, an overview of the current methods and response structure, and include technical sections describing the federal response following a nuclear/radiological incident.

**Wolf, Frederick, and Paul Sampson. 2007. Evidence of an interaction involving complexity and coupling as predicted by normal accident theory. *Journal of Contingencies and Crisis Management* 15(3): 123-133.**

This paper describes a test of the principle hypothesis of Normal Accident Theory. It posits and tests for the existence of an interaction involving interactive complexity and coupling associated with in an important class of manufacturing organizations. Ninety four (n=94) petroleum refineries located in the United States during the five-year period 1993–97 were examined. The dependent variable in this test was the ratio of Reportable Quantity accidental hazardous chemical releases per unit of production. Refinery capacity and age were included as control variables. This study identified a statistically significant interaction involving interactive complexity and coupling, as predicted by Normal Accident Theory. The interaction appears to be consistent with an important core hypothesis of normal accident theory over a significant portion of its domain. The nature of this interaction and its potential relevance to organizational sense making is discussed. Additional opportunities for quantitative research involving Normal Accident Theory are identified.

**Yatsalo, Boris I. 2007. Decision support system for risk-based land management and rehabilitation of radioactively contaminated territories: PRANA approach. *International Journal of Emergency Management* 4(3): 504-523.**

Description of the approaches to a decision support system on Risk Based Land Management (RBLM) and rehabilitation of radioactively contaminated territories on the basis of integrating monitoring data, Geographic Information Systems (GIS), models, and decision support tools is presented in this paper. The key blocks of the PRANA DSS, developed for scientific and practical needs for model assessments and decision making support within the rehabilitation of radioactively contaminated territories of Bryansk region (Russia) after the Chernobyl accident are described. Examples of PRANA implementation for applied assessments are considered.

**Zahringer, Matthias, and Erich Wirth. 2007. The interaction between off-site decision making, decision support systems, modeling and monitoring in a nuclear emergency situation. *International Journal of Emergency Management* 4(3): 564-572.**

The interaction and inter-dependence among decision making, decision support systems (DSS), and measurements in a radiological emergency situation is discussed. Data and DSS products of importance are identified in different phases of an accident. Planning of decision making must focus on comprehensible and clear concepts. In the early phase, clear and unambiguous model prognoses are needed for fast decision making. However, the input data are highly uncertain and disputable. During cloud passage the options for decision making are limited. After cloud passage, decision making and monitoring are highly interactive and the efficacy of countermeasures requires that both DSS and measurement programs be well tailored. Data must be

representative and of sufficient number where decisions refer to Derived Emergency Reference Levels (DERL for food and feed). In the late phase, the DSS should enable decision makers to balance cost, environmental impact, averted dose and adverse psychological effects.

## Tsunamis

**Aitkenhead, Matthew J., Parivash Lumsdon, and David R. Miller. 2007. Remote sensing-based neural network mapping of tsunami damage in Aceh, Indonesia. *Disasters* 31(3): 217-226.**

In addition to the loss of human life, the tsunami event of December 26, 2004 caused extensive damage to coastal areas. The scale of the disaster was such that remote sensing may be the only way to determine its effects on the landscape. This paper presents the results of a neural network-based mapping of part of the region of Aceh, Sumatra. Before-and-after satellite imagery, combined with a novel neural network methodology, enabled a characterization of landscape change. The neural network technique used a threshold of acceptance for identification, in combination with a bootstrapped identification method for identifying problem pixels. Map analysis allowed identification of urban areas that were inaccessible by road, and which aid agencies could therefore only reach by air or sea. The methods used provide a rapid and effective mapping ability and would be a useful tool for aid agencies, insurance underwriters, and environmental monitoring.

**Farreras, Salvador, Modesto Ortiz, and Juan I. Gonzalez. 2007. Steps towards the implementation of a tsunami detection, warning, mitigation and preparedness program for southwestern coastal areas of Mexico. *Pure and Applied Geophysics* 164(2-3): 605-616.**

The highly vulnerable Pacific southwest coast of Mexico has been repeatedly affected by local, regional, and remote source tsunamis. Mexico presently has no national tsunami warning system in operation. The implementation of key elements of a national program on tsunami detection, monitoring, warning, and mitigation is in progress. For local and regional events detection and monitoring, a prototype of a robust and low-cost, high-frequency sea-level tsunami gauge, sampling every minute and equipped with 24-hour real-time transmission to the Internet, was developed and is currently in operation. Statistics allow identification of low, medium, and extreme hazard categories of arriving tsunamis. These categories are used as prototypes for computer simulations of coastal flooding. A finite-difference numerical model with linear wave theory for deep ocean propagation and a shallow water nonlinear one for the near shore and interaction with the coast, and non-fixed boundaries for flooding and recession at the coast, are used. For prevention purposes, tsunami inundation maps for several coastal communities are being produced in this way. The case of the heavily industrialized port of Lázaro Cárdenas, located on the sand shoals of a river delta, is illustrated, including a detailed vulnerability assessment

study. For public education on preparedness and awareness, printed material for children and adults has been developed and published. It is intended to extend future coverage of this program to the Mexican Caribbean and Gulf of Mexico coastal areas.

**Mak, Sum, and Lung-Sang Chan. 2007. Historical tsunamis in South China. *Natural Hazards* 43(1): 147-164.**

An accurate assessment of tsunami risk of a region requires a credible record of past tsunami events in the region. Existing surveys on historical tsunamis in South China have not presented a consistent list of events. The current report makes reference to original historical literature and evaluates the validity of suspected tsunami events in published surveys. A set of refined historical data for further investigation of the tsunami hazard in the region was produced. Only two events have been identified as credible reports of tsunami in the current study. Some events previously considered as tsunami, including a few with a high number of reported casualties, were unable to be substantiated.

**Orfanogiannaki, K., and G. A. Papadopoulos. 2007. Conditional probability approach of the assessment of tsunami potential: Application in three tsunamigenic regions of the Pacific Ocean. *Pure and Applied Geophysics* 164(2-3): 593-603.**

The authors develop stochastic approaches to determine the potential for tsunami generation from earthquakes by combining two interrelated time series, one for the earthquake events and another for the tsunami events. Conditional probabilities for the occurrence of tsunamis as a function of time are calculated by assuming that the inter-arrival times of the past events are lognormally distributed and by taking into account the time of occurrence of the last event in the time series. An alternative approach is based on the total probability theorem. Then, the probability for the tsunami occurrence equals the product of the ratio,  $r$  (= tsunami generating earthquakes/total number of earthquakes), by the conditional probability for the occurrence of the next earthquake in the zone. The probabilities obtained by the total probability theorem are bounded upwards by the ratio  $r$  and, therefore, they are not comparable with the conditional probabilities. The two methods were successfully tested in three characteristic seismic zones of the Pacific Ocean: South America, Kuril-Kamchatka, and Japan. For time intervals of about 20 years and over the probabilities exceed 0.50 in the three zones. It has been found that the results depend on the approach applied. In fact, the conditional probabilities of tsunami occurrence in Japan are slightly higher than in the South America region and in Kuril-Kamchatka they are clearly lower than in South America. Probabilities calculated by the total probability theorem are systematically higher in South America than in Japan while in Kuril-Kamchatka they are significantly lower than in Japan. The stochastic techniques tested in this paper are promising for the tsunami potential assessment in other tsunamigenic regions of the world.

**Yanagisawa, Ken, Fumihiko Imamura, Tsutomu Sakakiyama, Tadashi Annaka, Tomoyoshi Takeda, and Nobuo Shuto. 2007. Tsunami assessment for risk management at nuclear power facilities in Japan. *Pure and Applied Geophysics* 164(2-3): 565-576.**

The present study focuses on evaluation of the maximum and minimum water levels caused by tsunamis as risk factors for operation and management of nuclear power facilities along the coastal areas of Japan. Tsunamis generated by submarine earthquakes are examined, basing literature reviews and databases of information on historical tsunami events and run-up heights. For simulation of water level along the coast, a numerical calculation system should be designed with computational regions covering a particular site. Also the calculation system should be verified by comparison of historical and calculated tsunami heights. At the beginning of the tsunami assessment, the standard faults, their locations, mechanisms, and maximum magnitudes should be carefully estimated by considering historical earthquake-induced tsunamis and seismo-tectonics at each area. Secondly, the range of errors in the model parameters should be considered since earthquakes and tsunamis are natural phenomena that involve natural variability as well as errors in estimating parameters. For these reasons, uncertainty-induced errors should be taken into account in the process of tsunami assessment with parametric study of the tsunami source model. The element tsunamis calculated by the standard fault models with the errors would be given for the design. Then, the design tsunami can be selected among the element tsunamis with the most significant impact, maximum and minimum water levels, on the site, bearing in mind the possible errors in the numerical calculation system. Finally, the design tsunami is verified by comparison with the run-up heights of historical tsunamis, ensuring that the design tsunami is selected as the highest of all historical and possible future tsunamis at the site.

## Volcanoes

**Capra, Lucia. 2007. Volcanic natural dams: Identification, stability, and secondary effects. *Natural Hazards* 43(1): 45-61.**

Volcanic activity can enhance several secondary effects, including the formation of one or more natural dams. A common example is from volcanic collapse, where huge mass volumes are rapidly emplaced, obstructing the drainage around a volcano. Their duration depends on the volume of the obstructing mass, inflow rate, and on its textural characteristics. A block facies of a debris avalanche produces durable and permeable dams that consist of decimeter to meter-sized blocks without matrix, whereas a mixed facies is easily eroded after overflowing. Analysis of the sedimentological characteristics of different volcanoclastic deposits that formed natural dams indicate that a mean grain size ( $M_d$ ) equal to  $-1 \phi$  divides the field of debris avalanche dams ( $M_d < -1 \phi$ ) from that formed from other types of volcanic deposits. In addition, the matrix



proportion of dams formed by debris avalanches are less than the 50% and the percentage of mud fraction is highly variable, up to 30%. Combining the granulometric textures with duration time of the dam shows no clear relation. Dam durability is probably more dependent on the volume of the lake and the inflow rate. Only in some cases, as mud fraction increases is the blockage also less durable because the lower permeability favors rapid infilling. The texture of the dam also determines the types of secondary flows that originate by their breakdown. These vary from cohesive debris flow to hyperconcentrated flow, representing different hazards due to their magnitude and their different behavior downstream.

found to perform satisfactorily during dry testing, but during wet testing significant clogging/blocking of the condenser's radiator occurred, dramatically reducing airflow through the condenser. Specific mitigation recommendations have been developed that include cleaning with compressed air and adapting farm management techniques to lessen usage of the condenser during an ash-fall event. Specific recommendations for management of dairy farm operation are given to mitigate the effects of an ash-fall event.

## Warnings and Evacuations

**Ewert, John W. 2007. System for ranking relative threats of U.S. volcanoes. *Natural Hazards Review* 8(4): 112-124.**

A methodology to systematically rank volcanic threat was developed as the basis for prioritizing volcanoes for long-term hazards evaluations, monitoring, and mitigation activities. A ranking of 169 volcanoes in the United States and the Commonwealth of the Northern Mariana Islands is presented based on scores assigned for various hazard and exposure factors. Fifteen factors define the hazard: volcano type; maximum known eruptive explosivity; magnitude of recent explosivity within the past 500 and 5,000 years; average eruption-recurrence interval, presence or potential for a suite of hazardous phenomena (pyroclastic flows, lahars, lava flows, tsunami, flank collapse, hydrothermal explosion, primary lahar), and deformation, seismic, or degassing unrest. Nine factors define exposure: a measure of ground-based human population in hazard zones; past fatalities and evacuations; a measure of airport exposure; a measure of human population on aircraft; the presence of power, transportation, and developed infrastructure; and whether or not the volcano forms a significant part of a populated island. The hazard score and exposure score for each volcano are multiplied to give its overall threat score. Once scored, the ordered list of volcanoes is divided into five overall threat categories from very high to very low.

**Wilson, Thomas M., and James W. Cole. 2007. Potential impact of ash eruptions on dairy farms from a study of the effects on a farm in eastern Bay of Plenty, New Zealand; implications for hazard mitigation. *Natural Hazards* 43(1): 103-128.**

This paper investigates the impact ash fall would have on dairy farming, based on a study of 'Tulachard', a dairy farming operation at Rerewhakaaitu, North Island, New Zealand. It includes analysis of the potential effects on the dairy shed and milking machine, electrical supply and distribution, water supply and distribution, tractors and other farm vehicles, farm buildings (hay sheds, pump sheds, implement sheds, etc.), milk-tanker access to the farm, and critical needs of dairy cows and the farm to keep milking. One of the most vulnerable areas identified in the study was the cooling of milk at the milking shed, pending dairy tanker pick-up. The cooling system's condenser is exposed to the atmosphere and falling ash would make it highly vulnerable. Laboratory testing with wet and dry ash was conducted to determine its resilience to ash ingestion. It was

**Burnside, Randolph, DeMond Shondell Miller, and Jason D. Rivera. 2007. The impact of information and risk perception on the hurricane evacuation decision-making of greater New Orleans residents. *Sociological Spectrum* 27(6): 727-740.**

This article contributes to the current discussion on how residents living in vulnerable areas make the decision to evacuate when they are in harms way. Key in this discussion is the question, what role does information and risk play in shaping evacuation behavior? This study used a sample of respondents from the greater New Orleans region (Orleans, Jefferson, and St. Bernard Parishes) of the Twelve Parish Survey (N = 1,207) conducted prior to Hurricane Katrina. The findings indicate that information sources are vitally important in the evacuation process. By examining the role of information from authorities, family, and friends; visual imagery; and the media, the authors found that individuals use a variety of sources when they decide to evacuate. Further, the importance of visual imagery in the evacuation process is discussed. The article concludes with a discussion of the implications of information dissemination and its importance to members of the media and public policy makers.

**Ebi, K. L. 2007. Towards an early warning system for heat events. *Journal of Risk Research* 10(5): 729-744.**

Severe and sustained episodes of hot weather during the summer season are associated with marked short-term increases in morbidity and mortality in the United States and Europe. The death toll in an unprepared region can be substantial, as was evidenced in the 2003 heat event in Western Europe. There is growing interest in developing early warning systems to advise the public when weather conditions pose risks to health. These systems link meteorological forecasts of dangerous weather with public health actions. The principal components of an early warning system include identification and forecasting of the event (including consistent, standardized weather criteria for when warnings are activated and deactivated), prediction of possible health outcomes that could occur, an effective and timely response plan that targets high-risk populations, and an ongoing evaluation and revision of the system and its components. A particular challenge is the development of effective communication of the behavioral changes needed to prevent adverse health impacts.

Hess, Daniel Baldwin, and Julie C. Gotham. 2007. Multi-modal mass evacuation in Upstate New York: A review of disaster plans. *Journal of Homeland Security and Emergency Management* 4(3).

The devastating aftermath from Hurricane Katrina accentuates the need for localized disaster planning that considers those without access to automobiles including the poor, elderly, and disabled. Planning for evacuation during extreme events should consider the "carless" by paying special attention to the movement of people to safety using a combination of methods by foot, public transit, coaches, and vans. Many areas in upstate New York are ill prepared for the large-scale evacuation of the carless that may result from an extreme event. The share of households without vehicles in several upstate cities, Albany (28 %), Buffalo (31 %), and Syracuse (27 %), surprisingly meets or exceeds the share in New Orleans when Hurricane Katrina struck. This study identifies strengths and weaknesses within upstate written disaster plans in regards to multi-modal evacuation. Findings suggest that many upstate areas except for those near nuclear power plants have inadequate written plans for mass evacuation, especially when considering the carless population. The authors recommend future research directions to include wide samples, best practices for carless evacuations, and development of multi-modal evacuation models.

## Wildfires

Cohen, Erez, Peter Hughes, and Peter B. White. 2007. Media and bushfires: A community perspective of the media during the Grampians Fires 2006. *Environmental Hazards - Topical Issue: Environmental Hazards and Risk Communication* 7(2): 88-96.

This paper examines the ways residents in the Grampians area in the Australian state of Victoria used their local and their state and national media before, during, and after the 2006 bushfires (wildfires). The researchers were particularly concerned to learn how residents evaluated media sources as trustworthy and credible in relation to bushfire warnings and information about the fires delivered in the media. Analysis of data derived from two separate focus group sessions conducted by the researchers reveals four main themes: (1) The media are perceived as part of a broader information gathering process; (2) Local knowledge is the most important aspect in broadcast information; (3) Members of small communities can feel disenfranchised and resentful of the media when media coverage focuses on larger towns; and (4) the effects of media reporting, including specific warnings, are both immediate and long lasting. The paper explores some of the tensions that result from the ways rural residents use and distinguish between local/regional and metropolitan and out-of-state bushfire information, and it encourages better use of the local/regional media to increase community safety and awareness in relation to bushfire mitigation, preparedness, and crisis management issues before, during, and after the fires. It is suggested that risk communications professionals

need to understand that when mediated risk-related communications are provided, a key evaluative criterion is whether or not those media and the messages represent and reflect local knowledge.

Schoenberg, Frederic P., Chien-Hsun Chang, Jon E. Keeley, Jamie Pompa, James Woods, and Haiyong Xu. 2007. A critical assessment of the Burning Index in Los Angeles County, California. *International Journal of Wildland Fire* 16(4): 473-483.

The Burning Index (BI) is commonly used as a predictor of wildfire activity. An examination of data on the BI and wildfires in Los Angeles County, California, from January 1976 to December 2000 reveals that although the BI is positively associated with wildfire occurrence, its predictive value is quite limited. Wind speed alone has a higher correlation with burn area than BI, for instance, and a simple alternative point process model using wind speed, relative humidity, precipitation, and temperature well outperforms the BI in terms of predictive power. The BI is generally far too high in winter and too low in fall, and may exaggerate the impact of individual variables such as wind speed or temperature during times when other variables, such as precipitation or relative humidity, render the environment ill suited for wildfires.

Sturtevant, Brian R., and David T. Cleland. 2007. Human and biophysical factors influencing modern fire disturbance in northern Wisconsin. *International Journal of Wildland Fire* 16(4): 398-413.

Humans cause most wildfires in northern Wisconsin, but interactions between human and biophysical variables affecting fire starts and size are not well understood. The authors applied classification tree analyses to a 16-year fire database from northern Wisconsin to evaluate the relative importance of human v. biophysical variables affecting fire occurrence within (1) all cover types, and (2) within forest types in each of four different fire size groupings (all fires; fires = 0.4 ha (1 acre); fires = 4 ha (10 acres); fires = 16 ha (40 acres)). Housing density was the most important indicator of fire observations. Increasing minimum fire size increased the relative importance of biophysical variables. Key biophysical variables included land cover type, soil moisture indicators, and an index of pre-settlement fire rotation associated with glacial landforms. Our results indicate the likelihood of fire starts is primarily influenced by human activity in northern Wisconsin, whereas biophysical factors determine whether those fire starts become large fires. Important interactions between human and biophysical variables were observed for nearly all fire types and size thresholds examined. Results have implications for both ecological restoration and the management of fire risk within historically fire-prone systems currently experiencing rapid rural development.

## Wind Storms, Winter Storms, and Other Severe Weather

**Ebi, K. L. 2007. Towards an early warning system for heat events. *Journal of Risk Research* 10(5): 729-744.**

Severe and sustained episodes of hot weather during the summer season are associated with marked short-term increases in morbidity and mortality in the United States and Europe. The death toll in an unprepared region can be substantial, as was evidenced in the 2003 heat event in Western Europe. There is growing interest in developing early warning systems to advise the public when weather conditions pose risks to health. These systems link meteorological forecasts of dangerous weather with public health actions. The principal components of an early warning system include identification and forecasting of the event (including consistent, standardized weather criteria for when warnings are activated and deactivated), prediction of possible health outcomes that could occur, an effective and timely response plan that targets high-risk populations, and an ongoing evaluation and revision of the system and its components. A particular challenge is the development of effective communication of the behavioral changes needed to prevent adverse health impacts.

**Jin, Menglin, Marshall Shepherd, and Christa Peters-Lidard. 2007. Development of a parameterization for simulating the urban temperature hazard using satellite observations in climate model. *Natural Hazards* 43(2): 257-271.**

Urban surface temperature is hazardously higher than surrounding regions (so-called urban heat island effect, UHI). Accurately simulating urbanization-induced temperature hazard is critical for realistically representing urban regions in the land surface-atmosphere climate system. However, inclusion of urban landscapes in regional or global climate models has been overlooked due to the coarse spatial resolution of these models as well as the lack of observations for urban physical properties. Recently, National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) Moderate Resolution Imaging Spectroradiometer (MODIS) observations illustrate important urban physical properties, including skin temperature, surface albedo, surface emissivity, and leaf area index. It is possible to identify the unique urban features globally and thus simulate global urban processes. An urban scheme is designed to represent the urban-modified physical parameters (albedo, emissivity, land cover, roughness length, thermal and hydraulic properties) and to include new, unique physical processes that exist in urban regions. The urban scheme is coupled with National Center for Atmospheric Research (NCAR) Community Land Model Version 2 (CLM2) and single column coupled NCAR Community Atmosphere Model CAM2/CLM2 to assess the mechanisms responsible for UHI. There are two steps in our model development. First, satellite observations of albedo, emissivity, LAI, and *in situ* observed thermal properties are updated in CLM2 to represent the first-order urban effects. Second, new terms representing the urban anthropogenic

heat flux, storage heat flux, and roughness length are calculated in the model. Model simulations suggest that human activity-induced surface temperature hazard results in overlying atmosphere instability and convective rainfall, which may enhance the possibility of urban flood hazard.

**Rose, Adam, Keith Porter, Nicole Dash, Jawhar Bouabid, Charles Huyck, John Whitehead, Douglas Shaw, Ronald Eguchi, Craig Taylor, Thomas McLane, L. Thomas Tobin, Philip T. Ganderton, David Godschalk, Anne S. Kiremidjian, Kathleen Tierney, and Carol Taylor West. 2007. Benefit-cost analysis of FEMA hazard mitigation grants. *Natural Hazards Review* 8(4): 97-111.**

Mitigation decreases the losses from natural hazards by reducing our vulnerability or by reducing the frequency and magnitude of causal factors. Reducing these losses brings many benefits, but every mitigation activity has a cost that must be considered in our world of limited resources. In principle, benefit-cost analysis (BCA) attempts to assess a mitigation activity's expected net benefits (discounted future benefits less discounted costs), but in practice this often proves difficult. This paper reports on a study that applied BCA methodologies to a statistical sample of the nearly 5,500 Federal Emergency Management Agency (FEMA) mitigation grants between 1993 and 2003 for earthquake, flood, and wind hazards. HAZUS-MH was employed to assess the benefits, with and without FEMA mitigation in regions across the country, for a variety of hazards with different probabilities and severities. The results indicate that the overall benefit-cost ratio for FEMA mitigation grants is about 4:1, though the ratio varies from 1.5 for earthquake mitigation to 5.1 for flood mitigation. Sensitivity analysis was conducted and shows these estimates to be quite robust.