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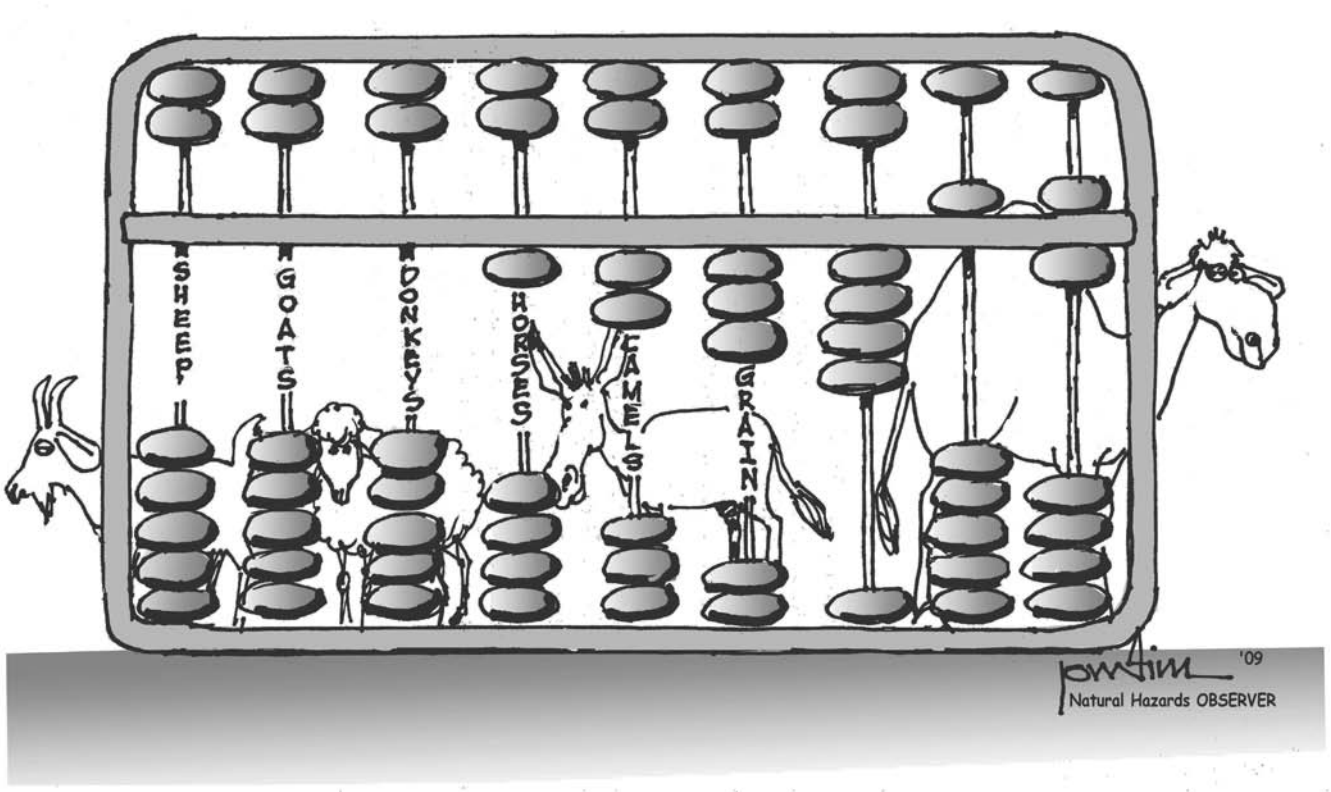

Extreme Events and Social Institutions: Lessons from East Africa

— Invited Comment

This is a story of institutions and social science research—about how societies have developed social institutions to cope with environmental stresses, and about how they can be undermined by well-intentioned efforts leaving people more vulnerable than they were before. It is also about the importance of extreme environmental events for the development of social science theory.

Web of Obligation

First, a little background. I am a cultural anthropologist who specializes in understanding the system of livestock management, land use practices, and decision making among pastoral peoples in East Africa. I have spent much of the last 30 years working with the Turkana of northern Kenya and more recently the Maasai in northern Tanzania. Drought is a common occurrence there and can have devastating effects. For the Turkana, the area is also subject to intense intertribal raiding and, while more localized than drought, can have even more severe impacts than drought at the household level.

During the early 1980's I was working with a Turkana man I'll call Angor. He was quite wealthy with four wives, about 1,800 goats and sheep, 80 camels, and 120 cattle. After I had been there for about three months, he told me that he was going to slaughter a goat for me. This was very gratifying for me, considering the Turkana do not normally offer things to others. If you want something you have to demand it. What puzzled me was that Angor then walked down the dry wash and "borrowed" a goat from a relatively poor man named Lori. Lori had one wife, about 80 goats and sheep, 15 camels, and about 25 cattle. When I asked Angor why he borrowed a goat from Lori, he said he didn't have one fat enough. Looking over his flock I could see many goats at least as fat as the one he began to slaughter. I remember feeling more than a little disconcerted, fearing I

(See "East Africa" continued on page seven)

Hot Times in the Old Towns

As the world heats up from climate change, residents of the Pacific Coast and northeastern regions of the United States are at greater risk of illness and death from heat stroke, according to a study published in June in *Environmental Health Perspectives*.

Heat waves are already the natural hazard that kills the most people worldwide and in the U.S. In a 2008 paper in the International Journal of Health Geographics, Kevin Borden and Susan Cutter wrote, "Chronic everyday hazards such as severe weather (summer and winter) and heat account for the majority of natural hazards fatalities." According to a 2002 paper by Rupa Basu and Jonathan Samet, an average of 400 deaths occur in the United States each year that can be attributed to heat, with most of the fatalities occurring among the age group over 65 years of age. A 1995 heat wave in Chicago killed about 600 people in that one city over a five-day period. About 35,000 deaths are attributed to the infamous European heat wave of 2003.

The *EHP* paper, written by Colleen Reid of the U.S. Environmental Protection Agency and colleagues, found four factors explaining more than 75 percent of the variance in heat vulnerability. They were: (1) lower education/higher poverty/higher proportion of people of color/less green space; (2) social isolation; (3) lack of air conditioning; and (4) a higher proportion of elderly, especially those with diabetes.

When they applied these risk factors spatially across the country, they found that people living in the crowded northeast corridor between Washington and Boston, and those on the Pacific Coast—mostly between San Francisco and Los Angeles, but also in Portland, Oregon, and Seattle—were most at risk from heat waves.

Rupa Basu, an epidemiologist now with the state of California, says that according to studies she's conducted there, heat does not affect everyone equally. "We looked at different racial and ethnic groups," she says. "African Americans and Asians were at greatest risk, with a twofold increase in heat mortality compared to Caucasians." Her work covers only California, but she says that the results have been similar in other places.

In the heat, people die from cardiovascular problems, Basu says. The most likely killers are eschemic heart disease, myocardial infarction and congestive heart failure. Hospitalization for illnesses often result from respiratory problems, she says.

The authors of "Mapping Community Determinants of Heat Vulnerability" in *EHP* wrote, "The Intergovernmental Panel on Climate Change reports that heat waves … are projected to continue to increase in frequency, intensity, and duration worldwide which could result in future increases in heat-related morbidity and mortality. However, heat-related deaths are preventable. Several cities have implemented heat emergency response plans, and mortality has decreased during subsequent heat waves.

"But many elderly residents in four cities with heat wave warning systems reported that they did not take recommended actions during heat waves, implying that interventions for the most vulnerable populations need improvement … A national map of county-level heat vulnerability allows us to situate vulnerability to heat in geographic space and identify areas most in need of intervention."

Residents of downtowns in major metropolitan areas are almost always more vulnerable to heat waves, regardless of the overall vulnerability index of that city, the authors say.

In California, with rising average temperatures, Basu says rising heat—somewhat counterintuitively—will have the greatest negative effect on the coasts rather than inland. People living on the coasts are used to cooler weather, and air conditioning is less pervasive.

In a written answer to a question about urban impacts, Colleen Reid said, "Our maps show that almost every metropolitan area for which we had all of the data points has areas with higher vulnerability and areas with lower vulnerability. For the most part, these areas with higher vulnerability tend to be in the downtown areas, many of which have less green space and higher percentages of people living below the poverty line, both of which increase vulnerability to heat. Within metropolitan areas, we can say that these areas are more vulnerable."

Southern Tornadoes Drying Up?

Years with a dry fall and winter lead to fewer tornadoes in the southeast United States, according to research from geographers at the University of Georgia.

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Disasters Driving World Migration

Climate Change May Make It Worse

Climate change and its attendant environmental disruption may drive the migration of 200 million people worldwide by the year 2050. According to the UN report *In Search of Shelter*, "The impacts of climate change are already causing migration and displacement. Although the exact number of people that will be on the move by mid-century is uncertain, the scope and scale could vastly exceed anything that has occurred before. People in the least developed countries and island states will be affected first and worst." (www.ciesin.columbia.edu)

Economic and political factors are the main causes of human displacement around the world. But, "Disasters continue to be a major driver of shorter-term displacement and migration," the report says. As climate change increases the frequency and intensity of natural hazards such as cyclones, floods, and droughts, the number of temporarily displaced people will rise. This will be especially true in countries that fail to invest now in disaster risk reduction and where the official response to disasters is limited."

One issue is whether the cause of displacement will require different types of humanitarian relief. Koko Warner, an economist with the United Nations University and the lead author of the report, says, "The cause (of migration) does matter. Right now we have certain protection regimes for internally displaced people and refugees. There are resources and protection mechanisms for political refugees, and a clear case for being persecuted for religion, race, political affiliation or group identity. If the person can prove their persecution, countries are required to provide assistance."

However, "Environmentally induced migrants don't have status like that," Warner says. She cited as an example the flooding in Mozambique in 2002 in the Limpopo and Zambezi river valleys, affecting between 100,000 and 200,000 people. "There was no guaranteed assistance," Warner says. The situation came to the attention of the international community via media coverage—one woman gave birth while huddling in a tree above the floodwaters—and assistance was forthcoming. This isn't always the case, though. "In other floods," she says, "there's been donor fatigue. The cameras weren't there."

The anticipated climate-based causes of migration vary. In Asia, for instance, glacier-fed rivers originating in the Himalayas may deliver less water as the glaciers disappear, affecting power generation, irrigation, and fishing. Northern and central Mexico are expected to see declines in precipitation over the coming century of as much as 70 percent, affecting the area's primarily rain-fed agriculture. This could have the ancillary affect of increasing Mexican immigration into the United States, already a contentious issue.

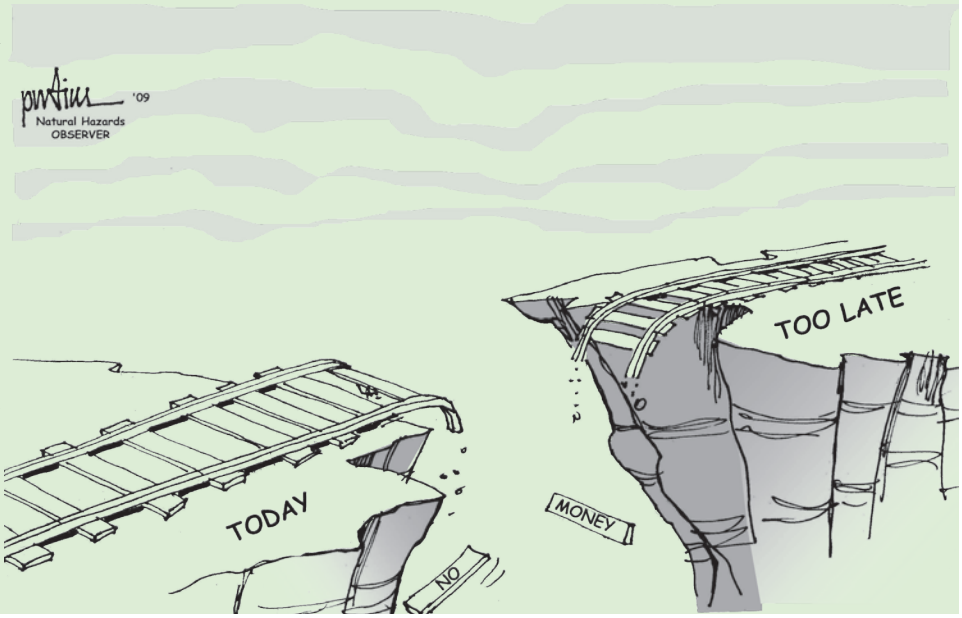
The data are not complete enough to know whether people are actually being motivated now to migrate because of climate stress. "What we've been hearing from the field is anecdotal," Warner says. Camps on the Mediterranean island of Malta, for instance, are often staging areas for refugees trying to get into Europe. "We went to Malta and talked with people operating the camps," Warner says. "They said that over the last five or six years, they've noticed changes in the characteristics of migrants who are arriving.

"Instead of healthy young men, 15 to 45 years old, they've started noticing more women, young children, babies, and more elderly. They've also been noticing more people traveling in groups, whole families, and some indications that there are clusters of neighbors or people from the same village."

This could, of course, have many causes—that countries have tightened admission standards, or that general economic conditions are worse. But some of these people would admit that they "had a hard time feeding their family … that's as far as we get in whether climate change was the driver of displacement right now."

In Search of Shelter suggests several policy initiatives to deal with the issues, including avoiding dangerous change, focusing on human security, prioritizing the world's vulnerable populations, and including migration in adaptation strategies.

— Dan Whipple



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Under regional forecasts for global climate change, this could mean a long-term impact on regional tornado activity.

"Our results suggest that there is a statistically significant reduction in tornado activity during a tornado season following drought the preceding fall and winter," says Marshall Shepherd, a UGA meteorologist and lead author of the study, published in the June 24 issue of the journal *Environmental Research Letters* (iopscience.iop.org/1748-9326/4/2/024012). On the other hand, wet autumns and winters examined in the study had nearly twice as many spring tornado days as drought years did.

Harold Brooks, a research meteorologist at the National Severe Storms Laboratory in Norman, Oklahoma, says, "This is a really intriguing result, and I hope we can do more with it in a larger area." However, he says, it isn't known whether the pattern would hold up in other tornado-prone regions like the Great Plains.

"No one's really looked at it locally," Brooks says. "I did a little check without nearly as high quality data as these guys had, and there appears to be a slight correlation in Oklahoma" between drought years and fewer tornadoes the following year. But most other information is anecdotal from storm chasers.

Shepherd and colleagues urge caution in the broader interpretation of their work, writing, "Our results are interesting but should be interpreted very cautiously until the analysis is repeated for other locations. The study region was a geographic region that experiences, climatologically, fewer tornado days than more active tornado regions. It would be interesting to replicate this study for very active tornado regions to ensure that results presented herein are not skewed or biased."

While climate change models broadly forecast more drought under a warming regime, there are wide variations regionally. In particular, there is no consensus among the models whether the Great Plains will get drier or not with the changing climate.

Jeff Trapp, an atmospheric scientist at Purdue University, says, "There is some consistency with work that we've done here, but with some differences, especially in interpretation. For example, we find seasonal variations … The early spring severe weather season, when the large-scale dynamical forcing is strong, might not be as sensitive to an antecedent drought as would the later spring/summer severe weather season, when the mesoscale forcing is more dominant.

"Something the authors still need to show is how the levels of tornado activity relate to the precipitation frequency in the 'same season.' In other words, is the low tornado activity due simply to infrequent precipitation, or to infrequent tornado-producing storms? The former represents a continuation of drought conditions from one season to the next, which would not be as compelling of a case as the latter."

Disaster Modeling in New York

A large-scale computer simulation of disasters in New York City called Plan C may help hospitals and emergency responders anticipate casualties and stressors on the health care system.

Devised by an interdisciplinary team of doctors, computer specialists and social scientists, Plan C was recently run on a simulated sarin gas attack at different locations in Manhattan. The scenario was based on the actual sarin gas attacks that occurred in Japan in 1994 and 1995.

"With the input of city demographic information, hospital resource and public transit data, the results showed that under certain circumstances, up to 22,000 individuals might become exposed, leading to 178 intensive care unit admissions," the simulation found.

According to lead author New York University Dr. Silas Smith, M.D., "In terms of creating the model, we wanted to start with a point source release … This allowed us to model a smaller population, so we were able to keep track of every single individual agent's movement on a minute-by-minute basis. We ran it 100 times for two days. We wanted to have a defined population and defined area of release."

Developed by researchers at NYU, "Plan C is an innovative tool for emergency managers, urban planners, and public health officials to prepare and evaluate optimal plans for response to an array of hypothetical urban catastrophic situations," according to a news release.

But while the Sarin attack was the most recent scenario run by the group, Smith says that they are next planning to model a pandemic flu outbreak. In the future, they hope to expand the model to deal with impacts from environmental disasters like a hurricane hitting New York.

"We would like to be able to translate this to that kind of scenario," Smith says. "The underlying technology could probably do it, covering environmental scenarios, the tidal zones or 'slosh' zones affecting New York, especially if we can incorporate other models like HAZUS that FEMA provides. Once you have an idea of the affected population, you could set a model like this up to see what would happen, where those affected populations might go. The trick would be—as in any model—in selecting the parameters."

While the current simulation was set in New York, Smith says his group demonstrated the model was portable for at least several other cities, including Philadelphia, Boston, and San Francisco.

"Models all have limitations," he says, "and we tried to provide some of the obvious and less obvious limitations to our own model. We put together a multidisciplinary team

of computer scientists, doctors, and sociologists because the perspective of everyone is particularly important. We thought it was necessary to create a model with perspective."

The paper, "A Novel Approach to Multihazard Modeling and Simulation," appears in the June 2009 issue of *Disaster Medicine and Public Health Preparedness*. More information about Plan C can be found at www.nyu.edu/ccpr/laser/plancinfo.html.

Hazards We Hadn't Worried About Before

The sheep in Scotland's St. Kilda archipelago are getting smaller because of a complex dance with the changing climate. Wild Soay sheep are losing 81 grams a year of weight, mostly because of ecological processes, some of them related to a climate change, according to research published in *Sciencexpress* (www.sciencemag.org/cgi/content/abstract/1173668).

The research by Imperial College London biologist Arpat Ozgul and colleagues found, "Climate change has the potential to generate rapid change in phenotypic traits, providing contemporary support for observations from the fossil record of phenotypic change accompanying climate change." They found that the sheep were growing more slowly than previously primarily for ecological reasons, rather than evolutionary ones.

Essentially, warmer winters on the archipelago have resulted in the survival of more sheep. But changing winter conditions have extended the grass season, reducing the amount of time sheep need to depend on stored fat.

The scientists report the sheeps' body size is primarily a consequence of environmental variation, not evolution. And environmental change—including, but not limited to, a warming climate—"has resulted in a reduction in lamb growth rates and … this explains why sheep are smaller than they used to be."

The research does not say, however, when climate change will be available as a weight loss regimen for humans.

Costing Out 'The Big One'

A recurrence of the 1906 San Francisco earthquake would result in economic damage of between $39 billion and $328 billion in 2005 dollars, and cause between 3,000 and 24,000 deaths, according to a paper by Kevin Vranes and Roger Pielke, Jr. in the August 2009 *Natural Hazards Review* (dx.doi.org/10.1061/(ASCE)1527-6988(2009)10:3(84)).

The researchers adjusted earthquake damages over the past 100 years for inflation, increases in wealth, and changes in population.

There is no time trend over the period for increasing or decreasing damages, they report. "Since 1900, 13 events would have caused $1 billion or more in losses had they occurred in 2005; five events adjust to more than $10 billion in damages. Annual average losses range from $1.3 billion to $5.7 billion with an average across data sets and calculation methods of $2.5 billion, below catastrophe model estimates and estimates of average annual losses from hurricanes. Fatalities are adjusted for population increase and mitigation, with five events causing over 100 fatalities when mitigation is not considered, four (three) events when one percent (two percent) mitigation is considered. Fatalities in the 1906 San Francisco event adjusts from 3,000 to over 24,000, or 8,900 (3,300) if one percent (two percent) mitigation is considered," the authors write.

TVA Takes TKO Over Ash Spill

The Tennessee Valley Authority took one on the chin again in July as two new studies pointed to its culpability in the December coal ash spill that dumped more than one billion gallons of fly and bottom ash over 300 acres in Kingston, Tennessee. TVA was still smarting from a June audit that excoriated it for failing to adopt Homeland Security's National Incident Management System protocols for emergency communications.

The latest reports revealed a lack of concern for safety stretching back to 1985 and attempts to mitigate legal liability in the recent spill, according to a Knoxville *News Sentinel* article (www.knoxnews.com/news/2009/jul/28/ig-tva-could-have-prevented-spill-limited-probe-ca).

"We conclude that TVA defaulted to a preference for litigation strategy over transparency and accountability," says the Inspector General's report on the causes of the spill.

The report says that the spill might have been avoided if the TVA hadn't ignored engineering concerns. In 1985, an internal memorandum written by a TVA engineer raised concerns about the stability of the Kingston ash storage. Again in 2004, external consultants raised the same red flag and a malfunction temporarily closed the facility. "For reasons that are not entirely clear," the report says, "appropriate safety modifications and additional analyses were not made."

The report also points to an agency culture that "is likely to be resistant to the kinds of reforms necessary to avoid other safety failures."

"We have some concerns about ponds that are similarly situated," Tennessee Clean Water Network's Renee Hoyos told the *News Sentinel*. "I'm hoping that TVA is looking at the historical records on those sites too. I hope they approach those ponds and deal with any problems quickly."

TVA—which is a federal entity—operates 10 other fossil fuel plants in Tennessee, Alabama, and Kentucky, according to its Web site (www.tva.gov/power/fossil.htm).

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In addition to claims of apathetic and irresponsible management, the Inspector General slammed TVA for narrowing the scope of a $3 million root-cause investigation to physical reasons for the dike failure, according to the *News Sentinel* article.

The IG report says, "We find that TVA made no effort to publicly disclose what management practices may have contributed to the Kingston spill. The very tightly scoped AECOM report minimizes TVA management's liability and provides no 'lessons learned.' TVA has urged everyone to 'move forward' without further explanation of what responsibility TVA management may have had for the disaster." AECOM Technology Corporation is the consulting firm TVA hired to review the disaster.

—Jolie Breeden

Perceiving 'Stayers' and 'Leavers' from Katrina

Survivors' decisions about whether to stay in New Orleans in the face of Hurricane Katrina or to evacuate were powerfully shaped by their environment and the resources they had at their disposal. But outsiders' perceptions of people who stayed were largely negative, even though "stayers" often had little real choice, according to new research.

Writing in the journal *Psychological Science*, Stanford University psychologist Nicole Stephens and colleagues conducted two studies to look at how observers and survivors "made meaning" after Hurricane Katrina. The first study analyzed how observers perceived survivors who evacuated versus survivors who remained in New Orleans. The second looked at how both "leavers" and "stayers" perceived themselves.

"Observers described leavers positively (as agentic, independent and in control) and stayers negatively (as passive and lacking agency)," the study says.

But the second study found the two groups "relied on divergent models of agency. Leavers emphasized independence, choice, and control, whereas stayers emphasized interdependence, strength, and faith. Although both leavers and stayers exercised agency, observers failed to recognize stayers' agency and derogated them because observers assumed that being independent and in control was the only way to be agentic."

Survivors who stayed adjusted themselves to the world, maintaining interdependence on other people. This may reflect a "compensatory secondary control." Those who stayed were mostly black and less wealthy that those who left, so they had fewer evacuation options.

"Rather than ask why stayers made bad 'choices' or inquire what was wrong with stayers," the paper concludes, "relief workers should perhaps have asked, 'What actions were possible in the resource-limited context of the stayers?' This alternate question acknowledges that all action is—and should be understood as—a product of what the individual can do given the resources of the sociocultural context."

Anthony Ladd, a sociology professor at Loyola University in New Orleans, says, he found the study "to be a valuable contribution to the disaster evacuation literature."

He adds, "In a nutshell, most people, lay and academics alike, have never really understood what this city is, or how it works in unique ways from the rest of the country. Compared to national norms, New Orleans is poorer, more populated with minorities, older, less healthy, with fewer modes of transport, and much, much, deeper community roots than most other areas of the United States, all of which—and research has shown this—played an important role in who was able to evacuate and who wasn't.

"But for almost everyone who was impacted by Katrina, there were a host of other factors that affect people's decisions here that don't usually exist in other places, factors like available roads to evacuate on, crime and looting after a hurricane, sick relatives, pets, an older housing stock, places to evacuate to, financial resources, and so on, that made the decision for most of us, whatever our rational calculus models might say. When we say we are 'Third World and Proud of It,' it is only slightly meant as a joke.

"But as the piece concludes, we have been inappropriately and harshly judged by the rest of the country in ways that really make many residents here angry—and with good reason. We are so sick of answering the same dumb questions about why we live here, why New Orleans should exist, what is wrong with us—you get the picture."

The Stephens et al. paper is published in Volume 20, Number 7 of *Psychological Science.*

—Dan Whipple

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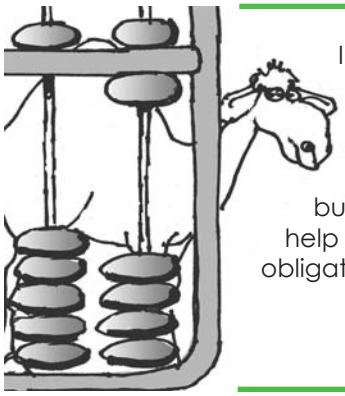
was never going to understand what Angor just did, or how the Turkana manage their livestock. I knew that something was going on—but nothing seemed to come from it at the time. Life went on.

It took a while, but I did learn. After about a year, I came to understand that Angor was actually doing Lori a favor. By indebting himself to Lori, Angor was creating the means whereby Lori could draw on Angor's resources if needed. Two years later, after a drought in which Lori had lost almost 80 percent of his animals, he did ask Angor for the goat back, and to borrow a number of additional animals. Angor repaid the debt, also lending Lori a number of other animals that turned out to be critical in Lori's ability to recover.

The Web Forms a Safety Net

It is this system of debts and obligations that form the safety net for people who need assistance. It may be years before one observes the importance of these institutions. I once asked Angor to list the debts that other herd owners owed to him, and to list the debts that he had to pay back to others. It turned out he owed about 50 livestock in various categories. Other herd owners owed him about the same number. The object was not to pay off debts, but to maintain a system of mutual help manifested through the rights and obligations associated with the transfer of livestock. The Turkana will never tell you this—although they certainly know it. You have be around long enough to see the system at work.



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A second social institution that involves the transfer of livestock is bridewealth. Bridewealth is a payment—in this case livestock—from the family of the groom to that of the bride. Among East African pastoralists this varies from the transfer of a few animals among some groups to hundreds of animals among others. The Turkana fall into the latter category. A completed bridewealth payment can entail the transfer of as many as 30 cattle, 30 camels, and 100 to 200 goats and sheep. For a man to marry, he must draw on the livestock resources of his entire extended family. When transferred, these animals are distributed in turn throughout the bride's extended family. Following the path of each animal illustrates the web of social interconnections of individuals and families. These networks are critical for households to survive in a dry, unpredictable, and dangerous environment like northern Kenya.

In the mid-1980's I worked on a project funded by the Norwegian government to assess the success of famine relief efforts in Turkana District. The area had experienced two severe droughts in the previous five years: 1980-81 and 1984. In 1984, an estimated 80,000 of the then 200,000 Turkana were living in famine relief camps. One strategy the Turkana utilized was to place all family members not critical to the raising of livestock in the camps, then move the rest of the family away with the still viable herds to the wetter and more productive highlands.

When the camp managers discovered this, they viewed it as a form of "cheating"—assuming these people didn't really need famine relief if they still had livestock. They demanded that, in order for anyone to receive food, all family members had to register at the camp. The result was that those herding the remaining animals moved closer to the camps to register, keeping the livestock a short distance away. The nearby areas became denuded of vegetation. Not surprisingly, many of the livestock died. The camps were in a perverse way creating their own victims. The strategy taken by the Turkana originally was the correct one: reduce the number of people dependent on the livestock for food, hoping they can recover quickly.

Along with the regular system of borrowing and repaying livestock, the transfer of livestock through bridewealth is an important means by which families who have lost stock can recover. I remember asking a herd owner who had

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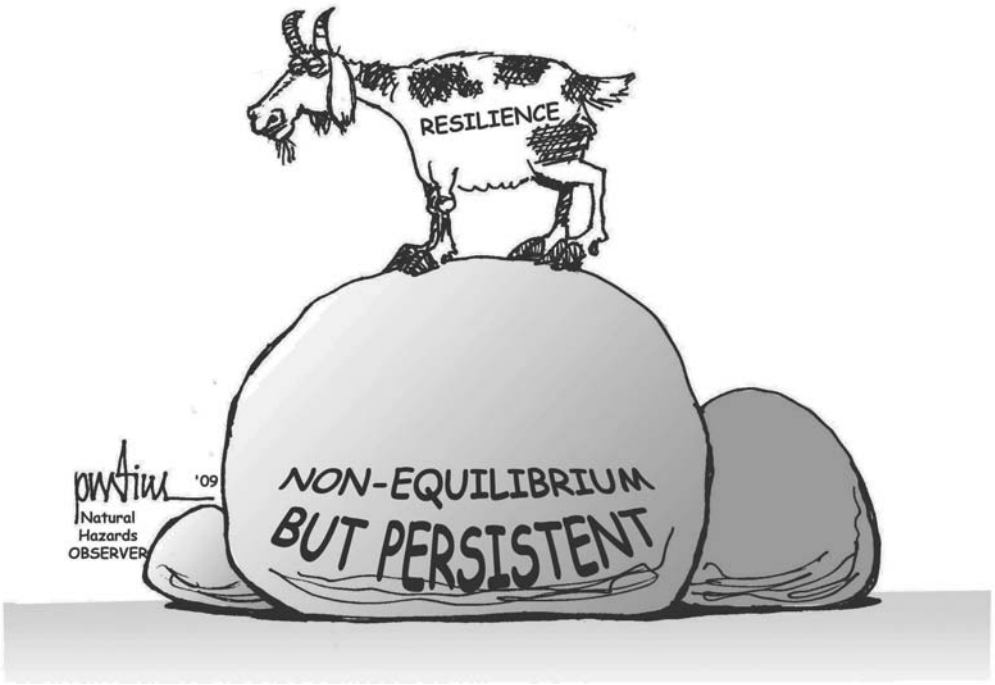

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lost over 60 percent of his herd to drought what he was going to do. He pointed to a neighboring encampment, saying, "See that man? He's rich. He has a number of unmarried sons living there. I may be poor in animals right now, but I have four daughters of marriageable age. Every time that they move, I move. I'm pretty sure that one or more of his sons will end up marrying my daughters."

An unexpected consequence of the relief camps was their impact on bridewealth. The Turkana view the connection of individuals and families made possible through the transfer of livestock as mutually beneficial. However, once someone went into a famine relief camp, the chance that that family would be a reliable partner greatly diminished. This was reflected in the collapse of bridewealth payments for young women living in the camps. Instead of transferring hundreds of animals, the family of the groom often transferred only a few goats and sheep, maybe a few cows or camels, as well as some household goods such as honey or blankets. Not only did the camps help to create their own victims, the camps undermined one of the critical social institutions that allowed families to recover from drought and rebuild their herds (McCabe 1990; McCabe 2002).

From Net to Resilience

The events just described had very practical significance. But extreme environmental events or shocks have real importance to social science theory as well. For anthropology, one can see an understanding of the role of shocks to the development of theory beginning in the 1970s. At the time many ecological anthropologists were using an ecosystem framework, trying to understand the role of humans in maintaining "homeostasis" or an ecological balance.

In 1975, Vayda and McCay published an article criticizing this approach as too static. They advocated instead a framework that examined how people cope with extreme events. It was the impact of these extreme events that shaped the direction of continuity or change in human-environmental interactions. Vayda and McCay were drawing on the earlier work in ecology of Holling (1973), examining the concepts of resistance and resilience in ecological systems. Vayda and McCay's proposed paradigm shift was not taken up by many anthropologists but did become popular in the fields of geography and sociology.

The importance of environmental shocks reemerged in the findings of the South Turkana Ecosystem Project that portrayed the Turkana environment as a "non-equilibrial but persistent ecosystem" (Ellis and Swift 1988). The structure and dynamics of the system were controlled by climate and frequent but unpredictable occurrences of drought. My book, *Cattle Bring Us to Our Enemies: Turkana Ecology, Politics and Raiding in a Disequilibrium System* (McCabe 2004) examines how understanding an arid or semi-arid environment helps explain human decision making with respect to mobility and the management of natural resources.

Today, a new paradigm of human and environmental relationship is developing in the form of resilience theory. Resilience is defined as "the capacity of a system to absorb disturbance and still retain its basic structure and function" (Walker and Salt 2006). There are a number of key issues to be addressed within a resilience framework. The first is that we all live within linked social and ecological systems. The second is that social-ecological systems are complex adaptive systems. They do not change in linear or predictable ways. They have the capacity to change rapidly, shifting in ways that fundamentally change the system. In resilience terms, they undergo a regime shift and may reorganize into alternative steady states.

Extreme environmental events have played an important role in the development of social science theory and will continue to do so. How these institutions function should be a critical component of social science research in the field of natural hazards.

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References

Ellis, James E., and David Swift. 1988. Stability of African pastoral ecosystems: Alternative paradigms and implications for development. *Journal of Range Management* 41 (6): 450-459.

Holling, C. S. 1973. Resilience and stability of ecological systems. *Ecological Systematics* 4: 1-23.

McCabe, J. Terrence. 1990. Success and failure: The breakdown of traditional drought coping institutions among the Turkana of Kenya. *Journal of Asian and African Studies* XXV (3-4): 146-160.

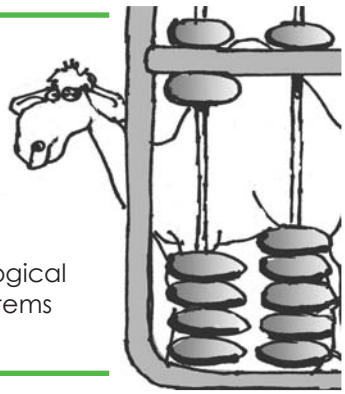
— 2002. The role of drought among the Turkana of Kenya. In: *Culture and Catastrophe.* Oliver-Smith, Anthony and Hoffman, Susanna, eds. School of American Research Press.

— 2004. *Cattle Bring Us to Our Enemies: Turkana Ecology, History, and Raiding in a Disequilibrium System.* University of Michigan Press.

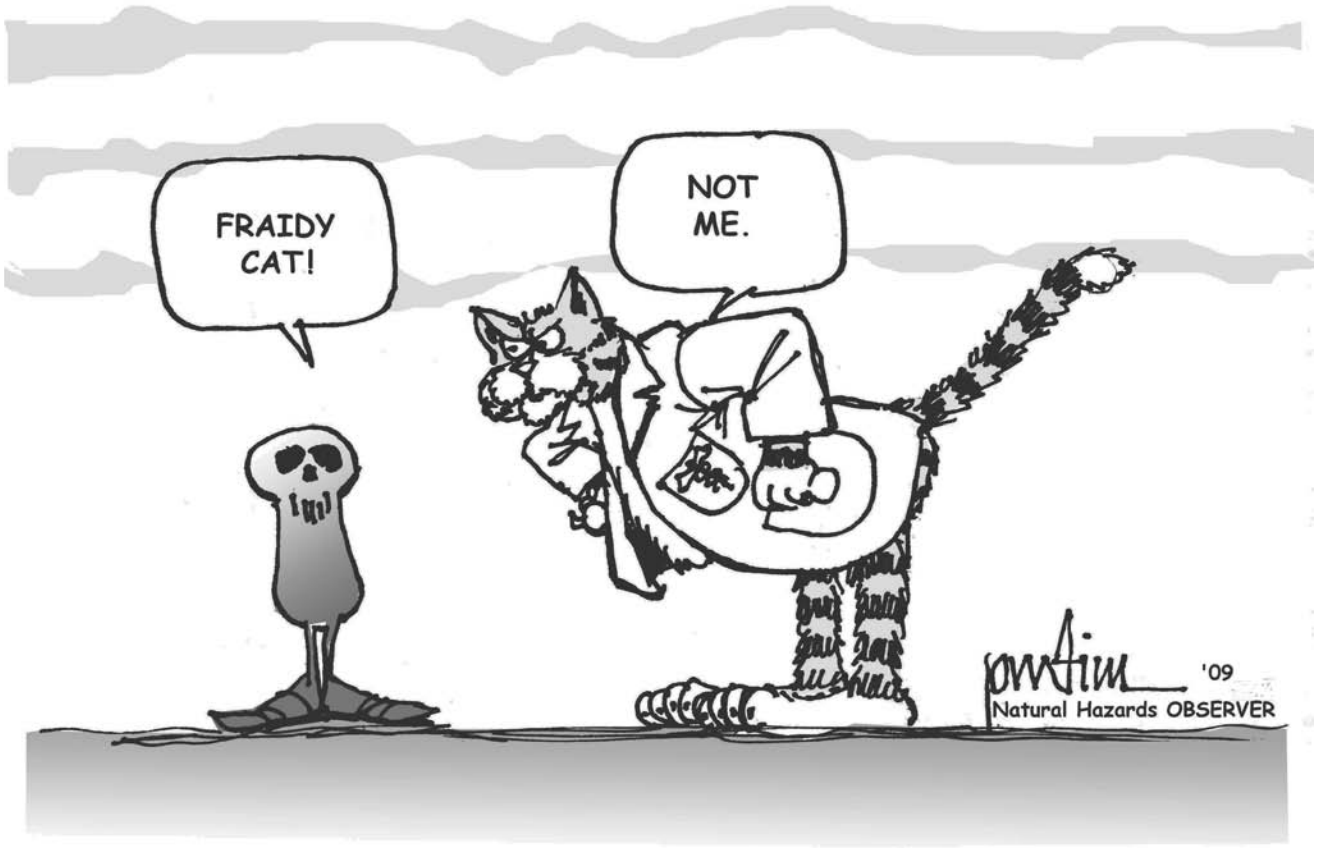
Vayda, Andrew P., and Bonnie McCay. 1975. New directions in ecology and anthropology. *Annual Review in Anthropology*: 293-306.

Walker, B., and D. Salt. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington: Island Press.

Today, a new paradigm of human and environmental relationship is developing in the form of resilience theory. Resilience is "the capacity of a system to absorb disturbance and still retain its basic structure and function." There are a number of key issues to be addressed within a resilience framework. The first is that we all live within linked social and ecological systems. The second is that social-ecological systems are complex adaptive systems.



Will Emergency Workers Show Up for Work?



In Barcelona in 1651, master tanner Miquel Parets lost his wife, his two older sons, and his only daughter to the plague. Only he and his four-year-old son Gabrielo survived. Parets wrote in his diary that no midwife was prepared to assist a plague-stricken mother giving birth. Priests would not provide the sacraments, even the last rites. Monks offered Communion at the end of a rod to avoid direct contact with the victims (Parets 1991).

On one level, Parets' small book is an account of one family's tragedy. But on another, it can be seen almost as a mid-17th century assessment of disaster management—one which, if you didn't know its provenance, might sound remarkably modern. In 1651 Barcelona, city authorities organized an evacuation of the city, isolated people to try to check the spread of the disease, distributed food ("badly organized," the tanner says), provided emergency health services, dealt with people too poor or otherwise unable to evacuate, disposed of corpses, handled mental health issues, anticipated where issues would arise next, provided emergency shelters ... and so on.

The seventeenth century plague and other more modern events offer lessons in a growing area of concern in the face of the emerging H1N1 flu epidemic—whether health workers will show up for work in a disaster. Several recent studies have indicated that there may be workforce reductions at hospitals when people decline to come to work in a disaster, especially those involving a biological agent or radiation (*Natural Hazards Observer* July 2009).

But the lessons of history, of other disasters, and the actual behavior of emergency workers—as opposed to what they say they'll do in the abstract—give reason to believe that most do not succumb to "role abandonment."

In *A History of Plague 1345-1730,* William Naphy and Andrew Spicer (2001) describe situations similar to Barcelona's when the plague struck London in 1665:

(See "Role Abandonment," continued on page ten)

Excerpts from:

A Journal of the Plague Year

By Miquel Parets
Translated and edited by James S. Amelang

How the sacraments were administered during the plague (Barcelona, 1651 CE)

The plague kept spreading in late April and early May. The dead and the sick were now carried in heaps to the pesthouse of Jesus, and the vicars in charge of the parishes either fled or died. Since none of the priests wished to serve as vicars and administer the sacraments, monks were sent to all the parishes to administer them.

The number of monks varied according to the size of the parish, and they ate and drank and lived in the vicarages and walked around with their robes cut short up to their knees. If there were two in a parish one went in front confessing and the other carried the Holy Sacrament behind him.

(See "Plague Year," continued on page eleven)

Role Abandonment ...

(Continued from page nine)

> Many officeholders and people in positions of responsibility were fleeing the city and their civil responsibilities. … The authorities (or those who remained) were powerless to halt the tide of fleeing refugees.

C.V. Wedgwood, writing in a 1965 issue of the *New York Times Magazine* says the wealthy left London, tradesmen closed their shops, clergy abandoned their parishes, and "most of the doctors followed their wealthy patients into the country."

In fact, it may not be relevant whether physicians stayed in London or other cities during past pandemics. In the 17th century, physicians looked after their own patients, persons who paid them. Those people were usually wealthy enough to flee the city during a plague and their physicians went with them. The idea that physicians had an ethical duty to care for the sick during an epidemic did not become common until the early nineteenth century (Wallis 2006).

Centuries later, in 1952, after his study of the Texas City explosion—when 2,300 tons of ammonium nitrate aboard the vessel *Grandcamp* exploded in the town's harbor in 1947, killing over 600 people—Lewis Killian concluded:

> The great majority of persons… involved in such dilemmas [family versus work] resolved them in favor of loyalty to the family or, in some cases, friendship groups (Killian 1952).

In 2006, Jacalyn Duffin, professor of History of Medicine at Canada's Queen's University and co-editor of *SARS in Context*, wrote that when an unknown disease strikes, doctors and nurses, will sicken, even die, along with their patients:

> This discouraging lesson pales in contrast to another: medical cowardice will arise. For every valiant doctor who died from the disease being fought, another ran away (Duffin 2006).

Recently, Ron Balicer (2006) and others surveyed health workers in Maryland. They reported in *BMC Public Health* that roughly half said they would not report to work during a pandemic. Lori Masterson (2009) and others did a roughly comparable study in urban and Midwestern hospitals and report in *The Journal of Emergency Medicine* that a willingness to report to work dropped when a biological or radioactive agent was involved.

Finally, in a study published in the July 24 edition of the journal *PLoS ONE*, "Approximately one in six public health workers said they would not report to work during a pandemic flu emergency regardless of its severity, according to a survey led by researchers at the Johns Hopkins Bloomberg School of Public Health. The findings are a significant improvement over a 2005 study conducted by the same research team, in which more than 40 percent of public health employees said they were unlikely to report to work during a pandemic emergency." The study also found that workers who thought their jobs were important were more likely to come in during a pandemic (Barnett 2009).

No Role Abandonment

All these examples seem to show there may be a serious problem getting medical personnel and others with emergency responsibilities to do their duty when a pandemic strikes. However, it is not clear that these anticipatory questions reflect what happens in an actual emergency. There is substantial evidence that what sociologists call "role abandonment" does not happen.

It is possible that a pandemic may raise different problems. It builds up over time. It gives those involved time to ponder. It will likely be a highly contagious disease. Anyone in contact with victims has every reason to believe he or she could become a victim, too. Many could think quite rationally that helping someone could be fatal.

In London in 1665, for example, many prominent persons did remain despite the plague. The Archbishop of Canterbury remained. The apothecary William Boghurst stayed in town, as did Dr. Hodges, and eight or nine other physicians, some of whom died as a result. Three other physicians agreed to stay specifically to deal with plague victims. Thomas Witherley, Edward Harman, and Thomas Gray became what amounted to the first Medical Officers of Health. They were given an initial payment of 20 pounds and then paid 70 pounds a year in two installments—provided they were still alive when the payments became due (Leasor 1961).

Samuel Pepys, the diarist, makes no reference to clergy leaving. He even mentions in his diary the text for a sermon used by his vicar. Another diarist, John Evelyn, notes on December 3rd his vicar at Deptford, Dr. Robert Bretton, also remained (Wheatley 1897). On December 10, 1665, at Greenwich, however, Evelyn notes that the person preaching was a stranger. Pepys had a dim view of Bretton, whom he refers to as "Britton" and calls him "that conceited fellow."

There is also no evidence—as is stated by one historian—that the Bishop of London warned priests they would lose their livings if they fled London. No such statements show up in the Bishop's papers in the Bodleian library in Oxford though there is one letter that refers to a decision to expel a priest—he was sent to Jamaica—who had supported the Puritans.

As for survey research, it assumes that people will do what they say they will do. It does not report actual

behavior. As Dennis Wenger and colleagues found out, people tend to believe the myths about individual behavior in disaster because these myths are so frequently reported by the mass media. However, no matter what people think about disaster, they behave differently. They may think people panic—but they don't. They may think victims will be dazed, confused, and in shock—but they act very rationally. They may think looting is a problem—but it seldom is (Wenger 1980). It is reasonable to assume that these recent surveys may also be flawed. People say they may not report for duty in a pandemic. But when pandemic strikes they may well do so. Studies of actual behavior in disaster support that conclusion.

Meda Miller White interviewed 128 members of various disaster relief organizations in three communities that had been hit by tornadoes:

> In our random sampling of 128 members of disaster relief organizations, we found that 77 percent did their jobs first, without serious diversion to family roles. Another five percent were doing rescue work as individuals, so in all 82 percent contributed to disaster relief as the first thing they did. Furthermore, some persons who had first tended to family, or else had done nothing, later came to work. By the end of the first four hours, 89 percent had worked at disaster relief. *Not a single person abandoned ongoing disaster work to be with his family* (White 1962).

Russell Dynes and E. L. Quarantelli found the same thing:

> In sum, in examining a sample of 413 persons who held positions in emergency-relevant organizations, *not one abandoned his/her emergency role obligations to opt for familial role obligations*…. Consequently… not a glimmer of support exists for the usual predictions about the consequences of role conflict in emergency situations. The empirical cupboard is so bare that there are no anecdotes to support the conventional wisdom (Dynes and Quarantelli 1985).

Both those findings were so overwhelming—neither White nor Quarantelli and Dynes found a single case of role abandonment—that further research seemed pointless. In addition, research by Fritz and Mathewson (1957) and by Scanlon (1991) documented that in emergencies the real problem is not lack of personnel but too many personnel. This research on "convergence" has never been challenged.

However, there are problems. The studies by White and by Dynes and Quarantelli focus on fast onset events. Those involved had to make an immediate decision about what to do. Second, they focused on destructive incidents that happened, then moved on. Those interviewed were for the most part not exposed to danger when they responded. Third, those interviewed belonged to organizations

(See "Role Abandonment," continued on page twelve)

Plague Year ...

(Continued from page nine)

Each carried a torch, for when confessing the sick the torch was held between the priest and the sick person, and they kept their distance because it is said the plague is carried by one's breath.

Thus they stayed far apart and they did not spend a long time with the confessions. When giving Communion they extended the Holy Sacrament on the end of a silver rod in order not to touch the sick person, and they gave them Communion and the last rites at the same time in order not to have to return.

When they went out to give the last rites they didn't do it just for one or two persons. Instead people went to the vicarage and wrote down the name of the street and of the house, and since there were so many sick at that time, the priests went around in turn to visit the sick and to give out food to everyone.

In the parish of St. Mary's, many times when they went out at the height of the plague they gave Communion to seventy or eighty persons before returning home. Thus the poor monk was exhausted when he returned to the church from such a long walk and from having climbed so many stairs, for most of the sick were up in attics in order for them not to have contact with anyone save the person nursing them.

When giving out Communion, no priest came along, just the monk who carried the remonstrance and the sacristan who carried the torch.

How plague continued in Barcelona in June and July

The provision of food during the plague was badly organized, both in the pesthouse and in the city. Many died in the pesthouse for lack of food who would not have died had things been better organized, and there were many who after arriving in the pesthouse died without having been seen by a doctor or surgeon.

And all the doctors and surgeons in the pesthouse were very young fellows without much experience, because it was so hard to find doctors willing to go there, especially after some of the first ones died. In the city there were a few good doctors and some came from Girona and Olot who had some experience with the disease, and the city gave 10 pounds to each of them, surgeons as well as physicians.

Of the great suffering the plague caused

The sick had to find someone, man or woman, who would nurse them for pay. These persons received 12 or 14 *reals*, along with expenses for each day they took care of the sick and they also arranged for payment of their quarantine after the sick person was either cured or dead, for which they charged 18 or 20 pounds and some even more … The demand for nurses was so great that when they left one house they went to another, and even then they were hard to find.

Role Abandonment ...

(Continued from page eleven)

that either have or see themselves as having clear-cut emergency roles: persons in police and fire departments, civil defense, hospitals, utilities, the mass media, and voluntary organizations such as the Red Cross. Only one religious organization was included—the Salvation Army, which prides itself on emergency response.

It is possible that a pandemic would raise different problems. It builds up over time. It gives those involved time to ponder. It will likely be a highly contagious disease. Anyone in contact with victims has every reason to believe he or she could become a victim, too. Many could think quite rationally that helping someone could be fatal. In the past, many of those who decided to evacuate were in positions where their emergency responsibilities, if any, were less clearly defined. Does a priest have to keep preaching when his flock may be at risk if they gather to hear him? There is no easy answer.

It is certainly true that people have concerns about family. Police in Edmonton after the 1987 tornado radioed colleagues and asked them to check on their families. Persons who are with their families when disaster strikes may try to see that their families are safe before reporting to work. And there is some evidence people are more likely to respond if they see their role as important. That in fact did show up in both of the recent surveys.

So What Are We to Believe?

Well, the growing literature on the 1918-20 influenza pandemic shows no evidence that medical personnel shirked their responsibilities. Our review of the literature—which is ongoing—has turned up reports of medical and other emergency personnel becoming sick and in some cases dying. That was sufficient to lead to staffing problems. But we have found no evidence that healthy persons failed to show up for work.

Nevertheless, there is no specific research on this topic—no study of what actually happened when people with emergency responsibilities face a pandemic. In short, as is often the case, there is need for further research. On balance, however, it would appear that the survey data is misleading. No matter what people say when asked, when a crisis actually strikes—even a pandemic—emergency personnel, including medical personnel, will respond if they are well enough to do so. Pandemic influenza will definitely strike medical personnel and it will lead to staff shortages. But, based on the evidence available, those shortages will not result because of an unwillingness of emergency personnel to meet emergency responsibilities.

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References

Balicer, Ron D., et al. 2006. Local public health workers' perceptions to responding to an influenza pandemic. *BMC Public Health*. www.biomedcentral.com/471-2458/6/99.

Barnett D.J., R.D. Balicer, C.B. Thompson, J.D. Storey, S.B. Omer, et al. 2009. Assessment of local public health workers' willingness to respond to pandemic influenza through application of the extended parallel process model. *PLoS ONE* 4 (7): e6365. doi:10.1371/journal.pone.0006365.

Duffin, Jacalyn, and Arthur Sweetman. 2006. *SARS in Context.* Montreal: McGill-Queen's University Press.

Dynes, R.R., and E.L. Quarantelli. 1985. Role simplification in disaster. *Role Stressors and Support for Emergency Workers* Center for Mental Health Studies of Emergencies Rockville, Maryland: National Institute of Mental Health.

Fritz, Charles E., and J. H. Mathewson. 1957. *Convergence Behavior in Disasters: A Problem in Social Control* Washington*:* Committee on Disaster Studies. Disaster Research Group.

Killian, Lewis M. 1952. The significance of multiple-group membership in disaster. *American Journal of Sociology* LVII (4): 311.

Leasor, James. 1961. *The Plague and the Fire.* London: McGraw-Hill Book Company, Inc.

Masterson, Lori, et al. 2009. Willingness to respond: Of emergency department personnel and their predicted participation in mass casualty terrorist events. *The Journal of Emergency Medicine* 36 (1): 43-49.

Naphy, William, and Andrew Spicer. 2001. *A History of Plague 1345-1730.* Stroud, Gloucestershire: Tempus Publishing Ltd.

Natural Hazards Observer. 2009. Hospitals should anticipate workforce reductions in disasters. XXXIII (6): 4.

Parets, Miquel. 1991. *A Journal of the Plague Year.* Edited and translated by James S. Amelang. New York: Oxford University Press.

Scanlon, Joseph. 1992. *Convergence Revisited: A New Perspective on a Little Studied Topic* Boulder: University of Colorado.

Wallis, Patrick. 2006. Plagues, morality and the place of medicine in early modern England. *English Historical Review* CXXI (490): 1-24.

Wedgwood, C. V. 1965. When Black Death stalked London. *New York Times Magazine* September 12.

Wenger, Dennis, Thomas James, and Charles Faupel. 1980. *Disaster Beliefs and Emergency Planning* Newark, Delaware: Disaster Research Center.

Wheatley, Henry B., ed. 1897. *The Diary of Samuel Pepys.* London: George Bell & Sons IV: 516.

White, Meda Miller. 1962 *Role Conflict in Disasters: Not Family but Familiarity First.* Chicago: University of Chicago.

Resources

Below are brief descriptions of some of the resources on hazards and disasters that have recently come to the attention of the Natural Hazards Center. Web links are provided for items that are available free online. Other materials can be purchased through the publisher or local and online booksellers.

All of the material listed here is available at the Natural Hazards Center Library. For more information contact librarian Wanda Headley at wanda.headley@colorado.edu

Climate Change

Informing Decisions in a Changing Climate. By the National Research Council of the National Academies. 2009. ISBN:978-0-309-13737. 188 pp. $35.10 (softcover) or $30 PDF download. The National Academies Press. www.nap.edu.

Past climatic conditions are no longer a reliable guide to the future. People, governments, and private organizations are not prepared for this change. They are asking the federal government to provide them with the information they need to make their way toward the future. This book provides "a framework and a set of strategies and methods for organizing and evaluating decision support activities related to climate change."

Not surprisingly perhaps, the distinguished panelists found that the same principles that make good decision making in other areas can be applied to the response to climate change. They suggest that government decision support efforts should "(1) begin with users' needs; (2) give priority to process over products; (3) link information producers and users; (4) build connections across disciplines and organizations; (5) seek institutional stability; and (6) design processes for learning."

The report came about at the request of several government scientific, regulatory and research agencies for decision support strategies. It offers nine recommendations for their roles in the future of climate decision making.

Dire Predictions: Understanding Global Warming. By Michael E. Mann and Lee R. Kump. 2008. ISBN: 978-0-7566-3995-2. 208 pp. $25 (softcover). DK. www.dk.com.

War, famine, pestilence, and death—all in four-color, glossy graphs and photos. This is the book you've been waiting for if you need a way to explain climate change and its impacts to your brother-in-law at Sunday dinner. The seriousness of climate change has been a hard sell to the American populace, lacking what University of Colorado senior scientist Mickey Glantz has called "the dread factor." By this he means something that is severe enough and immediate enough to scare the lethargic American public into action. Somehow the battle cry "Don't Buy Beachfront Property!" hasn't rallied the troops.

Dire Predictions may end all that. Subtitled *The Illustrated Guide to the Findings of the IPCC (Intergovernmental Panel on Climate Change),* the book leads readers from the physics of greenhouse gases to the looming extinction of the polar bear in beautiful pictures and easily intelligible charts and graphs.

From the hazards point of view, the book presents an all-too-convincing case of rising seas, increased drought in some places, increased flooding in others, less water, more famine, increased rates of extinction among species, and loss of ecosystem resilience.

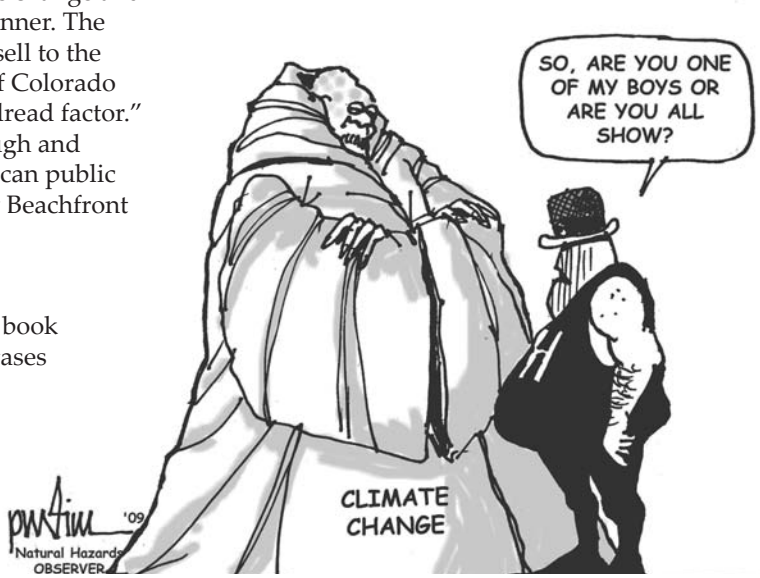
The last chapter of the book deals with potential steps for dealing with climate change. There is nothing here you haven't thought of before—energy conservation, wind power, electric cars, green building, planting trees—but they are presented clearly in the context of the overall issue.

The "dread factor" for the dwindling population of climate contrarians is that whatever steps are taken to control climate will be so costly that they won't allow economic growth to the level to which we'd like to become accustomed. But while these folks often cite the benefits of the unfettered carbon economy, they seldom cite the costs. Mann and Kump point out: "A prominent economist, William Nordhaus, estimates the present SCC (social cost of carbon) at US$30 (per ton). In other words, the typical American, who drives 10,000 miles per year and thereby emits a ton of carbon into the atmosphere, is imposing a cost of $30 on society. To add insult to injury, this cost impacts society both now and in the future, and the driver is not penalized for all these damages … According to Nordhaus, emission reductions over the next several decades could save the global economy US$3 trillion."

2009 Global Assessment Report on Disaster Risk Reduction: Risk and Poverty in a Changing Climate. By the United Nations International Strategy for Disaster Reduction. ISBN: 978-92-1-132028-2. 207 pp. free download at www.preventionweb.net/english/hyogo/gar/report/documents/GAR_Prelims_2009_eng.pdf.

This is the first biennial global assessment of disaster

(See "Resources," continued on page fourteen)



Resources ...

(Continued from page thirteen)

risk reduction for the UN's International Strategy for Disaster Reduction (ISDR). There is an old bumper sticker joke, "Rich or poor, it's good to have money." This is especially the case in disasters. This report finds conclusively that "disaster risk is disproportionately concentrated in developing countries." Exposure to hazards may be similar, but more poor people and more of their economic infrastructure is exposed to disruption.

Take drought, just as one example among many. Many more people in China are exposed to drought each year—about 300 million. But nearly 40 percent of the entire populations of Gambia and Niger are at risk. Or earthquakes. The people most at risk of dying in a quake live in Myanmar, Colombia, and Guatemala.

There is another issue that this report explores: "Within developing countries, disaster risk is also spreading extensively, manifested as a very large number of low-intensity impacts, affecting significant areas of a country's territory … Such risk patterns are expanding rapidly, driven by factors such as fast—but poorly planned and managed—urban growth and territorial occupation, which increase both the number of people and assets exposed."

The report offers a 20-point plan to reduce risk, starting with accelerated efforts to avoid dangerous climate change, through strengthening the capacity of disaster-prone countries to develop the policy and governance frameworks necessary to make them more disaster resilient.

Understanding Climate Change Adaptation: Lessons From Community-based Approaches. By Jonathan Ensor and Rachel Berger. ISBN: 978-1-85339-683-0. 192 pp. $29.95 (softcover). Practical Action Publishing. www.practicalactionpublishing.org.

Understanding Climate Change Adaptation takes a case study approach to just about every natural hazard that the developing world is likely to face with climate change. It's a litany of harsh news: flooding in Bangladesh; flash floods in Nepal; drought in Kenya; hazardous weather in Peru. While acknowledging the difficulties the residents—mostly poor farmers—face, it offers some hopeful perspectives on the ways in which these people adapt to changing circumstances. A project in Bangladesh, for instance, built social capital among residents of flood-prone embankments with voluntary community groups, developing livelihoods, generating income, and introducing technology.

In Nepal, project officers were able to build the confidence of farmers to introduce new techniques for reducing environment hazards, improving livelihoods, and demonstrating disaster reduction.

The projects were successful because they operated within the cultures of the areas. One lesson from this book is that adapting to climate change and the hazards it poses will require a long-term commitment on all sides.

All Hazards

Your Problem, Our Story. By Philip Algar. 2008. ISBN: 978-0-9540595-2-1. 312 pp. $26.25 (softcover). Matfield Books. www.matfieldbooks.com.

Many people consider the news media a nuisance, but at the top of that long list are companies who have just had an industrial accident. Consider Bhopal or the *Exxon Valdez*. Company managers seldom deal with reporters. Likely the only time they see those ink-stained wretches in full cry is after a disaster.

Philip Algar has written a how-to book for management response to the news media in the wake of emergencies. His advice is as fundamental as it is rarely followed. Plan ahead. Tell the truth. Be thorough. Algar also suggests basic communications training for companies, including running disaster response exercises for media inquiries. "The main objective of crisis or emergency management," Algar writes, "is to minimize the damage to people, environment, property, and the company's reputation, an important corporate asset … Journalists believe that large companies, in particular, should be sufficiently organized to minimize the possibility of accidents and then, if something goes wrong, to communicate effectively."

Risking House and Home: Disasters, Cities, Public Policy. John M. Quigley and Larry A. Rosenthal, editors. 2008. ISBN: 978-0-87772-427-8. 242 pp. $24.95 (softcover). Berkeley Public Policy Press. igs.berkeley.edu/publications.

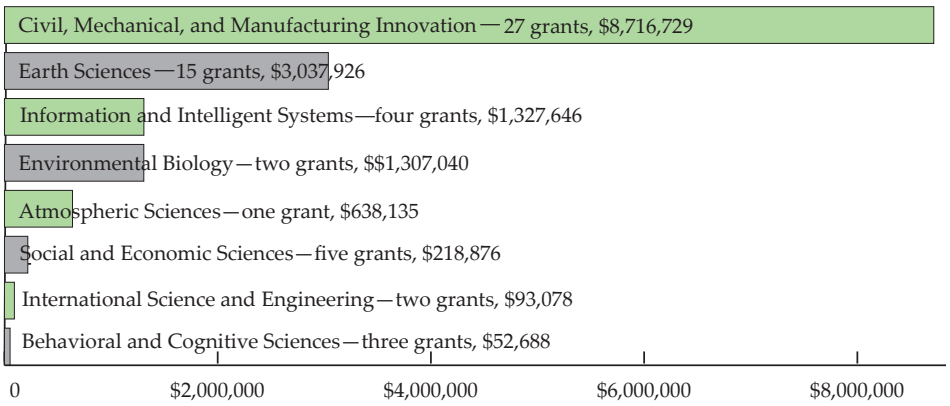
This collection of research essays deals primarily with the economic impacts of disasters and the steps individuals and governments take—or don't take—to reduce them. In the introduction, the editors say, "Several general points are suggested by this collection as a whole. First, experience with the lowest-probability, highest-gravity risks shows that markets and governments may necessarily fail to prepare for and respond to them as well as they might. Second, the most promising types of government action may be those persuading *households to mitigate their own risk privately*. Third, more comprehensive forms of all-risk insurance and loss mitigation are available to us in principle, but the trade-offs from lowered consumption, increased savings, regulatory and transaction costs, and high-capital reinsurance funds maybe exorbitant." (Emphasis in original.)

There is an interesting essay in the book about the writing of earthquake insurance in California. Given the state's history with earthquake risk, you'd think it would be easy. It turns out not to be the case. The reasons (if I'm reading this right) are twofold—insurers don't want to sell it, and homeowners don't want to buy it. Earthquake insurance in California is available through a public-private partnership called the California Earthquake Authority. But at the end of 2004, only 14 percent of California's residents were insured against earthquakes, down from a level of 31 percent eight years earlier. The offerings from the CEA lack flexibility in coverage options and face sales constraints.

The group has trouble getting the word out to potential buyers. "A final lesson," writes Georgia State University Professor George Zanjani, "is that there are real costs of production associated with underwriting earthquake risk. The aversion of private underwriters to earthquake risk partly reflects the high costs of managing that risk. In particular both the CEA and private underwriters protect themselves with reinsurance, which is well known to be expensive for catastrophic risks such as earthquake."

Contracts and Grants

Below are descriptions of some recently awarded contracts and grants related to hazards and disasters.
An inventory of awards from 1995 to the present is available at www.colorado.edu/hazards/resources/grants/



National Science Foundation Hazards-related Funding

June 14 to August 8, 2009
(by funding division)

Total hazards funding for period:
$15,392,118

Environmental effects of the coal ash spill and remediation at Kingston, Tennessee. National Science Foundation award #0935972. One year. $105,393. Principal investigator: Avner Vengosh, Duke University, vengosh@duke.edu.

The December 22, 2008 coal ash spill at the Tennessee Valley Authority's Kingston coal-burning power plant has provided a unique opportunity to study different environmental impacts of coal-ash derived metals on a regional scale. A preliminary investigation has revealed trace metals like arsenic, strontium, and boron are easily mobilized from coal ash sludge and dissolved in ambient surface water. Furthermore, it was found that mercury is enriched in the downstream river sediments, reflecting transport and mixing of the ash sludge with river sediments. This research will investigate the environmental impacts of the coal ash spill and the remediation activities proposed by TVA. In particular, this study will focus on: (1) the critical water/sediment ratio at which the content trace metals from ash leaching begin to impact water quality; (2) the transport and accumulation of ash in downstream river sediments; (3) the potential of sulfate-reducing bacteria to generate methylmercury in the downstream anaerobic river sediments; and (4) the suitability of boron and strontium isotopes as geochemical tools for elucidating coal ash metals in aquatic systems.

Doctoral dissertation research in political science: Rethinking the institutional basis of urban development—Hurricane Katrina and neighborhood recovery efforts in New Orleans. National Science Foundation award #0921058. One year. $12,000. Principal investigator: John Oliver, University of Chicago, eoliver@uchicago.edu.

In the urban development literature, social capital is considered essential to community development. Yet empirical evidence that supports this claim has been mixed. In light of the gap between theoretical justifications and empirical findings, this project will examine the following questions: Are poor neighborhoods any different from their richer counterparts in terms of their organizational pattern and density, and how is it associated with community development? To what extent is social capital effective in promoting urban development, and which aspect of social capital is associated with the processes of urban development? Ultimately, what are the political and social forces that shape the topography of social capital in urban areas?

The research will answer these questions by looking at the effects of New Orleans's pre-existing neighborhood institutions on the pace and scope of recovery after Hurricane Katrina. Using GIS, the investigator reconstructs the topography of local institutions that existed before Hurricane Katrina and statistically analyzes whether there is an association among poverty, local institutional arrangements, and post-Katrina resettlement. Inteviews with public housing residents and authorities will shed light on the extent to which political forces shape the characteristics of social capital at the local level.

US-Africa: Workshop for the evaluation, monitoring and communication of volcanic and seismic hazards in East Africa. National Science Foundation award #0913230. One year. $59,675. Principal investigator: M. Meghan Miller, UNAVCO, Inc., Meghan@unavco.org.

This workshop, led by Meghan Miller of UNAVCO, will be convened at the International Centre for Theoretical Physics in Trieste, Italy, for United States, African, and European participants. It will develop and enhance plans for investigations of processes leading to volcanic eruptions and large earthquakes in continental rift zones, with emphasis on the evaluation, monitoring, and communication of volcanic and seismic hazards in East Africa. The two-day workshop will precede a two-week professional development course for African geoscientists supported by ICTP, the International Council for Science, the African Union, the Royal Society/Natural Environment Resource Council of the UK, and UNAVCO, to provide strategic guidance to the international community based on lessons learned from natural hazards in Africa and elsewhere. The goals of the NSF-funded pre-meeting

workshop are to establish a new initiative for cooperation in East Africa, to design programs to comprehensively evaluate and monitor the time and length scales of plate boundary and volcanic deformation, and to develop networks for exchange of ideas and expertise.

Kinematic and dynamic rupture characterization of the 2008 Ms 8 Wenchuan earthquake sequence. National Science Foundation award #0911769. One year. $361,394. Principal investigator: Chen Ji, University of California-Santa Barbara, ji@geol.ucsb.edu.

The May 12, 2008, Mw 7.9 Wenchuan, China earthquake was the largest intraplate earthquake recorded by modern geophysical observations. It ruptured unilaterally about 250 kilometers beneath the predominantly northeast-trending Longmen Shan, a steep, high mountain range that bounds the Tibetan Plateau to the northwest and the Sichuan Basin to the southeast. The strong ground shaking caused over five million buildings to collapse and nearly 70,000 fatalities. The occurrence of this major earthquake surprised most of the geoscience community because the source region historically lacks large earthquakes and has a very low slip rate based on geological and geodetic data.

This catastrophic earthquake and its aftershock sequence will be investigated with seismic, geodetic and geological observations. The rupture process will be constrained to match the tectonic background and surface observations, consistent with rupture dynamics. Quantitative understanding of such giant intraplate earthquakes and their aftershocks can contribute to hazard analysis that will ultimately be useful for guiding societal response for the future events. There are many areas in United States with very low strain rates—e.g., New Madrid, and Charleston—where large magnitude events have occurred. This research provides an opportunity for understanding the character and processes of intraplate earthquakes in areas of low strain rates.

Laboratory earthquakes: Characterization of ground motion and stress states in complex rupture scenarios using high resolution optical diagnostics. National Science Foundation award #0911723. Three years. $405,000. Principal investigator: Ares Rosakis, California Institute of Technology, rosakis@aero.caltech.edu.

This research will focus on a unique experimental capability for generating earthquake-like ruptures under controlled laboratory conditions. The experiment features a model specimen with an interface that simulates a natural fault in the earth's crust. The assembly is held together by static friction under the action of an applied compressive load which mimics natural tectonic stresses. Seismic slip induced within the specimen results in a dynamic rupture that propagates along the fault while radiating seismic wave energy into the body of the specimen. A well instrumented laboratory earthquake setup provides a versatile testing capability for investigating complex seismological phenomena such as dynamic frictional sliding, radiated ground motion, supershear ruptures, and dynamic rupture processes associated with complex geometries. Work will target the development and integration of new optical diagnostics for the precise measurement of the resulting particle (ground) motion and associated stress fields in these experiments. A full suite of optical diagnostics, such as time resolved interferometry techniques and high speed digital photography will enable high resolution measurements of stress and ground motion at an array of fixed measurement stations in addition to full field characterization of radiated wave fields.

Theoretical earthquake nucleation, with applications to creep fronts, tremor, and slow slip. National Science Foundation award #0911378. Three years. $271,351. Principal investigator: Allan Rubin, Princeton University, arubin@princeton.edu.

Traditionally, faults were thought to accommodate slip in one of two ways: stick-slip motion, in which long periods where the fault is essentially locked are punctuated by brief episodes of rapid slip (earthquakes); and steady creep at plate tectonic rates (centimeters per year) or less. The discoveries within the last decade of episodic slow slip and associated tremor within numerous subduction zones, and tremor along the San Andreas fault, show that fault behavior is much more varied. In episodic slow slip, faults slip at rates one to two orders of magnitude larger than plate tectonic rates at quasi-regular intervals on the order of one year. Because the slip episodes last for several weeks and extend over areas tens to hundreds of kilometers across, they release energy equivalent to earthquakes of magnitude 6 or more. Tremor is a quasi-continuous seismic signal thought to be made up of myriad small events similar to regular earthquakes of magnitude 1.5 or less except in being more sluggish. Because slow slip events increase the stressing rate on the shallower locked portion of faults that can slip in magnitude 9 earthquakes, understanding them may prove to be useful for earthquake hazards reduction.

Modeling recent behavior of Mt. St. Helens: Extrusion dynamics, deformation, and seismicity. National Science Foundation award #0910708. Two years. $144,573. Principal investigator: Paul Segall, Stanford University, segall@stanford.edu.

It is generally believed that with adequate monitoring it is possible to detect premonitory signals prior to volcanic eruptions. Eruptions are often preceded by swarms of earthquakes and bulging of the volcano as magma rises from the earth's mantle into the crust. However, the length of the period of unrest can vary greatly, and eruptions can be either explosive or passive. The 2004-08 eruption of Mount St. Helens erupted magma with essentially the same chemical composition as the devastating 1980 eruption. However this eruption was very gas poor and thus non-explosive. The 2004 onset was preceded by only a few days of seismic activity and no detectable ground deformation. We will develop rigorous physical and chemical based models of the eruption and test these against observed seismic and Global Positioning System measurements of ground deformation.

Estimating eruption model input parameters from direct observations of deeply eroded basalt conduits, San Rafael, UT. National Science Foundation award #0910696. Two years. $178,775. Principal investigator: Charles Connor, University of South Florida, cconnor@chuma1.cas.usf.edu.

Volcanoes create hazards for millions of people worldwide, including many living in parts of the United

States. Scientists can now forecast the timing of many eruptions at well-monitored volcanoes. Unfortunately, it is currently not possible to accurately forecast how explosive an eruption might be, because this depends on a large number of factors, such as the shape of volcano conduits and the composition of magma, most of which depend on processes operating in the deep subsurface and so are not directly observable prior to eruptions.

This project will investigate the geology of deeply eroded ancient volcanoes in the San Rafael desert of southern Utah. This unique geologic environment, where volcanoes have not erupted in millions of years, provides essential insight about processes operating in the subsurface during volcanic eruptions. We cannot observe these processes directly at currently erupting volcanoes, but we can interpret them from the features preserved in the geologic record. The research will combine geologic mapping with 3D terrestrial LiDAR imaging, geochemistry and petrological modeling, and analysis of the elastic properties of host rocks to develop a detailed understanding of the erosion and mixing processes that controlled formation of volcanic conduits of the San Rafael desert. The goal of these observations is to place geological and geochemical constraints on input parameters common to models of conduit flow and volcanic eruptions.

Risk-based design of seismic isolation for critical facilities. National Science Foundation award #0900324. Three years. $236,759. Principal investigator: Henri Gavin, Duke University, henri.gavin@duke.edu.

Lightly-damped rolling isolation systems are being used to protect mission-critical equipment from shock and vibration hazards. This project will develop experimentally validated models and seismic qualification guidelines for rolling isolation systems incorporating passive and controllable damping treatments. The passive damping treatments will use elastomeric composites and will be modeled and designed using a combination of experimental and semi-analytic methods. The controllable friction damping will feature magnetically controlled friction damping incorporating novel magnetically permeable polymers with high friction coefficients. It will be assessed using methods of nonlinear optimal control. This project will resolve persistent issues regarding displacement capacity, damping levels, damping mechanisms, and response control pertaining to the protection of equipment from earthquake hazards.

Statistical analysis of emergency services data. National Science Foundation award #0926814. Three years. $329,936. Principal investigator: Dawn Woodard, Cornell University, woodard@orie.cornell.edu.

Where should ambulances be placed to minimize the time required to reach calls for help? Emergency medical services providers increasingly rely on sophisticated operations research (OR) models for ambulance deployment. These models depend on reliable forecasts of call arrival rates over different parts of a city and at different times. Unfortunately, current forecasting methods are not very effective, and result in poor inputs to the OR models. This can lead to inefficient deployment decisions and long response times. The first part of this research will investigate advanced statistical methods for better estimating these arrival rates. The OR models also rely on accurate representations of travel times on road networks. Travel time estimation does not effectively use the wealth of GPS data that ambulances accumulate. The second part of this research will investigate advanced statistical methods for better estimating travel times on road networks.

Estimating the costs of an epidemiological externality from malaria control through indoor residual spraying in Uganda. National Science Foundation award #0922392. One year. $14,980. Principal investigator: Randall Kramer, Duke University, kramer@duke.edu.

Indoor residual spraying (IRS) of insecticides on interior surfaces of residential structures is currently one of the most cost-effective means of reducing transmission of mosquito-borne human diseases such as malaria. However, IRS remains a controversial malaria control strategy because of the potential environmental and human health impacts of the insecticides used. Dichloro-Diphenyl-Trichloroethane has been the preferred insecticide. The acute and chronic impacts of DDT exposure in humans remain uncertain. The negative environmental impacts from the widespread transport of DDT through ecosystems, while still uncertain, have been more clearly demonstrated, yet the costs of these impacts, when considered against clearly established costs of malaria-induced mortality and morbidity remain difficult to assess. Due to these uncertainties, policymakers must understand the conditions under which IRS is effective at reducing malaria transmission.

When do boulders move in steep mountain streams? National Science Foundation award #0922199. Three years. $349,547. Principal investigator: Michael Lamb, California Institute of Technology, mpl@gps.caltech.edu.

Most of the rivers in hilly and mountainous landscapes have small, steep channels, which are typically mantled by boulders that rarely move. These boulders moderate the rate of river incision, roughen the flow creating local patches of gravel, and provide crucial habitat for a variety of organisms. Coarse sediment can also become entrained by river floods, which rush downslope with destructive consequences. A semi-empirical theory for boulder mobility and step-pool formation will be developed and tested using a newly constructed state-of-the-art laboratory flume at the California Institute of Technology. The flume experiments will allow exploration of channel slopes (up to 30 percent) and grain sizes (up to 10 centimeters) that have been severely limited in past studies. Experiments will investigate the conditions under which boulders move and the mechanisms responsible for boulder organization into steps and pools. Data from these experiments will be used to test and validate predictive models for boulder transport and step-pool formation. The experimental and theoretical findings will be compared to observed flow conditions during boulder movement events in tributaries of the South Fork Eel River in the University of California Angelo Coast Range Reserve. Results from this project will aid in restoration and hazard mitigation efforts where assessing boulder mobility is needed for restoring stream habitat, as well as mitigating flood and debris flow hazards in steep urban areas.

FEMA Director Craig Fugate on ...

Survivors, Money, and *Star Trek*

Changing vocabulary is a first step in the effort to manage hazards and disasters as a partnership among the federal government, the states, the local governments and the community, Federal Emergency Management Agency administrator Craig Fugate says.

"I'm doing my little social science experiment. I'm changing vocabularies one word at a time," Fugate says, "We call people 'survivors,' not 'victims.' We've always looked at the public as a liability. Everything was based on the proposition that they were there waiting for people to take care of them."

He adds, "You can't look at the public as a liability. You have to look at them as a resource. The survivors are the ones we have to empower."

Fugate gave the opening keynote speech at the 34th Annual Natural Hazards Research and Applications Workshop in Broomfield, Colorado, on Thursday, July 16, 2009.

In his talk, Fugate continued a theme that was prominent in his confirmation hearings in April. In his opening statement at that time, before the U.S. Senate Committee on Homeland Security and Governmental Affairs, he said, "We have to begin looking at our citizens as a resource, not as a liability in our plans. We have to integrate and build capacity and capability at the local level, the state, and federal level. It has to incorporate the volunteer, faith-based and community-based organizations, and the private sector."

At the Workshop, Fugate reemphasized the cooperative and coordinated effort necessary to plan for, respond to, and mitigate hazards. "FEMA by itself is oftentimes nothing more than a funding mechanism," he says. "We may set policy and guidance and things through those mechanisms, but the bottom line is: It's money."

> "You can't look at the public as a liability. You have to look at them as a resource. The survivors are the ones we have to empower."
>
> —*Craig Fugate*

But all of the activity that goes into dealing with disasters "is really a team effort," he says. "It is not just FEMA. It is our parent agency the Department of Homeland Security, it's the entire federal family … But, hey, guess what? Who's got more fire trucks? Us or local and state government?"

Disasters are best managed locally, Fugate says, "But that doesn't mean they're by themselves."

Fugate was upbeat about the potential for new technology and social networking to provide information and education during disasters. Holding up his Blackberry, he said, "This is the tricorder of *Star Trek* fame. It's my communicator, it's geo-aware … I can send my location out. I can send pictures and video out. I can actually send out my observations, too."

He says that there has been some resistance in bureaucratic circles to using social networking information because "this is not official." He was optimistic about the possibilities of changing behavior because of the weatlth of information available from social networking. He cited the example of a rumor that spread in Florida that gasoline prices would be reaching five dollars a gallon after a hurricane knocked out some refineries. The information wasn't correct, but people nonetheless bought up gasoline supplies to try to beat the price increase.

Craig Fugate speaks with Chaman Pincha

This power to get people moving, changing behavior in the face of crises is an untapped potential resource in times of disaster, he said.

Fugate's "little social science experiment" appeared to have an immediate impact at the Workshop at least, as speaker after speaker in later sessions caught themselves mid-sentence, cutting off the word "victim" after the first syllable and replacing it with "survivor." He also persuaded everyone to call him "Craig," instead of "Mr. Fugate" or some other unwieldy title.

Reaction to Fugate's speech was positive. "I see a time of greater positive change coming to FEMA and the emergency management profession if Craig is given the time and support necessary to allow him to expand the vision that he created for emergency management in Florida to the whole country," said Bob Goldhammer of the International Association of Emergency Managers.

Emphasizing that he was speaking for himself and not for his organization, Goldhammer adds, "One might think that changes in FEMA operations and policies will happen quickly, but I don't think that will be the case. As fervent as Craig is, and as much as emergency managers want to see things happen, he will have to operate within the confines of a fairly well established hierarchy of duties and agendas.

"This constraint applies not only to FEMA but within government as a whole. It would be challenging enough to try to steer a new course for the agency if everything around it was stable, but with all the changes that are taking place within the federal government—especially with the new administration selecting new people for leadership positions—I believe it is going to take some months or longer to see the impacts of the policies that Craig is promoting," Goldhammer says.

— *Dan Whipple*

HUD's James Lopez on ...

Collaboration, Innovation, and Creativity

James Lopez

To transform the complexity of climate change and natural hazards into real change will take collaboration, innovation, and creativity, according to Jim Lopez, senior advisor to the deputy secretary at the Department of Housing and Urban Development (HUD).

To a room packed with hazards and disasters professionals at the 34th Annual Natural Hazards Research and Applications Workshop, Lopez explained HUD's Sustainable Communities Initiative, a plan to link housing, transportation, and land use. Lopez told attendees in a keynote address that the ideas set forth in the department's initiative are relevant to the work of disaster professionals.

"You can't have a sustainable community unless that community is prepared and that community is resilient," Lopez says.

The initiative, which is spearheaded by Lopez, focuses on six core principles: provide more transportation choices; promote equitable, affordable housing; enhance economic competitiveness; support existing communities; coordinate policies and leverage investment; and value communities and neighborhoods.

This initiative will improve the coordination of transportation and housing investments to result in more regional and local sustainable development patterns, reduction of greenhouse gas emissions, and more transit-accessible housing choices, according to a press release. The initiative is attempting to "connect the dots between livability, sustainability, and climate resiliency," Lopez said.

"Housing decisions shouldn't be made in a vacuum to transportation decisions," Lopez says.

The Sustainable Communities Initiative is a partnership among HUD, the Environmental Protection Agency, and the Department of Transportation.

"It is multi-disciplinary, multi-layered, and collaborative," he says.

Lopez ended his address noting that ideas on sustainability and resilience are shifting.

"We are in a unique time," he says. "There is stress to our country's economy … but there is also this movement towards sustainable, green growth and a new kind of definition of how we interact with our environment. We need to catch this tide now and leverage that movement to include all of our agendas around this principle of sustainability."

— Corey Reynolds

They said it:

Quotable Quotes from the 2009 Hazards Workshop (via Twitter)

"Let's not be in the business of helping people do the wrong thing more precisely."—**Roger Pulwarty**, National Integrated Drought Information System.

"Land use is a state and county issue, the federal role is to incentivize or not. Every dollar sends a message."—**Sam Medlock**, Association of State Floodplain Managers.

"You can't really have a sustainable community unless that community is prepared."—**James Lopez**, U.S. Department of Housing and Urban Development.

"To have an effort like this and not have it evaluated is the social science equivalent of a major crime."—**Kathleen Tierney**, University of Colorado Natural Hazards Center, on the recent California ShakeOut exercise.

"Getting money for ShakeOut was like Tom Sawyer whitewashing the fence."—**Lucy Jones**, U.S. Geological Survey Multi-Hazards Demonstration Project.

"I would be very nervous about storing anything of value in a basement."—**Norbert Baer**, New York University.

"People aren't social scientists. They tell stories. If we don't embed data in a compelling story, they won't take notice."—**Ian Mitroff**, Mitroff Crisis Management.

"For those of us on the social science side, and for emergency managers as well, the problem was 'what things are we going to do about climate change that are different as a priority from hazard mitigation, awareness, preparedness, vulnerability, all those things we've been doing up to now?' We didn't come to a very satisfactory conclusion."—**David King**, James Cook University Centre for Disaster Studies.

Thomas, Freudenburg, and Tierney on ...

Mom Nature, MRGO, and Dynamic Risk

We are building communities in bizarre ways, says Ed Thomas. "We're spending all this money to build stuff that got flooded or burnt down. It's really remarkable how we do that—and I think we need to stop doing it."

Thomas, with the engineering firm Michael Baker, Jr., Inc., is an attorney and former Federal Emergency Management Agency staffer who has worked on over 200 disasters. He spoke at the closing plenary session of the 34th Annual Natural Hazards Research and Applications Workshop held in

(See "More Workshop," continued on page twenty)

More Workshop ...

(Continued from page nineteen)

Broomfield, Colorado from July 15 to 18, 2009.

"I think we need to think about reduction in misery," Thomas said. "Misery to the environment, to the people, to the community officials, and how about misery to the taxpayer."

The fallback scapegoat in any disaster is, says Thomas, "of course our own dear Mother Nature."

But Mother Nature is not to blame, he says. "We've got a system right now that rewards dangerous, bizarre behavior. We need to remove perverse incentives, reward good planning, safe building, and safe reconstruction."

Speaking on the same panel, William Freudenburg, University of California sociology professor, examined the issues around Hurricane Katrina. Katrina was not the first powerful hurricane to hit New Orleans, he noted. "If it's more vulnerable, it's more vulnerable like the canary in the coal mine," Freudenburg said. "It tells the rest of us something. This is a location where, first, people struck nature. Not all of us get Ed's (Thomas) point about doing no harm to others. It was a very small number of us who struck nature in a way that came back to haunt us all."

Freudenburg says that cypress stands in the Louisiana marshes have long been one of the first lines of defense against storm surges from hurricanes. But decades of misguided development—headlined by the notorious Mississippi River Gulf Outlet (MRGO) ship channel—have destroyed this protective barrier. "Cypress trees are probably the most effective way of slowing down storm surges ever invented by Mother Nature … Five miles of cypress swamps still in existence between New Orleans and the Gulf of Mexico probably would have lowered the storm surge by about five feet," he says. "It would have probably saved 1,200 of the 1,500 people who got killed."

MRGO, he says, "is a horrible thing to do to wetlands." Sold, as most such projects are, as an economic boon, it is a 75-mile long ditch costing $600 million to dig originally. It must be dredged annually, at a recent cost of $19 million. However, there are only about 12 round-trips of large cargo ships each year on MRGO, making the average subsidized cost of a round trip about $1.5 million for the dredging alone.

Freudenburg echoed Thomas, saying that current law is set up "to do the worst for disaster management and for each other."

"The developers and speculators who started all this are completely outside the loop," he says. "What we need to do as part of the legal reforms Ed is talking about is to set up our laws in such a way that those who benefit from doing dumb things also have to pay for it."

This means internalizing costs that have in the past been borne by society at large or by the environment. "If they have to pay for it, suddenly the price the market will provide for those houses in dangerous places will start to reflect the true cost."

Summarizing the messages delivered in this plenary and in the conference as a whole, Natural Hazards Center director Kathleen Tierney says, "Disasters and their impacts are socially produced. We'd better understand the social forces that produced them. Then we can become more resilient in the face of events."

Ed Thomas (left) and Bill Freudenburg

She adds, "Risk is dynamic. Disasters arise not from hazard events but rather from the social order and broad historical and global processes."

—Dan Whipple

Jones, Applegate, et al. on ...

The Great California ShakeOut

In November 2008, more than five million Southern Californians participated in what has been called the largest-ever social experiment in earthquake preparedness. The Great Southern California ShakeOut was such a success in creating a sense of urgency toward community and individual earthquake preparedness that one year later, in October 2009, another exercise will take place. This time, it will involve the entire state.

A panel comprised of four ShakeOut steering committee members and moderated by David Applegate of the U.S. Geological Survey explained the successes of the 2008 exercise and laid out goals for the 2009 drill at a plenary session during the 34th Annual Natural Hazards Research and Applications Workshop.

The 2008 ShakeOut, which involved 5.47 million people from schools, businesses, communities, and governments, was a "success in terms of the sheer numbers involved, communities involved, and changes that are taking place as a result," Applegate said.

The ShakeOut included a broad-based outreach program, media partnerships, and public advocacy by hundreds of partners. ShakeOut organizers encouraged Southern Californians to "drop, cover, and hold on"—wherever they were—and practice what to do when the big one hits. English and Spanish Web sites, blogs, booklets, presentations, workbooks, community meetings, sample plans, an interactive game, and countless other resources were all part of the exercise.

"The southern part of the San Andreas Fault averages a big earthquake every 150 years and it's been 300 years since the last one," says Lucy Jones, a seismologist with the U.S. Geological Survey's Multi-Hazard Demonstration Project. Jones said that the idea of "drop, cover, and hold on" is being stressed throughout this exercise because there is evidence that many California adults did not know what to do when an earthquake hits.

A survey after the 2008 exercise found that 97 percent of participants would participate in a drill every year. The statewide Great California ShakeOut will now be

held on the third Thursday of October each year, with the 2009 exercise taking place at 10:15 a.m. on October 15. The ShakeOut program has a goal of involving 10 million people in 2009. Nearly three million people had already signed up.

"This is meant to inspire Californians to get ready for big earthquakes," said Mark Benthien, director for communication, education, and outreach for the Southern California Earthquake Center, which is headquartered at the University of Southern California.

One concern expressed by panelists and audience members alike was that this huge social experiment did not include a comprehensive evaluation. Measuring the success and impact of the program would prove valuable information, Benthien said.

"To have an effort like this and not have it evaluated is the social science equivalent of a major crime," Kathleen Tierney, director of the Natural Hazards Center, told the panel.

Registration and other information about the 2009 ShakeOut can be found on the program's Web site: **www.shakeout.org**.

—Corey Reynolds

Smith, Pulwarty, Davidson, King, Baughman, et al. on ...

The Uncertain Impact of Climate Change on Hazards

The world must prepare for a wide variety of changes in the face of a changing climate.

"There is uncertainty about change itself," says Joel Smith of Stratus Consulting, a lead author for the Intergovernmental Panel on Climate Change. "The assumption has been for many years that climate is stationary. The climate change community is saying that's not the case. The future is going to be different. Indeed the present is already changing."

> "Even very ambitious mitigation will not avoid climate impacts. We need to accelerate and define and implement effective strategies in capacity building, and increase the resilience of ecosystems."
>
> *—Margaret Davidson*

But scientists in the hazards community and those in the world of climate research don't even speak the same language about these threats. In climate-speak, for instance, "mitigation" refers to efforts to reduce emissions to prevent the occurrence of warming in the first place. In the hazards world, this would be called "preparedness."

"If the terms are not interchangeable, how and to whom do we communicate the distinctions? Does it matter that we have to parse them out?" asks Maria Honeycutt of the National Oceanic and Atmospheric Administration. Honeycutt moderated a panel at the 34th Annual Natural Hazards Research and Applications Workshop on "Climate Change Mitigation, Adaptation or Preparedness?"

Ricardo Alvarez of Florida Atlantic University, an architect, says that it's important to define a common language. "If you're in a construction project, you can't afford to not be understood," he says. "What happens between different communities when they use such terms as mitigation, adaptation, and preparedness with different meanings? You need to define your common language, agree on definitions and use those definitions to communicate."

Roger Pulwarty (left) and Margaret Davidson

Roger Pulwarty, with NOAA's National Integrated Drought Information System, says that the disciplines need common meaning. He adds, "Where we find commonality is probably the most critical aspect across the board. In spite of knowing that the choices we make about land use increases our risk, in neither of these fields have we gotten action commensurate with that knowledge, even though we've known it for 40 years."

Margaret Davidson, director of NOAA's Coastal Services Center, says, "Even very ambitious mitigation will not avoid climate impacts. We need to accelerate and define and implement effective strategies in capacity building, and increase the resilience of ecosystems."

One issue surrounding climate change and hazards concerns what, if anything, should be done differently regarding hazards. David King, from Australia's James Cook University Centre for Disaster Studies, says, "It's easy to come up with priorities for climate change science … for those of us on the social science side, and for emergency managers as well, the problem was, 'What things are we going to do about climate change that are different as a priority from hazard mitigation, awareness, preparedness, vulnerability, all those things we've been doing up to now?' We didn't come to a very satisfactory conclusion."

King did a literature review of about 500 papers discussing climate and hazards. "We were looking for patterns in research to drive hazard mitigation in this new scenario of climate change." He found 50 papers and books that dealt specifically with climate change and mitigation. Many of them dealt with vulnerability and resilience. "We've been doing those things for ages," King says. "I haven't come up with any clear guidance of how vulnerability is going to be different under different climate change scenarios, and likewise what resilience issues are going to be more important."

(See "Climate," continued on page twenty-two)

Climate ...

(continued from previous page)

He adds, "Planners love sustainability. This one of the most overused and incorrectly used terms, but we're stuck with it. My own feeling is that everything we do currently is unsustainable, particularly in planning. What we're doing at present is not going to be sustainable under climate change.

"One big thing that's pointed out is the loss of food resources. Some places on the planet are probably going to become unsustainable. People won't be able to live in these places. We already have over a billion people who are not supported by the world's resources," King says.

Bruce Baughman, a consultant with Innovative Emergency Management, says, "I'm a practitioner. The president has finally recognized we've got a problem with climate change. For eight years we've stuck our head in the sand … The next thing is to understand what the risk is. The mayor is going to ask, 'What is the risk to my community above and beyond what I've already got?'

"What specifically do you want that mayor or county supervisor to do, above and beyond what we're already doing in hazard mitigation?"

"We need to incorporate climate change, but we don't have a national strategy."

Baughman suggests that coastal zone management programs might provide a blueprint for dealing with climate change. "We're now doing a very effective job with coastal zone management. These are very effective programs that we can pattern this strategy after."

Baughman calls for a national—though not necessarily "federal"—program. "The next step we've got to do is set up that national program, and start providing some national guidance. When I say 'national,' I don't mean federal guidance. I mean we have got to work together collectively to come up with a strategy and leverage ongoing programs. Because we're not going to get lots of new money to do this."

The comments were made at two sessions on climate issues at the 34th Annual Natural Hazards Research and Applications Workshop in Broomfield, Colorado.

— Dan Whipple

Maki, Tatsuki, and Hayashi on ...
Japanese Quake Preparation

Japan is facing a serious issue of an aging populace, creating new challenges for disaster preparedness and response, especially in dealing with special needs populations. Researchers there have developed some innovative mapping solutions to identify and deal with these populations in the event of an earthquake.

Tokyo faces a 70 percent risk of a magnitude nine earthquake within the next 30 years. The Nankai Trough risk of an M9.0 quake is between 50 and 60 percent over the next 30 years. The Nankai Trough extends about 650 miles offshore, south of the island of Honshu.

Norio Maki of Kyoto University Research Center for Disaster Reduction Systems says Japan is facing a rapid depopulation, with a decline from about 127 million people in 2005 to about 80 million by 2050. While the population will be smaller, the age distribution will be substantially older, presenting different challenges for emergency operations.

Shigeo Tatsuki of Doshisha University says, "Special needs population is a very hot topic in Japan. In Japan it started in 2004"— with the Mid Niigata Prefecture Earthquake of 2004—"when old folks living alone, their lives were devastated. The national government started working on measures to deal with the problem."

Using GIS, Tatsuki and colleagues were able to map the density and locations of physically handicapped people in the Hyogo ward of Kobe city, which has a total population of 1.5 million, "We estimate that 155 individuals in the ward will require immediate evacuation and shelter planning (in the event of an earthquake). We were able to pinpoint who were most vulnerable. In addition to the individual mapping, using a composite score, we created a weighted density map, in which we were able to identify which areas had a higher density of people with special needs during times of disaster.

"We've learned that when disaster hits, for the first ten hours or so, an area depends on self-help and mutual help. This information encourages a community-minded response," Tatsuki says.

Haruo Hayashi of Kyoto University Research Center for Disaster Reduction Systems led a team that did emergency mapping in response to the 2007 Niigata earthquake. "Surprisingly," Hayashi says, "the Japanese officers (dealing with the emergencies) did have not training to make use of maps. We established an emergency mapping center, producing 139 types of maps for 23 days to create a common operational picture."

Hayashi discovered that the local authorities were most interested in maps that tracked the day-by-day restoration of water availability, sewage services, and housing. "We have to have an understanding of what's the real problem for them, then transform it into the map products," he says.

Ken Topping, an emergency management consultant with Ken Topping Associates, says the Hayashi project "represents a real turning point. It's a landmark in GIS evolution in Japan … They turned the corner from a top-down to a user-driven, bottom-up approach."

The researchers spoke on July 17 at the 34th Annual Natural Hazards Research and Applications Workshop.

—Dan Whipple

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Copies of the *Observer* and the Natural Hazard Center's electronic newsletter, *Disaster Research*, can be downloaded free from the Center's Web site:

www.colorado.edu/hazards/

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Conferences and Training

September 7-10, 2009
Children and the Law: International Approaches to Children and Their Vulnerabilities
Prato, Italy
Cost and Registration: $788, open until filled

The international conference will bring together practitioners, policy contributors, advocates and researchers from welfare, criminology, law, policing, health, and mental health to examine the vulnerabilities of children and young people. The ways in which systems that respond to those at risk should be reshaped to better protect their rights and interests.

www.med.monash.edu.au/socialwork/conference09/

September 8-11, 2009
Investing in Floodplains for Future Generations
Floodplain Management Association
San Jose, California
Cost and Registration: $465 before August 31, open until filled

This conference addresses critical issues in floodplain management including new floodplain infrastructure, leveraging local, state, and federal resources, floodplain mapping tools, and improving relationships with community based organizations.

www.floodplain.org/conference.php

September 13-17, 2009
10th International Conference on Structural Safety and Reliability
International Association for Structural Safety and Reliability
Osaka, Japan
Cost and Registration: $723, open until filled

Scientists and engineers will share knowledge, experience, and information on structural safety and reliability. Special emphasis will be placed on advanced technologies, analytical and computational methods of risk analysis, damage assessment, social aspects, and urban planning.

www.ndaportal.com/icossar2009-conference.html

October 12-16, 2009
Fifth European Conference on Severe Storms
European Severe Storms Laboratory
Landshut, Germany
Cost and Registration: $246 before September 13, open until filled

This conference covers all aspects of severe convective weather. Session topics include severe weather climatology and hazards assessment, climate change impacts on severe storms and adaptation concepts, and severe storms forecasting, nowcasting, and warning.

www.essl.org/ECSS/2009/

October 22-23, 2009
Symposium on Building Safer Communities—Improving Disaster Resilience
Applied Technology Council
Charleston, South Carolina
Cost and Registration: $225 until October 15, open until filled

The Applied Technology Council is commemorating the 20th Anniversary of Hurricane Hugo by exploring changes in coastal construction practices, improved building safety and community resilience, and addressing unresolved building safety and damage reduction issues.

www.atcouncil.org

November 4-6, 2009
Disaster Risk Reduction for Natural Hazards
University College London
London, England
Cost and Registration: $164 before August 28, open until filled

This meeting examines the concepts and processes of disaster risk reduction and stresses multihazard environments and multidisciplinary approaches in natural hazards research. Defining ways to make disaster risk reduction more effective in the future is emphasized.

www.ucl.ac.uk/drrconference/

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Support Center Operations—Provide support for core Center activities such as the *Disaster Research* e-newsletter, Annual Workshop, library, and the *Natural Hazards Observer*.

Build the Center Endowment—Leave a charitable legacy for future generations.

Help the Gilbert F. White Endowed Graduate Research Fellowship in Hazards Mitigation—Ensure that mitigation remains a central concern of academic scholarship.

Boost the Mary Fran Myers Scholarship Fund—Enable representatives from all sectors of the hazards community to attend the Center's Annual Workshop.

To find out more about these and other opportunities for giving, visit:
www.colorado.edu/hazards/about/contribute.html

Or contact Ezekiel Peters at ezekiel.peters@colorado.edu or (303) 492-2149 to discuss making a gift.

A U.S.-based organization, the Natural Hazards Center is a nonprofit, tax-exempt corporation under Section 501(c)(3) of the Internal Revenue Code.

The mission of the Natural Hazards Center is to advance and communicate knowledge on hazards mitigation and disaster preparedness, response, and recovery. Using an all-hazards and interdisciplinary framework, the Center fosters information sharing and integration of activities among researchers, practitioners, and policy makers from around the world; supports and conducts research; and provides educational opportunities for the next generation of hazards scholars and professionals. The Natural Hazards Center is funded through a National Science Foundation grant and supplemented by contributions from a consortium of federal agencies and nonprofit organizations dedicated to reducing vulnerability to disasters.

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Observer cartoons are drawn by Rob Pudim.

Send items of interest to the Natural Hazards Center, University of Colorado at Boulder, 482 UCB, Boulder, CO 80309-0482; (303) 492-6818, (303) 492-2151 (fax); hazctr@colorado.edu. The deadline for the next *Observer* is **July 25, 2009**.