



Reacting to Climate Change, Floods, and Uncertainty

— Invited Comment

IACTUALLY THINK THE SCIENCE around climate change is real. It is potentially devastating ... If you look at the flooding that's going on right now in North Dakota and you say to yourself, "If you see an increase of two degrees, what does that do, in terms of the situation there?" that indicates the degree to which we have to take this seriously — **President Barack Obama, April 2009**

WHEN THE PRESIDENT OF THE UNITED STATES starts talking about flooding and climate change, the ante has been raised. Shortly after the president commented on the Red River flooding, Secretary of Energy Steven Chu told Western Hemisphere environmental ministers assembled in Trinidad and Tobago, "Caribbean countries face rising oceans and they face increases in the severity of hurricanes. This is something that is very, very scary to all of us ... Lots of area in Florida will go under. New Orleans at three-meter height is in great peril."

These messages are not new. Scientists have been addressing the potential impacts of climate change on riverine and coastal flooding for decades, emphasizing the threat posed by increased precipitation and sea level rise. At the same time, some other scientists report little evidence of climate-related increases in flooding. How does the floodplain manager, the first responder, the elected official, and the average citizen decide how to address these predictions? Should they let people build in low-lying areas? Should they invest their retirement savings in property along the coast? Should the government slow down potentially hazardous development? If they knew for certain what sea level might be along our coasts in 2050, understood the potential changes in hurricane intensity and resultant storm surges, and had sufficient tools available to allow us to identify the changes in frequency and

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Living Dangerously

Reducing global carbon dioxide emissions to levels low enough to prevent the earth's average temperature from increasing two degrees Celsius (3.5 degrees F) by 2100 will be very difficult, according to several papers published in the April 30, 2009, journal *Nature*.

The "two degrees C" level has been a generally accepted target as the level to avoid dangerous climate change. But even at that temperature, the planet would be warmer than it's been in millions of years.

A paper by German climate scientist Malte Meinshausen and colleagues found that temperatures in 2100 depend primarily on how much carbon dioxide is emitted by 2050. They say to stay below the two degrees C level, nations can emit only 190 gigatons of CO₂ to have a 75 percent chance of staying below the level. Currently emissions are about nine gigatons a year, increasing at a rate of one to three percent. At that rate, the 190 gigaton level will be reached in about 2030.

A second paper by Oxford University physicist Myles Allen and colleagues in the same issue say that total anthropogenic carbon emissions of about one trillion tons of CO₂ will most likely result in the two degrees C level. About half of that amount has already been emitted in the industrial era.

In a commentary on the papers, NASA scientist Gavin Schmidt and the University of Chicago's David Archer write that these two results are approximately equivalent, although the methods used to reach the conclusions are different. Much is still unknown about the planet's "climate sensitivity," which refers to the amount of warming that results that results from a given increase in atmospheric carbon.

Archer and Schmidt conclude, "The bottom line? Dangerous change, even loosely defined, is going to be hard to avoid. Unless emissions begin to decline very soon, severe disruption to the climate system will entail expensive adaptation measures and may eventually require cleaning up the mess by actively removing CO₂ from the atmosphere.

Like an oil spill or groundwater contamination, it will probably be cheaper in the long run to avoid making the mess in the first place."

The difficulty of limiting carbon emissions to 191 gigatons with current technology is pointed out in another piece by Richard Monastersky. He writes, citing an approach suggested by NASA scientist James Hansen, "Go ahead and burn all the remaining oil and gas in conventional reserves, he says, and at the same time concentrate all efforts on quickly phasing out coal—or capturing and storing the emissions associated with it. If nations can cut off coal use by 2030 and avoid tapping unconventional fossil fuels, such as tar sands and methane hydrates, the world could limit future CO₂ emissions to 400 gigatons of carbon."

From a hazards standpoint, people would be vulnerable in several ways, including risks of flooding, especially in Asian delta cities, increasing intensity of tropical cyclones and hurricanes, heat waves, drought, and food shortages.

Engineering Can't Hold Off All Big Storm Damage

The 100-year level of floodplain protection—used as the critical standard for flood insurance—is inadequate in places like New Orleans "where the failure of protective structures would be catastrophic," according to the National Academy of Engineering and National Research Council report *The New Orleans Hurricane Protection System: Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness* (www.nap.edu/catalog.php?record_id=12647).

The report says engineering solutions can never make New Orleans completely secure from big storms. "There are many inherent hydrologic vulnerabilities of living in the greater New Orleans metropolitan region, especially in areas below sea level," the report says. "Post-Katrina repairs and strengthening have reduced some of these vulnerabilities. Nevertheless, because of the possibility of levee/floodwall overtopping—or more importantly, levee/floodwall failure—the risks of inundation and flooding never can be fully eliminated by protective structures no matter how large or sturdy those structures may be."

"A 100-year profile does not include a Katrina," G. Wayne Clough, chairman of the peer review committee, told the New Orleans *Times-Picayune* (http://www.nola.com/news/index.ssf/2009/04/100year_protection_not_enough.html).

"The planning and design for upgrading the current hurricane protection system should discourage settlement in areas that are most vulnerable to flooding due to hurricane storm surge," the report said. "The voluntary relocation of people and neighborhoods out of particularly vulnerable areas—with adequate resources designed to improve their safety in less vulnerable areas—should be considered as a viable public policy option."

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Straw Bale Houses Resist Quakes

Pakistan experience shows potential for developing country housing

STRAW BALE HOUSES SHOW POTENTIAL AS A LOW-COST, EARTHQUAKE-RESISTANT housing option for developing countries. In University of Nevada-Reno, tests, a straw bale house was able to withstand an input motion equivalent to the Mw 6.7 Northridge Earthquake in 1994.

The full-scale, 14-by-14-foot house “performed exceptionally well,” says Darcey Donovan, CEO and founder of the nonprofit Pakistan Straw Bale and Appropriate Building. A report in the Earthquake Engineering Research Institute newsletter said, “The house was subjected to a series of seven tests, beginning at 25 percent of the recorded ground acceleration and increasing at 25 percent increments until the house cracked at the seams, sent out a small cloud of dust and straw, but remained standing” (imedia.unr.edu/shakertables/straw_bale_house_test_270.mov).

The house survived 0.82 g (0.82 times the acceleration of gravity), twice the acceleration of the Northridge quake record, Donovan says.

Straw bale construction uses straw compressed into one-by-one-by-two foot bales. The bales are stacked and secured. Most modern straw bale construction in the United States is used as insulation in framed housing, but in Pakistan the bales are designed to be load bearing.

Donovan says that after the 2005 Mw 7.6 Kashmir earthquake—which killed 100,000 people and left 3.3 million homeless—she received an e-mail from a colleague in Pakistan asking her to consult on some green building techniques. She has her own engineering firm in California emphasizing green construction techniques. She says that she is working on the Pakistani straw housing project on a “full-time, volunteer basis.”

Donovan’s Pakistani project has built nine straw bale homes using funds from small donations, as well as Donovan’s own resources. Two more are under construction.

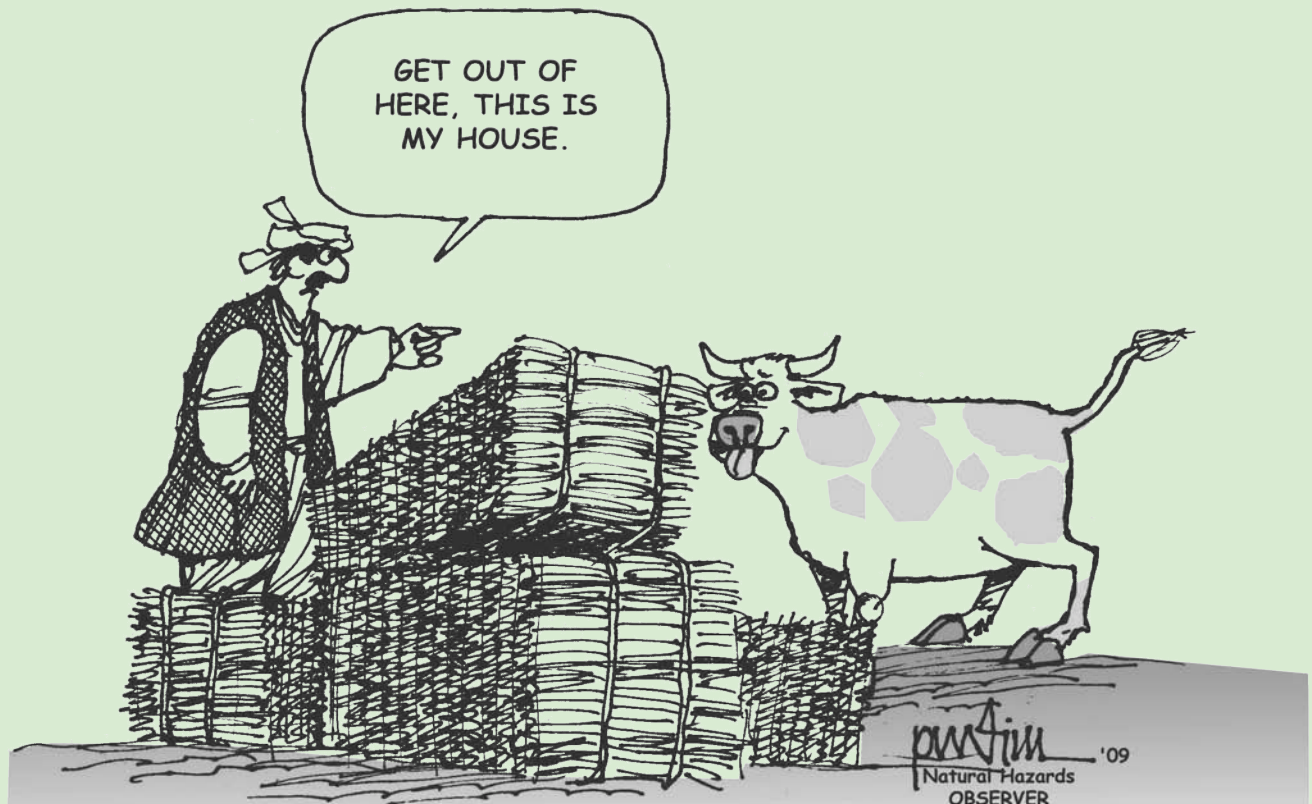
“We’re hoping to build a whole lot more,” she says. “It’s a matter of finding funding.”

While the construction techniques are new to most Pakistanis, Donovan says they’re enthusiastic about the idea.

“There are similarities to traditional building techniques,” she says. “When they’re completed, they look like an adobe house. They typically use stone and mud and mortar. We’re trying to use a very simple foundation, gravel bags encased in cement. It’s a simple adaptation.”

A typical house is 24-by-24-feet with two rooms, a veranda, and a kitchen. Houses cost about \$2,500 each.

The homes are especially welcome in Pakistan’s earthquake-prone areas, which are susceptible to much stronger quakes than the 7.6 magnitude one that occurred in 2005. Current building methods in the region are very poor, Donovan says, but “looking at the raw materials, there is something about that they seem to get.”



Politically speaking, the relocation of large, entrenched populations from flood-prone areas is difficult to accomplish. In the confirmation hearing for Federal Emergency Management Agency director Craig Fugate, Sen. Mary Landrieu (D-La.) asked specifically if Fugate would waive building restrictions in high-hazard areas where there are “viable communities.” Fugate answered he’d approach these issues on a case-by-case basis.

The NRC report was the final review of the U.S. Army Corps of Engineers’ nine-volume, 7,500-page Interagency Performance Evaluation Task Force report. In general the NRC team praised the IPET report but urged that it be made “easily accessible and understandable to the public and that the IPET makes a strong effort to present its key findings in as clear and organized a manner as possible.” NRC also mildly criticized the delays in issuing the IPET report.

“The volume that the National Research Council panel reviewed was an interim draft; it was not a finished document,” said Corps IPET director Ed Link. “We agreed with the panel in December that the volume needed greater clarity and better explanation of the analysis. The documentation of the IPET risk work must be both comprehensive and understandable. This work is setting the mark for future risk analyses in Louisiana and elsewhere.” (www.usace.army.mil/CEPA/News/Pages/IPETWork.aspx)

Hospitals Should Anticipate Workforce Reductions in Disasters

Hospital emergency workers say they won’t respond equally to all emergencies, according to research published in the *Journal of Emergency Medicine*. While about 87 percent of emergency room workers said they’d come to work in the event of an airplane crash, only 54 percent said they would in a disaster involving biological agent. In the event of a radioactive bomb, 72 percent would come in.

Lori Masterson of Chicago’s Resurrection Medical Center and colleagues surveyed 204 emergency room workers from eight Chicago hospitals who participated in the May 2003 TOPOFF 2 national disaster drill.

Masterson and colleagues wrote in *JEM*, “Hospital management should anticipate significant reductions in workforce during biologic and radioactive disaster events. Employees’ willingness to respond was not augmented by any incentives offered by hospitals, although enhanced financial remuneration and disability coverage showed the most potential to increase response.”

In Britain, a similar survey revealed that as many as 85 percent of National Health Service workers might stay off the job if an influenza pandemic occurred in the country.

This survey, published in the open access journal *BMC Public Health*, found that absenteeism in a pandemic would be considerably higher than current estimates. The researchers found, “The likelihood of working may differ by job type. While doctors were more likely to say they would attend, nurses and ancillary staff were more likely to say they would stay away. The survey shows that willingness to work during a pandemic will be strongly impacted by two types of factors.

“Firstly, issues relating to family and caring

responsibilities. Workers with children or elderly family for whom they are carers would be more likely to be absent from work if influenza illness at home (or the possibility of it) became a worry. Second, issues relating to the work environment itself. These included the possibility of having to take on duties for which a worker felt they had not received training, being asked to work at a different place (from) normal, working with untrained people, or fears of possible future litigation if mistakes were made while working under abnormal conditions.”

Both reports found that hospital personnel are pretty much immune to incentives to report to work when faced with a disaster that might affect their own long-term health. The British group wrote, “Measures intended to persuade health care workers to work as normal during a pandemic will need to be tailored to different job types. But as the research suggests, the groups who may be most in need of suitable interventions may also be the least receptive.”

Patients in a pandemic appear to be more pliable than employees, however. Swiss investigators found that air travelers in Europe were remarkably willing to comply with traditional public health measures in the event of an outbreak of contagious disease. They collected data from 1,880 travelers at airports in Haut-Rhin, France, and Kloten, Switzerland.

Author Nicole Senpinar-Brunner and colleagues, writing in the May 2009 *Emerging Infectious Diseases* (www.cdc.gov/EID/content/15/5/831.htm), found, “A total of 71.6 percent would cancel their trip if postponement of nonessential travel was recommended, 93.7 percent would wear face masks, 93.2 percent would fill out a health questionnaire, and 89.1 percent would accept having their ear temperature measured on arrival. If fever were detected, 88.1 percent would undergo a short physical examination. If persons were diagnosed with a disease and were receiving treatment, 92.3 percent would accept isolation for seven days. If feeling healthy but were seated next to someone with a cough on the airplane, 69.2 percent would accept seven-day quarantine ... and would monitor their health.”

IPCC to Report on Climate and Extreme Events

The Intergovernmental Panel on Climate Change has agreed to prepare a special report on “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation,” to be released in the second half of 2011.

“In its Fourth Assessment Report, the IPCC had found that climate change was being manifested in the nature of changed frequency, intensity and length of many extreme events, such as floods, droughts, storms and extreme temperatures. This special report will generate knowledge on these extreme events and their characteristics, whereby the global community can prepare more effectively for adapting to future risks posed by the hazards that these occurrences will present. Communities at the local level and national governments can deal with such extreme events by adopting a range of disaster risk reduction strategies, and prevent some of the worst humanitarian consequences that they are projected to give rise to” says Rajendra Pachauri, the Chairman of the IPCC.

“Extreme events are one of the direct consequences of

climate change, with severe economic repercussions. There's new and relevant scientific literature subsequent to the AR4, in particular on disaster risk management," says Working Group II Co-Chair Vicente Barrios.

Hazards We Hadn't Worried About Before

Feelings of lack of control and stress from natural disasters can lead to compulsive shopping, according to a paper in the July 2008 journal *Marketing Letters*.

Judith Z. Sneath and colleagues found, "Data collected

from 427 U.S. Gulf Coast residents who were impacted by Hurricane Katrina ... show that perceived lack of control and loss of possessions contribute directly to stress, and event-induced stress impacts depression. Depressive states, in turn, lead to impulsive and compulsive buying behaviors ... Disaster victims engage in distinct purchasing behaviors to manage emotional states, recoup losses, and restore their sense of self."

These results have important ethical and social responsibility implications for marketers, the authors say.

Cutler Bay's School Bus Brigade

WHEN HURRICANE ANDREW PUMMELED the south Florida coast in 1992, Cutler Bay was one of the hardest hit jurisdictions. In 2005, Hurricane Katrina left more than 20 inches of rain in Cutler Bay, a town of about 25,000 in Miami-Dade County, making rescue and supply transport virtually impossible. Cutler Bay's town manager, Steven Alexander, and Director of Public Works Ralph Casals knew high-clearance, large emergency response vehicles were needed to protect the municipality from inevitable future disasters.

But with a cost of nearly \$300,000 per manufactured emergency response vehicle, the town recognized that cost would be prohibitive and therefore an innovative solution would be needed. Creativity took hold, and Alexander and Casals led an effort to convert surplus school buses to effective emergency response vehicles. The *Natural Hazards Observer* spoke with Ralph Casals about the town's efforts.

Can you briefly tell us about Cutler Bay and its vulnerability to disaster.

The Town of Cutler Bay is a coastal community, located 25 miles south of Miami and bordered to the east by Biscayne Bay. The highest elevation within the town is nine feet above sea level. Any type of significant tidal surge will cause a great deal of damage to homeowner's properties and pose a serious issue to the town's first responders.

Considering your experience in Hurricane Andrew and your risk to future disasters, why not just purchase manufactured emergency response vehicles?

One short answer: costs. These large, high vehicles that can transport personnel and supplies—food, equipment, communication—can range in cost from several tens of thousands to as high as a hundred thousand dollars.

Why school buses?

The school buses were used due to the body frame's height. Additionally, the buses are currently powered by diesel fuel and can be converted into bio-diesel.

Can you describe the conversion processes? What do the buses look like now?

Town staff removed several rows of seats from the buses and custom built racks to hold barricades, traffic cones, portable generators, and other emergency supplies.

How much did the project cost? How much savings did you see by choosing existing school buses instead of other types of emergency response vehicles?

The town acquired the buses from the Miami-Dade School Board, through an agreement which allowed the town to purchase the buses for \$10 each. The buses will be utilized to transport emergency supplies and equipment into several flood prone areas. Additionally, some of the buses remain intact and can be utilized to transport evacuees from the affected disaster zones.

Describe how you manage and use the fleet? What kind of collaboration is there among government agencies? What kind of non-hazard uses do the buses have?

The buses are not used on a daily basis, but throughout the month the buses are used during the special events and community outreach meetings. In regards to collaboration amongst surrounding governmental agencies, the town is an active participant with the county and regional emergency operation centers. The buses are listed as available equipment that would be used to support any type of disaster recovery efforts.



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magnitude of major riverine floods, these decisions might be easier to make. But there is a great deal of uncertainty.

New Climate and New Impacts?

REPORTS IN 2008 AND 2007 BY THE INTERGOVERNMENTAL Panel on Climate Change spoke to continued or accelerated global warming in the 21st century. The IPCC has directly addressed the potential for increased flooding and sea level rise in the years ahead. In 2008, the IPCC said, "Increased precipitation intensity and variability are projected to increase the risks of flooding and drought in many areas. The frequency of heavy precipitation events will be *very likely* to increase over most areas during the 21st century." (Emphasis in original.)

Global mean sea level has continued to rise. The rate of rise is also increasing (Bates 2008). The March 2009 United Nations *Third World Water Assessment Report* finds that the "hydrologic cycle will intensify and that extremes will become more common. The moisture-holding capacity of the atmosphere has been increasing ... creating the potential for heavier precipitation." Data gathered on a monthly river flow indicates "seven of [every] eight 100-year floods occurred in the more recent half of the records."

The Organisation for Economic Co-operation and Development finds that the growth in emissions of greenhouse gases and the resultant increase in global temperatures is leading to increased heat waves, droughts, storms, and floods. The OECD says sea level rise will result in significant exposure of major world port cities—including most major U.S. ports—to catastrophic flood losses (OECD 2009). In April, the European Commission issued a white paper indicating the impacts of climate change will be "swifter and more severe" than suggested by the IPCC (CEC 2009).

In 2002, as part of its "Foresight" studies, the British government commissioned chief science adviser Sir David King to examine, under several scenarios, the impact of climate change on flood defenses throughout the United Kingdom (King 2002). His team found that "a combination of sea level rise and increased storminess will allow storm surges to reach much further inland, so that Britain's coastal defenses will be subjected both to higher water levels and to more energetic wave attack ... these combined effects have the potential to increase risk of floods in 2080 by up to 30 times present levels." The study also identified the less studied threat of flooding that could be caused by the inability of urban sewer and drainage systems to deal with the expected intense rainfall events. The report expressed concern for the impact of this future flooding on disadvantaged elements of society. The risk to this group would increase by factors of three to 20—"significant sections of the population could be blighted" (King and Thomas 2004; Foresight 2004).

Scientists in the United States have pointed out these threats for decades. In 1987, a committee of the National Research Council identified the challenges to be faced with

potential climate-induced sea level rise. In 2000, a National Assessment Synthesis Team reported, "Droughts and flash floods are likely to become more frequent and intense."

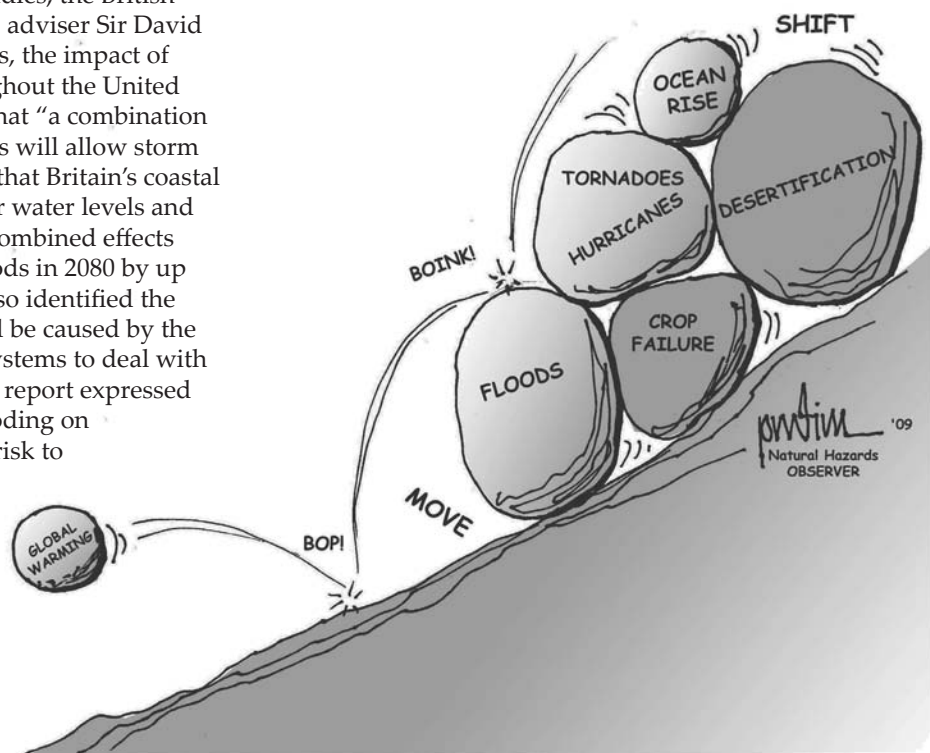
In 2002, P.C.D. Milly and colleagues reported that during the twentieth century, "The frequency of great floods had increased substantially and ... the recent emergence of a statistically significant positive trend in risk of great floods is consistent with results from the climate model, and the model suggests that the trend will continue."

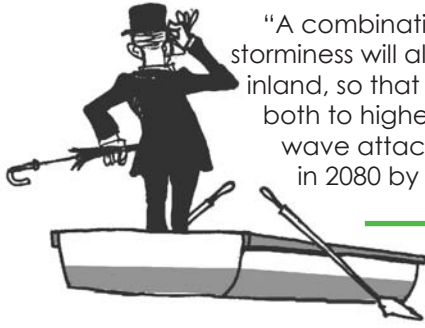
Related Factors

ADDING TO THE CHALLENGE of predicting future flood levels in a changing climate are the problems associated with our current use of hydrologic models and the under-considered aspects of future development and channel erosion. These latter problems create more uncertainty for decision makers. Several senior scientists (Milly et al. 2008) recently wrote, "In view of the magnitude and ubiquity of the hydroclimatic change apparently now under way ... we assert that stationarity is dead and should no longer serve as a central, default assumption in water-resource risk assessment and planning."

For decades the principal tools in development of flood frequency analyses have relied on the concept that we can predict the future of flooding by looking at the past. The longer the record in hand, the more accurate should be the results. This reliance on past trends is stationarity. Milly defined it as "the idea that natural systems fluctuate within an unchanging envelope of variability."

Flood flows from a specific rainfall event also can increase for reasons other than climate change, for instance when upstream development in a watershed changes the volume and timing of the runoff that produces the flood, or erosion of the channel modifies the hydraulics. Recent studies for the National Flood Insurance Program have pointed out that, over time, the impacts of upstream development can significantly increase flows and downstream losses (Blais 2006). Subsidence, as in New





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Orleans and other coastal areas, can cause an area that once seemed protected from floods by levees and floodwalls to discover that the threat has dramatically increased because the structures have "sunk" (IPET 2008).

All of this is coming at a time when we face significant demographic changes. During its 2007 Gilbert F. White Assembly on the Floodplain of 2050, the Association of State Floodplain Managers Foundation (2008) identified population growth and resultant demand for development of housing, commercial facilities, and accompanying infrastructure as significant drivers shaping conditions of the future floodplain landscape. ASFPM noted these factors will force migration to urban areas, concentrating the population in the West, the South, and on the coast.

This population movement will match up with flood- and hurricane-related hazards, creating the potential for dramatically increasing flood losses. The report says, "Intensified development in high-risk areas accompanied by climate and weather changes will bring increased potential for frequent flood disasters, and for large, Katrina-like catastrophes as well" (ASFPM Foundation 2008).

Even without climate change, the nation faces significant flood challenges. Flood losses have been increasing every year. The significant loss of life in New Orleans and the far-reaching impacts of the 2008 Midwest floods have emphasized that damages are not just economic. The social and environmental aspects of flood losses must also be considered. New Orleans confirmed the *Foresight* conclusion that flooding may disproportionately affect certain socioeconomic groups—minorities, the elderly, and the poor.

Uncertainty and Risk

THERE IS CLEARLY DISAGREEMENT about the probability of increased flooding related to climate change. Bob Hirsch, former U.S. Geological Survey associate director for water, argues that there is little empirical evidence that flooding is getting worse. He also expresses concern over the reliability of hydrologic predictions from existing climate models. However, he further notes, "Recent literature and global climate models suggest that greenhouse gas-induced warming will make extreme precipitation events more common. Prudent emergency preparedness and flood mitigation measures should be based on understanding historic flood records while searching the data for trends related to climate-forced events" (2008).

The 2009 UN *World Water Development Report* finds that, to date, "Documented trends in floods show no evidence for a globally widespread change."

Hirsch (2009) also notes that we need to "be prepared for surprises. I think we do not know what the consequences of global climate change are going to be."

Given the uncertainties, how do we reduce the risks we face? If we see risk as a function of the hazard event (flood, hurricane), the effectiveness and reliability of the structural and nonstructural risk reduction systems (levees, floodwalls, floodproofing, insurance, etc.), and the impacts that could result from a hazard event, we should take steps to address each parameter. It is clear

that we don't have a lock on the probabilities associated with the hazard. The uncertainties that result from climate change, problems with our recurrence interval calculations and ability to predict subsidence, and the unknowns of the impacts of future development and channel morphology make definitive judgments difficult.

Our post-Katrina experience has taught us how little we know about the integrity of our structural flood protection systems and the utility of many of our nonstructural approaches. If you accept population growth in areas subject to flooding, you can expect the consequences of any event to rise dramatically.

The recently released multi-agency federal study on water and climate change (Brekke 2009) concludes:

- The best available scientific evidence, based on observations from long-term monitoring networks, indicates that climate change is occurring, although the effects differ regionally.
- Climate change could affect all sectors of water resources management, since it may require changed design and operational assumptions about resource supplies, system demands or performance requirements, and operational constraints.

Handed the *Foresight* study on flood defenses in the UK, Elliot Morley, Minister for Environment and Agri-Environment, suggested, "We cannot, of course, eliminate the risk of flooding. But we can seek to manage the risks" (*Foresight* 2004). The IPCC points out that climate change will certainly affect the way the world's infrastructure must operate and suggests that our current practices may not be "robust enough to cope" with climate change impacts (Bates 2008).

So, Where Do We Go?

SOME WILL WANT TO POSTPONE TAKING ANY ACTION until studies more precisely identify climate change impacts—"No sense in wasting money until we're sure." The lack of full scientific certainty should not be a reason for postponing action on measures to reduce present and future risks from flooding. Many of the actions needed as part of a more focused program of managing today's risks and future uncertainties will solve current problems. One does not even need to see a discernable climate signal to take action.

These "adaptive management" actions are related to precautionary actions. They set the stage for, and are a prerequisite to, the implementation of the next suite of more politically and socially difficult adaptation measures. Many of the initial required actions reside within local and state

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responsibilities to deal with risk management. The federal role is more suited to looking ahead at climate uncertainties, by instituting comprehensive monitoring programs and improving the scientific tools needed for forecasting future conditions (Stakhiv and Pietrowsky 2009).

Those responsible for floodplain and coastal management must identify the current risks they face and determine what steps are necessary to deal with the hazy future. They should:

- Implement land-use changes to reduce future consequences. In some cases, this might include relocation of at-risk facilities or siting new development away from hazard areas (OECD 2008, ASFPMF 2008). Land-use is a state and local responsibility.
- Carefully examine existing structural and nonstructural flood risk reduction measures to analyze how they will perform under various climate change and development scenarios. Once examined, actions should be taken to modify them accordingly. What can be done to buy down the risk?
- Modify major programs like the National Flood Insurance Program to take into account the potential impacts of climate change and the conditions such as subsidence and land development.
- Integrate planning for flood risk reduction into an overall effort to plan for across-the-board climate change impacts on water resources (Brekke 2009).
- Increase research efforts to develop higher-resolution models, better understanding of non-stationarity, and the socioeconomic factors that influence decisions to place development in at-risk areas in the floodplain.
- Adequately support riverine and coastal data-gathering and monitoring programs.

Now is the time to begin to work to reduce the risk of future flooding. There may be uncertainties about climate change, hydrologic calculations, subsidence, and land development, as well as their impact on flooding. However, when you multiply the potential impacts by the demographic changes that will put more people at risk, it becomes obvious that it is time for concerted action.

The participants in the 2007 Gilbert White Assembly concluded we are at a fork in the road. One road leads to a future with significant increases in flood losses and social disruption. The other road leads to a long-term reduction in the adverse consequences of natural hazards.

Speaking to a National Academies meeting on responses to climate change, Jane Lubchenco, the new National Oceanic and Atmospheric Administration administrator, borrowing the words of the late Dr. Martin Luther King, suggested to the audience, "We cry out desperately for time to pause in her passage, but time is deaf to every plea and rushes on ... over the bleached bones and jumbled residues of numerous civilizations are written the pathetic words: Too Late" (Block 2009).

We don't want to be Too Late.

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How Certain Are We About Our Flood Risk?

— Invited Comment



FLOODS APPEAR TO BE MORE FREQUENT AND MORE INTENSE. They certainly are causing more damage. The deteriorating condition of much of our flood-related infrastructure—levees, dams, bridges, culverts—has become well known through the work of the U.S. Army Corps of Engineers, the American Society of Civil Engineers, the Association of State Dam Safety Officials, and others. We have endured several years of frightening hurricane seasons, punctuated by the Katrina disaster, which resulted from the combination of insufficiencies in infrastructure with a serious hurricane. Anticipated changes in climate threaten to make flood-related hazards of the future even harder to address.

The last few years have been a wakeup call for practitioners, policy makers, and scientists alike. Among floodplain management professionals a consensus is growing, based in part on the benefits of hindsight, that we have failed to factor in all we know along with the uncertainties, ambiguities, and unknowns inherent in flood risk.

Flood Risk as a Complex Concept

IT HAS BEEN ALL TOO EASY TO ALLOW DIFFERING CONCEPTS of “risk” to influence our understanding of it, and how to

manage it. Risk researchers and analysts usually define risk as the product of the probability of an event’s occurrence and its consequences. In flood hazard terms:

$$\text{PROBABILITY OF A FLOOD (OF A GIVEN MAGNITUDE) X THE CONSEQUENCES OF THAT FLOOD = FLOOD RISK}$$

We have been trying to alter the overall risk by addressing some formula components while ignoring others. That’s a recipe for failure.

We use the historical record of rainfall, streamflow, tidal activity, and other events to estimate the probability of a given size flood. The short time frame—in both real and geomorphological terms—for which we have documentation of these events undermines the accuracy of our estimates. In addition, we often throw out the “high outliers,” so that the most extreme flood events aren’t used in the analysis.

On top of these uncertainties, predicting probabilities is complicated by many other factors. For example, development within a watershed can cause a significant

(See “Flood risk,” continued on page ten)

Flood risk...

(Continued from page nine)



Federal assumption of costs provides a disincentive to other levels of government (and private parties) to take action on their own. The most effective solutions to reducing costs and suffering are vested in land use and building codes. The authority for those rests in local and state government.

increase in flood levels. Studies for the Charlotte-Mecklenburg area of North Carolina showed two to nine feet of difference. Structural flood control projects themselves can increase flood damage across the river, upstream, or downstream. When human development of any sort disturbs the natural functions of floodplains—like filling flood storage areas—the characteristics of flooding are altered.

All three ways by which we predict the magnitude of a flood—flow frequency analysis, regional regression equations, and design storm runoff models—have inherent uncertainties. Not only does each step of the process incorporate assumptions, but also the methods rely on imperfect underlying data, notably stream gauge and precipitation records. The period of time for which we have data is too short. Because of climate change, past trends may not hold for the future.

An additional, insidious way in which we have underestimated magnitude has been by the use of an arbitrary prescriptive standard, the 100-year flood. Originally intended in the 1960s as a compromise level that would serve as a norm while we experimented with national policy and flood insurance, it has become institutionalized, misconstrued as a safety standard. It is clear that, if we are going to use the standard this way, it should have been set much higher, perhaps at the 500-year flood level. At the very least, the standard should be varied based on the consequences of flooding for a given area.

As a final insult, in many cases what was a 100-year flood when the flood maps were produced is now a more frequent occurrence because of alterations to our watersheds, making the flood level depicted on maps too low for current conditions.

Consequences Unexplored

OUR HISTORICAL VIEW OF THE CONSEQUENCES OF FLOODING has been a narrow one, focusing first on deaths and injuries, then adding damage to public and private property.

In fact, we now realize the consequences of flooding

take many forms—social, financial, cultural, and environmental. Some consequences are beneficial, a function of the natural processes that sustain ecosystems. Unaltered marshes, dunes, bluffs, wetlands, and other features often occurring in floodplains have intrinsic value. They also absorb flood impacts, protecting human development without human intervention.

In the socioeconomic arena, the costs of flooding must be borne by someone. Currently, those who choose to live at risk from floods are allowed to externalize a large portion of the consequences of that choice to other segments of society—usually the federal taxpayer. Further, there is an absence of shared responsibility among public entities. States and localities have come to believe that protecting people from flooding is a federal responsibility. Federal assumption of costs provides a disincentive to other levels of government (and private parties) to take action on their own. The most effective solutions to reducing costs and suffering are vested in land use and building codes. The authority for those rests in local and state government.

Companions to the far-reaching consequences of floods are the consequences of our efforts to control them. These include the costs of flood control, along with the unanticipated impacts on ecosystems. Floods carry sediments that build deltas and nourish beaches, but levees, dams, and coastal groins interrupt this replenishment, resulting in subsiding wetland estuaries and sand-starved, eroding beaches. When we design and build projects with a too-short project life, protection levels that are too low, and maintenance arrangements that are sketchy, we are introducing additional negative consequences into the risk equation. In some cases flooding may be deferred in

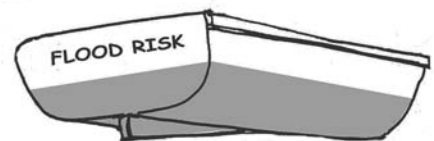


smaller events by these measures, but when a flood exceeding its protection level does occur and the structure fails or is overcome, the consequences are catastrophic.

Our well-meaning flood management techniques likewise have had enormous consequences. Flood insurance programs, for example, use maps to depict the boundaries of the 100-year flood. This “line on a map” approach has conveyed to the public and decision makers a sense of certainty about risk that doesn’t exist. It fosters a belief that it is safe to build outside of the flood hazard displayed on the map. Our national policy approach once we identify the flood hazard area is, paradoxically, not to show people how to avoid it, but rather how to build in it. There is a small “no build” zone on rivers, but none in coastal areas subject to high storm surge—where there is huge risk exposure.

Further, the pervasive misunderstanding of flood risk has inhibited sensible behavior, both individually and collectively. In the public sector, development decisions tend to be made based on short-term economic return rather than long-term sustainability. This eventually results in significant financial costs. People don’t understand the flood risk, so they don’t avoid flood-prone areas, buy flood insurance, or take other protective actions.

As a last complication, the consequences of flooding in the future are likely to



increase. Our population is growing. We are becoming increasingly urbanized, disturbing more land surface, and converting land that once absorbed water to impervious surface. Coastal areas and lands adjacent to waterways will soon be more densely populated than they are even now.

Levees as a Case in Point

THE WAY WE BUILD, USE, AND MANAGE LEVEES is a good illustration of how the many uncertainties in the risk equation come into play to create potentially disastrous situations.

Levees reduce ordinary flooding, but contribute to catastrophic damage in extreme flood events—When a levee is built to control or minimize flooding to existing buildings, the levee is most often only designed to protect to the 100-year flood level. No other measures are required behind the levee—no flood insurance, no elevation of buildings, no access for people or emergency vehicles when the levee overtops or fails. It is an “all or nothing” approach through which people become complacent during smaller floods, thinking they will always be safe from flooding, even though there have been dire consequences from levee-related flooding in the last few years—in the Midwest, California, on the Red River, and on the Gulf Coast. Current national policies create this situation, yet those policies have not been changed in decades.

Poorly estimated magnitude—The calculations are for yesterday’s flood, not tomorrow’s flood. The latter would be based on planned watershed development and climate change. Many of the levees in the nation built to withstand the 100-year flood no longer do, because the level of the 100-year flood has changed. Other nations, such as Germany and The Netherlands, not only design to a higher standard (e.g., the 1,000- or 10,000-year event) but also add 15 to 25 percent to the calculated design flows to account for future unknown increases.



Unintended consequences—Levees will usually cause an increase in flood levels on other property, either across the river, upstream, or downstream. Those increases may affect an area that is already developed, or a non-protected area. This same problem occurs with temporary levees put up during flood fighting operations. Some of these temporary levees are installed and removed time after time, with no compensation to nearby landowners whose property is inundated by the higher water levels the levees cause.

Collection of water behind a levee—Rainwater will collect behind a levee, since it can no longer flow to the river. The water must be pumped out to keep structures behind the levee dry or at least at lessened risk. This introduces other risk uncertainties: Are the pumps big enough to handle all the water? Will they be operable during a catastrophic event? Will operators be there to staff the pumps? We heard the unfortunate answers to the last two questions during Katrina.

Planned failure points are not built into levees—Dams are designed with emergency spillways for flows that exceed the design flood. This adds resilience and long-term reconstruction savings by ensuring that the dam will not

An additional, insidious way in which we have underestimated magnitude has been by the use of an arbitrary prescriptive standard, the 100-year flood. Originally intended in the 1960s as a compromise level that would serve as a norm while we experimented with national policy and flood insurance, it has become institutionalized, misconstrued as a safety standard.



completely wash out. Levees could be designed similarly, with planned failure points, but they rarely are. Sections of the levee might be built lower and reinforced, allowing extreme floods to flow over into sections of open or minimally developed land without washing out the levee.

Who pays?—In the case of levees, the answer is, in large part, the federal taxpayer. Levees are typically built by the U.S. Army Corps of Engineers. Design and construction costs are usually paid 65 percent by federal taxpayers and 35 percent from non-federal sources. Operation and maintenance costs are supposed to be borne by the local sponsor. Some sponsors do a good job. However, there is now a push for Congress to provide money to bring levees up to standards because local sponsors failed to properly operate and maintain them over the years. The Corps also has a repair and rehabilitation program whereby local sponsors can have the levee rebuilt after it fails or overtops, using either 80 percent or 100 percent federal taxpayer funds.

Increased development behind levees increases the risk—Perhaps the largest factor increasing risk and costing taxpayers money associated with levees is the lack of land use controls behind the levee. In the past, many levees protected agricultural areas. If the levee failed, the consequences were short. However, with no land use control behind these agricultural levees, development of all kinds occurred behind them. Levees are often built in deep floodplains, where the failure or overtopping results in 10 or even 20 feet of water on and in structures. Because of these severe consequences, one could argue that the “residual risk” behind even well-maintained levees is higher than that in unprotected areas.

Buy down risk in many ways—There are many ways to reduce the level of flood risk—a levee is only one. The levee neither takes away all risk, nor does it relieve the community of the obligation to consider other options for a safer, more sustainable community. Flood insurance requirements, zoning and building codes, evacuation planning and exercises, outreach with notification of risk to all property owners behind the levee—all can be used in combination, with or without levees, to reduce risk. Even if all of the measures are taken, it is important everyone understands: There is still residual risk.

Working the entire risk equation—There are those who believe the solution to the levee problem is better engineering. This can affect the probability of failure, and if standards are increased from the 100-year protection level to something like the probable maximum flood,

(See “Flood risk,” continued on page twelve)

Flood risk...

(Continued from page eleven)

the likelihood of overtopping can be reduced. But it does nothing to the consequence part of the equation. If everything else remains constant and development increases, the risk still increases. Appropriate planning and zoning is the real key to flood risk reduction.

Needed Changes

FLOOD POLICIES MUST BE BASED IN SCIENCE. A methodical approach to analyzing every component of the risk equation before making decisions is sorely needed. We have put too much focus on predicting the probability of a flood and on delineating its magnitude without recognizing the limitations of our abilities to do both of those things.

Challenges for hazards research

- Refine and enhance hydrologic modeling so that estimates of probability and magnitude are continually improved.
- Develop accurate, scenario-based models useable by decision makers at all levels so that current and future consequences of all flood risk mitigation alternatives can be fully evaluated, individually or in combination.
- Expand interdisciplinary work: refine hydrology and develop risk analysis models that depict and communicate flood risk based on knowledge about what changes human behavior.
- Continue refinements in digital mapping, especially refining display and presentation to convey complicated scenarios of flood risk.

Challenges for floodplain management professionals

- Recognize that we often don't know as much as we think we do when it comes to calculating flood risk; add factors of safety to account for that uncertainty.
- Expand the conceptualization of consequences to look far into the future and deep into the potential social, economic, and environmental reverberations of flooding.
- Critical use facilities demand a higher level of protection than ordinary residential and commercial development. Hospitals, police and fire stations, water supply and wastewater facilities, emergency evacuation roads need to be operable during an extreme flood. In order to protect lives and sustain a community there must be a higher

level of protection—at least to the 500-year or probable maximum flood.

- Use and integrate what we already know and are discovering about, for example, global warming impacts. Don't fall back into the previous trap of expecting clear and solid evidence about all aspects of risk. Err on the side of caution.
- With new digital mapping and computerized rate setting, we should do a much better job of rating flood insurance. Rates should be actuarial, considering all aspects of flood risk, not just probability. Some areas with very deep or high velocity flooding should probably not be offered flood insurance at any cost.

Challenges for the administration and Congress

- Restore science-based policy.
- Foster individual and household self-reliance by making the consequences of failing to address flood risk fall on those who fail to act.
- Support risk-based hazard insurance and consider making its purchase mandatory for everyone. Be realistic about broadening the risk pool if flood insurance is only mandatory in the 100-year floodplain. Thirty percent of claims are for properties outside of the identified 100-year flood zone.
- Address insufficiencies in infrastructure, including higher protection and performance standards in new construction and repair. Investments must be made in rehabilitating existing flood protection infrastructure but should not be made for new projects except in already densely settled areas.
- Invest in basic data, such as stream gauges, flood damage assessment for each event, insurance claims data by property, and detailed topographic mapping.

Conclusion

As a society we must act as wisely as we can, based on the best information available. Scientists, practitioners, and decision makers of decades past undoubtedly believed they were doing that. But the benefits of hindsight, supplemented by the strong dose of humility being administered to us by Mother Nature, should be enough move us toward the future with more caution, with more scrutiny of our surroundings, and with a methodical, scientific approach for managing our flood risk.

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Community Safety After the Victoria Fire

Australia's wildfires challenge the "leave early or stay-and-defend" strategy

FOR DAYS, OFFICIALS HAD PREDICTED THAT SATURDAY, February 7, would present the worst fire danger in the history of the Australian state of Victoria. On Friday, the state's chief fire officer observed we were entering "uncharted territory." The state's premier—the equivalent of a U.S. governor—said, "Tomorrow probably by a long way, [is going to be] the worst day ever ... if you can stay at home, stay at home."

In the event, the weather was even worse than predicted. There was a record high in Melbourne, the state's capital, of 46.4 degrees Celsius (115.5°F). Elsewhere, temperatures were even higher, with very strong winds and extraordinarily low humidity—perfect wildfire conditions. More importantly, the day came after 12 years of the state's hottest and longest drought, a string of the hottest years on record in the last decade. Through January, a 35-day dry spell for Melbourne equalled the second longest in history, topped off by the most severe heat wave on record the week before. Fuels, even in normally damp areas, were desiccated and ready to burn.

It's not surprising then, that on February 7, 2009, Victoria experienced its worst ever fire losses. The state seemed stunned. Each hour, death and losses rose, finally settling at 173 fatalities, more than 2,000 homes lost, major infrastructure damage, up to one million animals killed, and massive, ongoing social and economic disruption. But no firefighters died.

Stay-and-Defend Tested

IN ACCORDANCE WITH THE STATE'S "prepare, stay-and-defend, or leave early" policy, people were advised to activate their fire plans and to decide whether they would stay or leave early. I live in the bush town of Mt. Macedon. We had long ago decided that we would be better off

defending someone else's property rather than our own. Our timber house would probably be difficult to defend with its multiple levels, complex roof design, and a bushy landscape around it. Being on the southern slope of the mountain the bush would normally be lush and resistant to burning—but not this year. We spent the day on standby with the local volunteer fire brigade. By early afternoon a fire was spreading fast and resources were being called in.

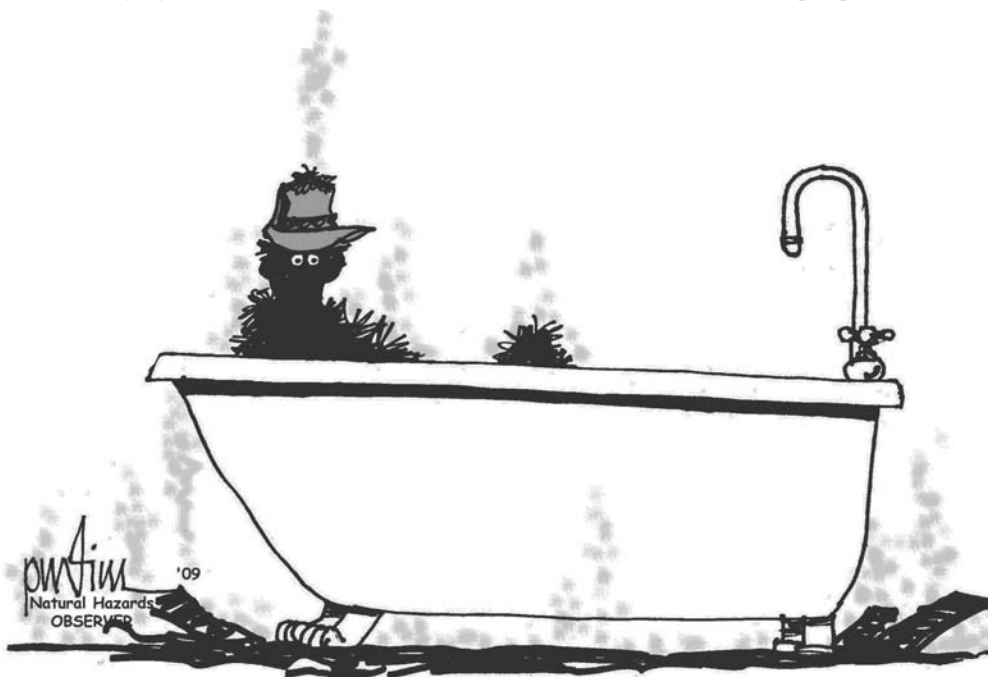
Fairly quickly there seemed to be other fires, spotting up to 35 kilometers (about 22 miles) ahead or becoming combined with yet more fires. By midafternoon, we heard on the fire radio an unfolding disaster as emergency management was overwhelmed with some 1,600 incidents reported on the state's fire agency's website from all over the state—all made worse when a strong wind change arrived in the evening.

Firefighters and householders defending their properties found the fire came first from one unexpected direction and then from another, due to wind change, local effects, or possibly the wind conditions generated by the fire itself. In some cases it back-burned. Many times, the fire front lasted much longer than anticipated. The weather continued to worsen for the next week or so. I rushed home one afternoon to ash falling on our house—but a wind change blew that fire back on itself.

In the days immediately after the fire, the community safety policy of electing to leave early or stay-and-defend remained in place, although it came under intense scrutiny. Money flowed from the Australian public and governments. A major public inquiry was announced. A loose consortium of fire-related agencies sponsored a major post-fire research program through the existing national Bushfire Cooperative Research Centre (CRC). The recovery process got under way with a high-profile Bushfire Concert, which attempted to represent the various affected groups and pay respects to the deceased.

The people and businesses of Australia rapidly generated a fund of well over A\$350 million (about US\$275 million), in turn creating questions about how to use the money. Despite immediate grants, months later some people claim to have received nothing. Some argue the uninsured shouldn't receive compensation. But it's unclear why losses shouldn't be shared. At present the insurance sector, with well over a billion Australian dollars in claims, is bearing much of the loss—along with government, the people of Australia through their donations, and of course the often traumatized survivors.

Other arguments take the position that people take risks when they decide where to live,



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Fires...

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so they should be responsible for their losses. In Australia, the urban-bushland interface is developed by land corporations and planning departments, not individuals. Many people do like the bush environment. But a more powerful driver is affordability, especially since home prices in Victoria—unlike elsewhere—show no signs of decline.

It is argued that planning should direct development away from bushfire prone areas. But the planning system in Australia has other priorities, promoting economic development rather than hazard management, with some exceptions (Handmer 2008). Additionally, many of the areas burnt have historically been seen as low risk areas for bushfires. Until the current long drought, they were wet temperate forests by Australian standards.

The substantial post-fire research effort focused on collecting time-critical data, gleaned the lessons emerging in three areas: human behavior and community safety; building performance; and fire behavior. The research seeks to document whether, and to what extent, the fire and losses deviate from previous research results and experience—for example, for the “stay-and-defend or leave early” policy.

In the weeks following the fire, this work involved intensive fieldwork with teams of researchers and investigators from across Australia. It presented a major logistical challenge, setting the scene for a substantial improvement in knowledge. To get a better understanding of building performance, each building team worked with a human behaviour specialist who interviewed survivors about their experiences and how their house interacted with the fire. Over 650 interviews are being analysed. These will be complemented by a mail-out questionnaire to a large sample within the affected areas.

A Royal Commission

THE STATE GOVERNMENT ESTABLISHED a Royal Commission—the most powerful quasi-judicial form of inquiry in Australia (www.royalcommission.vic.gov.au). It has broad evidence-gathering powers, including the power to commission its own research. Although its remit is broad, the inquiry is concentrating initially on warnings, information flow, and community safety policy—issues with a high media profile. The commission must deliver its interim report in August, before the next fire season.

An important question concerns how people died—and how many died while staying and defending. We know that people died fleeing the event in cars, many died

outside, and many people died in their homes. We know at this stage that at least some died while sheltering. The fire nonetheless overwhelmed some well-prepared residents. We know that many people survived in their homes, and in some cases outside. Many were able to leave safely—albeit later than would have seemed advisable. Houses were destroyed in heavily forested areas with crowning fires as well as through classic ember attack in low fuel areas where gardens remain scorched but unburnt. Some people apparently believed the bathroom was the safest room. This can only have come from instructions for dealing with hurricanes and tornados. It is deadly advice in bushfires.

Not surprisingly, public attention has focused on those who died in houses rather than those who were saved there. But before anything definitive can be said about the pattern of fatalities, we must await the fatality reports being prepared by the police for the state coroner following normal practice.

No Risk-Free Options

MUCH OF THE MEDIA COMMENTARY on “stay-and-defend or leave early” illustrated the range of interpretations the approach is subject to, as well as some misinformation about the policy’s status and evidence base. It has been asserted that the policy had never been reviewed. This is incorrect. In one sense, the approach has been subject to constant review because key fire agency staff have made it their business to examine its performance informally after each major fire event.

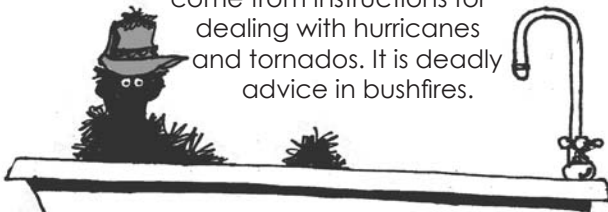
In a formal sense, when the national bushfire research group was established in 2003, one of its priorities was to undertake a critical examination of the approach (Handmer and Tibbits 2005; Handmer and Haynes 2008). The Australian Peak Fire Agency Association was formally reviewing the policy as well, before being overtaken by events. Following the recent fires, it is appropriate the policy be considered in the light of new experience.

Our earlier review highlighted that while no option is risk free, the historical evidence strongly supports the policy—which has long been and remains a reality for rural Australians. But there are clearly implementation issues and challenges, especially at the urban interface. For example, many people facing the threat of a bushfire do not make a clear decision. Instead, they adopt a wait-and-see approach, often deciding to leave at the most dangerous moment when the fire’s arrival is imminent. Or they find themselves mentally or physically unprepared for a proper defense. In some cases, little thought has been given to how to ensure the safety of vulnerable household members.

This all highlights the magnitude of the task facing fire educators. Most in the interface and bush areas are aware that they live in bushfire risk areas. However, this does not necessary mean there is much understanding of what bushfire risk means for them personally or in terms of preparation for either leaving or staying safely.

The policy depends on properties being defensible. This is not always the case. It is not simply a matter of householders failing to maintain clear space. A new bushfire-prone areas building code has come into force, but brings its own issues. This risk-based code is hailed by some as a solution. The code reduces the standard for many of the areas burnt out on February 7, because they are classified as low risk.

Some people apparently believed the bathroom was the safest room. This can only have come from instructions for dealing with hurricanes and tornados. It is deadly advice in bushfires.



The Royal Commission has a mandate to report on changes that would improve community safety and reduce the risk of future devastating losses. Everything is under review—including the policy of people deciding whether they would prepare, leave early or stay-and-defend. There are calls to change the “stay-and-defend or leave early” policy. But there is also a desire to scrutinize the evidence from post-fire and other relevant research before making major recommendations.

Of course, there is always room for improvement in implementation, education, warnings, and triggers for action. But are there completely different alternatives that would enhance community safety? Suggestions include mass evacuations, bunkers, and community fire refuges. Unfortunately, any solution will bring its own risks. For example, mass evacuations require time, resources, and infrastructure. Fire bunkers are made and promoted without any standards, and may promote passive behavior—why prepare if there is a bunker for shelter? Community fire refuges were widely signposted and evident some years ago, but have now all but vanished. The challenge is to have an approach that recognizes its

limits, while delivering the best community safety outcome possible in circumstances which may not have been planned for.

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Washington Update

Fugate, FEMA and Funding

The following questions and answers are excerpted from the April 22, 2009, U.S. Senate committee confirmation hearings for Craig Fugate, then nominee to be the administrator of the Federal Emergency Management Agency. Before his nomination, Fugate was director of the Florida Division of Emergency Management. He's also been a volunteer firefighter, paramedic, and lieutenant with Alachua County Fire Rescue. He was confirmed on May 13.

Craig Fugate: The Post-Katrina Emergency Management Reform Act is one of the most momentous things to come about in emergency management ... We were oftentimes welded to the Stafford Act as to what our roles and responsibilities should be. Some of the things the Post Katrina Reform Act have done is make it clear that the FEMA is part of the Department of Homeland Security. It lays out responsibilities to make sure that this nation is prepared for all hazards, not just the natural hazards that many of us in emergency management have experience with.

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 in the volunteer, faith-based and community-based organizations, and the private sector.

The Post-Katrina Emergency Management Reform Act has finally, for once, defined what FEMA's role is in that program, and our task is to go forward to build that team, and respond to the next catastrophe.

Question—Sen. Joseph Lieberman (Ind.-Conn.): *The Congress has a rising interest and concern about the rising danger of cyberattacks ... It seems to me that FEMA ... ought to be at the center of the Department of Homeland Security's planning for*



both prevention and response to a cyberattack.

Fugate: Mr. Chairman, as the director of the state of Florida (emergency management), I'm well-known for doing no-notice exercises which we call “thunderbolts.” We've actually done exercises involving critical failures in our communities' infrastructure through various cyber-attacks ... Our role in FEMA is to be prepared for the consequences if things go out. It's really not relevant what caused it go out.

Q—Lieberman: *Let me briefly ask you, without belaboring the point, but it is an important one to us on the committee. In*

Fugate ...

(Continued from page fifteen)

the past you've made statements that it would be a mistake to take FEMA out of the Department of Homeland Security. Do you still hold that position?

Fugate: Mr. Chairman, yes I do. The next confirmed administrator of FEMA needs to be focused on the next disaster. And being focused on that means that that debate, as far as I'm concerned, is over.

Q—Lieberman: *I'd like to get your view on the role of the regional offices in enabling FEMA to achieve its critical mission.*

Fugate: I believe the role of the regional offices is to be the principal interface with the state in building that team. I believe very much that we should be delegating down to the administrators the ability to deal with the day-to-day issues, and the response that they may have supporting a state, and to build those partnerships prior to the next event. There has to be accountability, there has to be responsiveness, but I think we'll be best able to achieve that using the regional structure.

Q—Sen. Susan Collins (R.-Maine): *Technologies are now available so that we can target notification to a geographic location—reverse 911, text messaging and email—to give people notice of impending damage, as well as instructions of what to do. FEMA has been experimenting with parts of an integrated public alert and warning system that would take advantage of these new technologies. What are your thoughts on how we can improve communication and will you make a priority to move this project forward?*

Fugate: Senator Collins, absolutely. Here's the bottom line: If we cannot reach the population at risk with the information they need to act on on a Sunday morning at 3 a.m. when nobody's watching television or listening to the radio, the system fails. You have to define the outcome, then apply the process and technology to achieve the ability to warn people when they're not prepared, when they're not paying attention, when they may not know a threat exists.

Q—Sen. Mary Landrieu (D.-La.): *I agree that construction and development should follow sound flood and storm data ... However, some of these actions have left viable Louisiana communities ... Federal regulations permit FEMA to authorize construction in a "V zone" [high-hazard "velocity zones"] if no practical alternative sites are available. Will you use your authority to approve some construction—like fire stations and police stations—in communities that obviously need those basic protections?*

Fugate: Senator Landrieu, if I'm confirmed, one of the things I want to be able to do is look at V zones and make sure that we are pragmatic in our decision making. Obviously when a community is at risk and we can minimize that risk to their lives and property and future we should achieve that. There are times when that is not practical and we need to look at the potential options through engineering or other mitigation techniques that can be used to mitigate that hazard.

Q—Sen. Thomas Carper (D.-Del.): *... Some of your key priorities, please.*

Fugate: Obviously the top priority is being prepared

for the next disaster whatever may that be ... [then] the recovery that we currently have under way with hurricanes Katrina and Rita and rebuilding the Gulf Coast.

The challenges then are from the Post-Katrina Emergency Management Act. What is our national strategy for recovery? ... One of the things we have to define [for housing] is, what are we really talking about as far as numbers? I know that in the great Miami hurricane in Florida, we'd be looking at about half a million housing units. That would not be an 18-month to 24-month program... [which is] what groups have the resources to address in our case, Florida, but we look at other states, whether we had a storm come up the mid-Atlantic states, if we had the New Madrid earthquake, and look at what would be the potential number in a worst-case scenario.

Then I would start going back to our programs and say, "Where are the gaps at?" Too often we take our programs and try to build up to a number, not really having an expectation that that number might be so large the process won't get us where we need to go. That will give us better clarity as to the roles and responsibilities in the immediate as well as the long term. If you lose half million units in Florida, I can assure you that the need for affordable housing will be there long after the Stafford Act programs have expired.



Firefighters get hosed

FEMA Budget 'Essentially Flat'

Fugate was confirmed as FEMA director on May 13, about three weeks after his confirmation hearing. Sen. David Vitter (R.-La.) dropped a hold on the nomination after he received a letter from FEMA committing to work on solutions that meet the needs of those affected by disasters. It may have been only a coincidence that hurricane season was only a few weeks away. A headless FEMA may have had its response efforts hampered, which wouldn't look good for the politician who happened to be holding the head.

On May 13, the White House formally notified the Congress that FEMA would remain within the Department of Homeland Security, as forecast by Fugate in his testimony.

Two weeks after Fugate's testimony, the Federal Emergency Management Agency released its budget, which allows a glimpse at the priorities the agency has established for the coming year.

The Obama administration has requested a fiscal year 2010 budget total of \$10.4 billion—\$6.6 billion in discretionary funds and \$3.9 billion for nondiscretionary

FEMA grants programs. The FEMA budget represents an increase of \$626 million over FY 2009, or about 10 percent. The grant allocation budget is about 10 percent lower.

FEMA's budget represents about 20 percent of the entire budget of its parent agency, the Department of Homeland Security. It's roughly equivalent to the amount provided for the U.S. Coast Guard, but about \$2 billion less than for Immigration and Customs Enforcement.

The biggest line item increase in the FEMA budget is \$60 million, about a 67 percent increase, for the national pre-disaster mitigation fund. The program makes funds available to state emergency management offices for mitigation activities like acquiring property, moving structures, building shelters, retrofitting buildings, and so on. Studies have shown mitigation efforts to be among the most cost-effective measures available to reduce the damage from a disaster.

The Obama budget doesn't perfectly parallel the previous administration's line-by-line. Two areas in particular are reconfigured—"state and local programs" and "targeted infrastructure" line items. Taken together, these two show a decline in spending from the previous year of about \$176.5 million, or 4.8 percent. Nearly all of that results from shrinking the "Assistance to Firefighters Grants," which goes from \$775 million last year to \$590 million this year, a decline of about 24 percent.

Homeland Security and Governmental Affairs Committee Chairman Joe Lieberman (Ind.-Conn.), said of this, "I regret that the administration is seeking cuts in key homeland security grants states need to train and equip firefighters and to protect seaports, rail, and transit systems. While I support a substantial and long-overdue increase in funding for the SAFER grant program, which assists communities in hiring fire fighters, I am deeply disappointed that the administration would decrease by nearly 70 percent the Assistance to Fire Fighters Grant Program, which helps fire departments with essential equipment and training." The budget for firefighter grants is about 70 percent of the prior year's budget, but it wasn't "decreased by 70 percent," as Lieberman says here.

The targeted infrastructure program shows a comparable year-to-year decline of \$355.5 million, or about 20 percent. This is mostly the result of a large decrease in the port security grants (\$400 million in 2009, \$250 million in 2010), rail and public transportation security grants (\$400 million in '09, \$250 million in '10), and a complete zeroing out of grants for bus security, trucking industry, regional

catastrophic preparedness, and interoperable emergency communications. The latter save a total of about \$105 million.

The budget shows a request for a large increase in the Disaster Relief Fund from \$1.4 billion in FY 2009 to \$2 billion in 2010.

"Essentially flat funding for the Federal Emergency Management Agency's operations budget could impair its steady transformation into an agency capable of responding to catastrophes," Lieberman said.

Another area specifically covered in Fugate's confirmation hearing was cybersecurity. That line item is completely zeroed out of the FEMA budget, from about \$1.7 million in 2009. However, elsewhere in the Department of Homeland Security budget, cybersecurity got a fairly large increase. There is an additional \$75.1 million for DHS to deploy cybersecurity technologies, and a total of \$37.2 million (up \$6.6 million) for cybersecurity research. Asked whether these amounts address Lieberman's concerns about FEMA's approach to cyber-threats, a spokeswoman for the Senate Homeland Security and Governmental Affairs Committee said she didn't know, but would get back to us on it. She never did.

Melissa Hathaway, the Obama administration's top cybersecurity official—her official title is acting senior director for cyberspace for the National Security and Homeland Security Councils—told the RSA Security Conference in late April, "Our global digital infrastructure, based largely upon the Internet, is neither secure enough nor resilient enough for what we use it for today and will need into the future. This poses one of the most serious economic and national security challenges of the 21st century. The design of today's digital infrastructure was driven more by considerations of interoperability and efficiency than of security."

But Hathaway's talk was short on specifics about a solution, although she did cite the need for transcending "the jurisdictional purview of individual departments and agencies because ... no single agency has a broad enough perspective to match the sweep of the challenges."

The *Washington Post's* Brian Krebs reports (voices.washingtonpost.com/securityfix/2009/04/obamas_cyber_czar_offers_few_d.html?hpid=sec-tech) that most of the interest in this topic so far has been in the "power struggle on cyber underway between the Department of Homeland Security and the National Security Agency."

—Dan Whipple

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. Direct 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

ALL HAZARDS

Disaster and Human History. By Benjamin Reilly. 2009. ISBN: 978-0-7864-3655-2. 391 pp. \$49.95 (softcover). www.mcfarlandpub.com.

Disasters, though sometimes of brief duration

themselves, can have lasting impacts on humans and their societies. *Disasters and Human History* takes a case study approach to these effects, examining earthquakes, tsunamis, environmental change, and the like for their game-changing effects on humanity.

(See next page)

As its title suggests, the book is a history, not a prescription for policy. But Reilly notes that the growth of population has resulted in increased deforestation, soil erosion, endangered water supplies, and exposed the world to the bold new frontier of climate change. The lessons of history might offer some guidance to dealing with these hazards.

At the end of each chapter, Reilly provides study questions for students to ponder. Though necessarily episodic and a little disjointed because of the case study format, this book is a very enjoyable read, offering the tension and drama these hazards deserve.

Managing for Long-Term Community Recovery in the Aftermath of Disaster. By Daniel Alesch, Lucy Arendt, and James Holly. 2009. ISBN: 978-0-9793722-2-3. 205 pp. \$35 (softcover). www.riskinstitute.org.

The next frontier for hazards research is community resilience. This book offers a concrete approach to what it calls "community recovery," focusing on methods to create vibrant and strong communities that are most likely to recover successfully from a disaster.

The authors examine in detail their seven critical steps for preparing for "the next event" so that a community is most likely to recover from it. These are: plan; diversify; network; standardize; position the community; partner; and "start today."

Managing for Long-Term Community Recovery should prove a very valuable book for people on the ground building resilient communities. It focuses on the pragmatic steps from the social and psychological to taxes and insurance.

Few of these steps will be easily accomplished. The "diversify" step listed above, for instance, refers to economic diversity. "Too much dependency on one industry or too much density in one location seems to increase the likelihood of community collapse," the authors write.

This is an uncontroversial insight, but "diversifying the economy" is already the number one priority of most communities across the country. The difficulty of accomplishing it is hard to overstate.

Nonetheless, this book should be on the shelf of all emergency planners, if only to remind them that planning for and recovering from a disaster is a complex, interlinked, step-by-step process.

Disaster and Spiritual Care: Practical Clergy Responses to Community, Regional and National Tragedy. Rabbi Stephen B. Roberts and Rev. Willard W.C. Ashley, Sr., editors. 2008 ISBN: 978-1-59473-240-9. 348 pp. \$40. (hardcover). SkyLight Paths Publishing. www.skylightpaths.com.

Disaster in a community is always a spiritual crisis as well as a physical one. Clergy often play a cross-disciplinary role in disaster, offering psychological and spiritual counseling to those affected. Clergy also have the responsibility to take care of themselves as well as their parishioners, increasing the pressures they might face in a community disaster. This book offers practical advice for pastoral counseling, along with the basics of a disaster's progression. It includes advice on working with the elderly, with uniformed and official personnel, and dealing with "compassion fatigue," among other topics.

Assessing Vulnerability to Global Environmental Change. Anthony G. Patt, Dagmar Schröter, Richard J.T. Klein, and Anne Cristina de la Vega-Leinert, editors. 2009. ISBN: 978-1-84407-697-0. 258 pp. \$146 (hardcover). Earthscan. www.earthscan.co.uk.

This book begins with an idiosyncratic example of vulnerability—the Norse who settled Greenland a thousand years ago. The Norse were among the best boat builders in the world at the time, write the editors, but they declined to make use of the Inuit designs of boats for hunting seals. It wasn't because they couldn't, but rather because they wouldn't. "The Norse proved to be remarkably unadaptive," they write, "but it was not because they lacked the technology."

The editors discuss clearly and openly the state of vulnerability theory, urging openness about the assumptions researchers make. But theory is hampered by the difficulty of reliably predicting the future in a changing complex system. "Vulnerability is not a feature of how a system functions in the present, but rather of how it is likely to function in the future, and in particular of the ways in which it will not function in the future as it does today," they write. "To surmise that a system is vulnerable, one has to combine projections of what events the future will bring with a theory of how these events will make the system under study worse off."

The book offers studies of different types of vulnerability assessments for numerous places around the world, and of many different components: ecosystem services, climate and trade, climate and health, and many others.

Corporate Responses to Climate Change. Rory Sullivan, editor. 2008. ISBN: 978-1-906093-08-2. 356 pp. \$67.50 (hardcover). Greenleaf Publishing. www.greenleaf-publishing.com.

This is a book you can read as either "the glass is half empty" or "the glass is half full" in the business response to climate change. In his opening essay, editor Rory Sullivan argues that climate change is the most serious environmental problem facing the planet. He surveys 125 British companies for their response. He finds that about a third of them have gone beyond the basics by committing to reduce greenhouse gas emissions, supporting effective government action on climate, and other steps. But 21 companies "scored extremely poorly, suggesting that there may be significant weaknesses in the manner in which these companies are managing their greenhouse gas emissions."

Sullivan says "Companies accept that they have responsibility for managing or reducing their GHG emissions and most have ... established the governance and policy frameworks and implementation mechanisms necessary for them to manage these emissions." At the same time, "Most companies do not see climate change as a risk to their business." Businesses are not trying to guide public policy, but are waiting to react to public policy as it emerges.

Disaster Risk Reduction: Cases from Urban Africa. Mark Pelling and Ben Wisner, editors. 2009. 978-1-84407-556-0. 224 pp. Price unavailable. (softcover). Earthscan. www.earthscan.co.uk.

This book takes a holistic view of risk and hazards in

Africa. "Reading through African nations' reports to the UN and sampling donor projects and academic research, one would think that Africa suffers mostly from drought, food emergencies (both often exacerbated by violent conflict), epidemics, and floods. The overwhelming impression is of rural vulnerability to the vicissitudes of climate, pests, warlords, and tyrants. However, this stereotype is false."

In fact, the authors say, Africans face the same threats—rising from rapid urbanization—as populations in Asia and Latin America. These include urban fires, traffic hazards, floods, epidemics, and so on.

The book looks at several case studies, making recommendations for the future based on the work.

HURRICANES

Horses of the Storm: The Incredible Rescue of Katrina's Horses. By Ky Evan Mortensen. 2008. ISBN: 978-1-58150-185-8. 220 pp. \$19.95 (softcover). Eclipse Press.

This is the story of how the Louisiana State University School of Veterinary Medicine and many volunteers moved in the wake of Hurricane Katrina to rescue horses that owners were forced to leave behind in September of 2005. They also managed to save some dogs, cats, goats, "and even a few pet iguanas." An appendix provides a useful emergency preparedness guide for horse owners.

CLIMATE CHANGE

Extreme Weather Hits Home: Protecting Your Buildings From Climate Change. By John C. Banta. 2007. ISBN: 978-0-86571-593-6. 235 pp. \$27.95 (softcover). New Society Publishers. www.newsociety.com.

Modern construction methods have solved a lot of problems with the buildings we live in, but they've created others. The changing climate will also offer new challenges to the homes that shelter us from the elements. Author John Banta offers an overview of expected issues resulting from climate change—more hail, high winds, hurricanes, fires, tornadoes—then suggests how homeowners can proactively protect themselves against those events likely to occur in their neighborhoods. The book offers an interesting look at the details of a home's health, from the amount of moisture that wood frame construction can take without rotting to the issue of ice dams on the roof from a rapid melt-freeze cycle.

Restructuring Federal Climate Research to Meet the Challenges of Climate Change. By the National Research Council of the National Academies. 2009. ISBN: 978-0-309-13173-5. 254 pp. \$50.18 (softcover), or free download at www.nap.edu/catalog.php?record_id=12595. National Academies Press. www.nap.edu.

"Climate change is one of the most important global environmental problems facing the world today," this book begins, admitting that holding average future warming to two degrees Celsius (~3 degrees F) will be a "Herculean task." The NRC outlines six research priorities to help out Hercules.

The first one listed is one that should give heart to the hazards community, because it calls for dealing with the human dimensions of climate change. "Addressing societal concerns," the report says, "requires a strong underpinning of observations and models, strengthened research across

the board—particularly in the human dimensions of global change and in user-driven (applied) research that supports decision making—and increased involvement of stakeholders."

The research program also calls for: establishing a physically, biologically, and socially based climate observing system; developing science and infrastructure to support the next generation of coupled modeling systems, to provide predictions of impacts affecting adaptive capacity; a national assessment process to determine the risks and costs from climate change; strengthening research on adaptation, mitigation, and vulnerability; and coordinating efforts to "routinely" provide climate information to decision makers.

Climate Change Adaptation in the Water Sector. Fulco Ludwig, Pavel Kabat, Henk van Schaik, and Michael van der Valk, editors. 2009. ISBN: 978-1-84407-652-9. 274 pp. \$75 (hardcover). Earthscan. www.earthscan.co.uk.

This Dutch-led effort takes a long look at the many aspects of water management on the current and future climate change scenarios—no small task. The authors note that while climate may already have had an impact on water availability in some places, there are other factors at work as well, especially increased population and increased water use. But in some cases, "changes in climate have contributed to dropping lake levels. For example, in western Africa, the water level of Lake Chad declined due to both human activities and reduced rainfall."

One of the great unknowns in water management strategy is the issue of stationarity. Until very recently, planners have relied on the fact that water supplies in an area vary with a relatively narrow and predictable band. But this assumption has come under increasing pressure. In a February 1, 2008 article in the journal *Science*, U.S. Geological Survey hydrologist Chris Milly and colleagues wrote a piece entitled, "Stationarity Is Dead: Whither Water Management?"

"How did stationarity die?" they ask, then answering, "Stationarity is dead because substantial anthropogenic change of Earth's climate is altering the means and extremes of precipitation, evapotranspiration, and rates of discharge of rivers."

The stakes are large. Globally more than \$500 billion is invested in water management annually. *Climate Change Adaptation in the Water Sector* says that what water managers are trying to accomplish is "climate proofing." The definition of climate proofing depends upon whether the local or national situation of the decision-making process is dominated by people using the "adaptive management paradigm" or the "foundational water management paradigm."

The book includes case studies from around the world, helpful in putting the theoretical aspects into concrete terms.

The Earthscan Reader on Adaptation to Climate Change. E. Lisa F. Schipper and Ian Burton, editors. 2009. ISBN: 978-1-84407-531-7. 459 pp. \$30.25 (softcover). Earthscan. www.earthscan.co.uk.

Most of the debate on how to deal with climate change has focused on reducing emissions of greenhouse gases. But as it becomes clearer that emission reductions large enough

(See next page)

to prevent dangerous warming are unlikely, more interest is being generated in adapting to the changes. "After years of benign neglect," write the editors in the introduction to this book, "the idea that humanity must give serious attention to adaptation to the climate change has finally come into its own."

What this adaptation might consist of is still up in the air. As one of the essays in this volume notes, much depends on the scale you're talking about. "Adaptations represent adjustments in something, sometimes called the 'unit of analysis,' 'exposure unit,' 'activity of interest,' or 'sensitive system,'" the authors write. "Are we considering adaptation in a species, or in an ecosystem, or in an economic sector, or across a social structure, or across a political entity?" Furthermore, adaptations unfold across an uncertain, shifting landscape.

This book applies much of the theory of adaptation to the climate conundrum, analyzing the impact of many suggested policies in the context of that theory.

Earth Under Fire: How Global Warming Is Changing the World. By Gary Braasch. 2009. ISBN: 978-0-520-26025-2. 267 pp. \$45 (softcover). University of California Press. www.ucpress.edu.

If you like your global catastrophes in lovely pictures, this is the book for you. A coffee-table sized exploration of the current impacts of climate many dramatic illustrations, Braasch digs remarkably deeply into the current changes in the earth brought on by anthropogenic climate change. Rising water, disappearing ice, changing habits of the checkerspot butterfly (among other species) are all chronicled in this readable and beautifully photographed and illustrated effort.

Growing Cooler: The Evidence on Urban Development and Climate Change. By Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Walters, and Don Chen. 2008. ISBN: 978-0-87420-082-9. 170 pp. \$44.95 (hardcover). Urban Land Institute. www.uli.org.

This book synthesizes the intensive research that is being done on the relationship between urban development, travel and the carbon dioxide from vehicles. It looks at the issue of "compact development" in urban areas to see how much CO₂ emission savings can be realistically expected by adopting compact development principles.

The news is good on this front, although it doesn't solve the carbon problem overnight. Nonetheless, smart growth can make a substantial contribution. "Viewed in total," the authors write, "the evidence on land use and driving shows that compact development will reduce the need to drive between 20 and 40 percent, as compared with development at the outer suburban edge with isolated homes, workplaces, and other destinations."

LANDSLIDES

The Landslide Handbook: A Guide to Understanding Landslides. By Lynn M. Highland and Peter Bobrowsky. 2008. ISBN: 978-141132226-4. 130 pp. Free. (softcover). U.S. Geological Survey Circular 1325. www.usgs.gov/pubprod.

Every once in a while—not often, thankfully—a rockfall landslide will squash a climber's parked car in one of the canyons along the Front Range. This is not the

gravest landslide threat faced by communities around the country, but it's a serious matter for some of us who park in these hazardous spots. Who knew? The U.S. Geological Survey's *Landslide Handbook* speaks to the depths of those of us curious about how falling rock arrives in our vicinity. The handbook "is intended to be a resource for people affected by landslides to acquire further knowledge about the conditions that are unique to their neighborhoods and communities."

RISK

The Fantods of Risk: Essays on Risk Management. By Felix Kloman. 2008. ISBN: 978-1-4363-0226-5. 133 pp. \$19.99 (softcover). Seawrack Press. www2.xlibris.com/bookstore/bookdisplay.aspx?bookid=45230.

This is an elegantly produced and well-written self-published book on the essence of risk and risk management. Kloman has more than 30 years of experience in the field, which he distills here in easily intelligible chunks. He starts, sensibly, with a definition of risk ("a measure of the probable likelihood, consequences and timing of an event") and risk management ("a discipline for dealing with uncertainty").

Regarding catastrophes, he speculates along with William McNeill that perhaps we are subject to "a 'law of conservation of catastrophe' that says the more we learn and do, the more we create conditions leading to the next one." He offers three suggestions in this particular essay: Individual responsibility; changes in tax structures to allow the creation of catastrophic reserves; and public and private cooperation.

Kloman tackles many other risk issues in this readable book, ranging from gambling to the war between the sexes.

Risk Governance: Coping with Uncertainty in a Complex World. By Ortwin Renn. 2008. ISBN: 978-1-84407-292-7. 455 pp. \$58.50 (softcover). Earthscan. www.earthscan.co.uk

Risk governance has become the preferred term for dealing with risks from a wide variety of sources. Ortwin Renn, who has studied risk for 30 years, offers a governance framework that includes "institutional design, technical methodology, administrative consultation, legislative procedure and political accountability on the part of public bodies, and social or corporate responsibility on the part of private enterprises." The two major challenges for risk governance, he writes, are generating and collecting knowledge about the risk, and making the decisions on how to handle it.

TECHNOLOGICAL DISASTERS

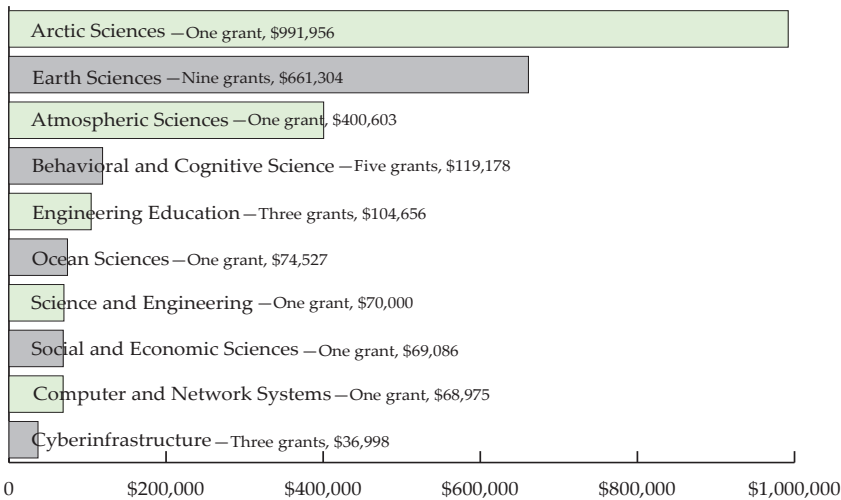
The Spill: Personal Stories from the Exxon Valdez Disaster. By Sharon Bushell and Stan Jones. 2009. ISBN: 978-0-9800825-8-6. 287 pp. \$17.95 (softcover). Epicenter Press. www.EpicenterPress.com.

Although the accident itself happened 20 years ago, the *Exxon Valdez* oil spill is like a man-of-war that has slipped its stingers into the lives of everyone it touched. *The Spill* is the record—in their own words of those stung—from fishermen to admirals, Native Americans to public relations officials. This is an eloquent tribute to the hardships and hard efforts of those affected by the disaster.

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, April 12 to June 13, 2009, by funding division Total funding for period: \$2,597,283

U.S.-China Planning Visit: Earthquake-Induced Landslide Hazard Assessment. National Science Foundation award #0918050. One year. \$3,806. Principal investigator: Tong Qiu, Clarkson University, tqiu@clarkson.edu.

The purpose of the visit is to discuss collaborative research, formulate research plans, assess laboratory conditions, and discuss a student exchange. The investigator plans to develop a joint research proposal with his Chinese counterparts to study earthquake-induced landslide hazards. Seismic slope stability is an important issue after major earthquakes.

Post-disaster Information Environments. National Science Foundation Award #0848941. One year. \$6,490. Annalee Saxenian, University of California-Berkeley, anno@sims.berkeley.edu.

Information and communication technologies have been presented as straightforward solutions to recent American disaster response failures. The assumption is that giving people a certain piece of information will result in a certain set of actions. The research will investigate situated information-related practices of early Internet users and Spanish-speakers in Northern California following the 1989 Loma Prieta Earthquake. The research focuses on three key ICT-related information practices that this work argues are general post-disaster actions: people notify others of their personal well-being; people and organizations try to gain awareness of the situation as it develops; and organizations inform others about resource needs and availability.

A Plate Boundary Observatory on the Nicoya Peninsula, Costa Rica. National Science Foundation awards #0841091 and #0841061. Three years. Two grants. \$199,743 to principal investigator Timothy Dixon, University of Miami, tdixon@rsmas.miami.edu; and \$200,000 to Susan Schwartz, University of California-Santa Cruz, susan@es.ucsc.edu.

The work will augment, upgrade, and extend the

monitoring period of an existing network of GPS and seismic instrumentation on the Nicoya Peninsula, Costa Rica. The questions addressed include: (1) What is the relationship between slow slip, tremor, strain accumulation and interplate earthquakes? (2) What is the role of temperature and fluids in tremor and slip generation? and (3) Is the occurrence of fast and slow slip tremor spatially and/or temporally separated?

Rapid Response to a Submarine Eruption at W. Mata Volcano. National Science Foundation awards #0930025, #0929881 and #0929411. One year. Three grants. \$96,088 to principal investigator Joseph Resing, University of Washington, resing@u.washington.edu; \$71,972 to Kenneth Rubin, University of Hawaii, krubin@hawaii.edu; and \$29,789 to Julie Huber, Woods Hole Marine Biological Laboratory, jhuber@mbi.edu.

This research is a time critical response cruise by a coalition of investigators to examine a newly discovered explosively erupting undersea volcano (Mata) in the Western Pacific Ocean. The volcano being investigated is presently erupting unusual lavas of compositions indicative of the initial stages of arc formation. As such they have an unusual chemistry and are thought to be associated with hydrothermal fluids of exotic and extreme compositions. The likelihood that novel and previously undiscovered microbiological life forms associated with these fluids is a study target.

Episodic Tremor and Slip of the Cascadia Subduction Zone. National Science Foundation award #0847985. One year. \$80,000. Principal investigator: Gina Schmalzle, genschmalzle@rsmas.miami.edu.

How slow slip events and episodic tremor and slip, observed on the Cascadia subduction zone, contribute to earthquakes in subduction zones is largely unknown. These events, observed in subduction zones worldwide, slowly release significant stress throughout the earthquake cycle in a matter of days to weeks. In contrast, earthquakes release stress in a matter of seconds to minutes. This research will use existing geodetic and seismic data sets combined with an aggressive modeling approach to explain new important and fundamental observations critical both to understanding the earthquake cycle of subduction zones and to seismic hazard assessment.

US-Peru Workshop: Adapting to a World Without Glaciers, Lima, Peru, July, 2009. National Science Foundation award #0924903. One year. \$70,000. Principal investigator: Robert Rhoades, University of Georgia, rrhoades@uga.edu.

This U.S.-Peru award will support a workshop focused

on the recession of tropical glaciers in an era of global climate change and the subsequent impacts on water resources such changes will have for vulnerable segments of society. The workshop will be held in July 2009 in Lima and Huarez, Peru, and will be co-funded by USAID as part of the NSF-USAID memorandum of understanding.

Glacier Sensitivity to Climate Change: Quantifying the Influence of Tributary Glaciers. National Science Foundation award #0913107. Eighteen months. \$34,875. Principal investigator: Summer Rupper, Brigham Young University, summer_rupper@byu.edu.

The Gornergletscher in Switzerland is the second largest glacier system in the Alps. It has been retreating rapidly, but at varying rates, since the turn of the century. Preliminary numerical mass-balance modeling indicate that changes in tributary glaciers that feed the main valley glacier may be the key to predicting the response of system to changes in climate. Changes in glaciers worldwide will greatly affect freshwater resources, hydroelectric power, tourism, local climate, and sea-level rise, among other things. This project will investigate the influence of tributary glaciers on ice dynamics of the Gornergletscher system, and how changes in tributary glaciers influence the sensitivity of alpine glaciers to changes in climate.

Development of a Landscape Approach for Understanding the Contribution of Landsliding to Carbon Budgets: Using the Rio Jones of the Sierra de Las Minas, Guatemala as a Test. National Science Foundation award #0909271. Two years. \$40,560. Principal investigator: Carla Restrepo, University of Puerto Rico-Rio Piedras, crestre@hpcf.upr.edu.

Landsliding is a variable process with potentially large effects on regional carbon budgets. This variability may have important consequences for estimating carbon pools and fluxes given the contribution of landsliding to the removal of organic C contained in vegetation and soil from the hillslopes, its deposition along the hillslope-fluvial interface, and its subsequent regeneration on landslides undergoing succession. This project will develop a landscape approach for quantifying C budgets associated with landsliding based on the integration of spatial (maps) and non-spatial (field measurements of C in vegetation, soil, and water) data into a GIS modeling framework for a model watershed in the Sierra de Las Minas, Guatemala.

International REU Program in Smart Structures. National Science Foundation awards #0851658, #0851659 and #0851671. One year. Three grants. \$45,075 to principal investigator Gunjin Yun, University of Akron, gy3@uakron.edu; \$30,050 to principal investigator Richard Christenson, University of Connecticut, rchriste@engr.uconn.edu; and \$29,351 to principal investigator Juan Caicedo, University of South Carolina, caicedo@engr.sc.edu

This 10-week collaborative international program will establish a Smart Structures Undergraduate Research Collaboratory where students at the Universities of Akron, South Carolina, and Connecticut will partner with the Korean Advance Institute for Science and Technology to gain access to world-class facilities in Smart Structures. Reducing structural damage due to natural and man-made hazards is vital to the safety and economic viability of society. Smart Structures which are those structures that can

sense their environment and react accordingly, can provide more resilient designs, more effective construction, and extend overall the safe life of our built infrastructure.

Adjoint Tomography, Seismic Hazard, and Active Tectonics of the San Joaquin Basin, California. National Science Foundation award #0848080. One year. \$80,000. Principal investigator: Carl Tape, carltape@gps.caltech.edu.

The project will construct a three-dimensional structure model of the San Joaquin Basin and adjacent regions, in terms of seismic velocity variations, density variations, and geometries of the major geologic interfaces. First, a basin model will be constructed using industry well logs and seismic reflection data. Second, numerical simulations of previously recorded earthquakes in the region will be performed using supercomputing clusters. Third, the basin model will be iteratively improved using the results of the numerical simulations in a procedure known as adjoint tomography. The resultant three-dimensional structure will be interpreted in the context of the local active tectonics, such as the delamination of the adjacent Sierra Nevada. Results from the earthquake simulations will be used to assess the seismic hazard in the San Joaquin Basin.

A Real-Time Measurement Inversion Prediction Steering Framework for Hazardous Events. National Science Foundation award #0929947. Eighteen months. \$68,975. Principal investigator: George Biros, Georgia Institute of Technology, biros@gatech.edu.

The project will develop a multiscale, data-driven, high performance computational framework for real-time reconstruction of hazardous events from sparse measurements, and consequent probabilistic prediction of the evolution of the hazard. The framework is distinguished by four phases that are performed continually with dynamically obtained data over the lifetime of the hazardous event: (1) Measurement: Distributed sensors provide dynamic measurements over a specified time horizon that will be used to reconstruct the initial conditions of the event. (2) Inversion: Driven by the sparse measurements, an inverse problem is solved to estimate the initial conditions for the equations governing the evolution of the hazard. (3) Prediction: Statistical analysis of the inversion results permits estimation of the uncertainty in the initial conditions, which is propagated into a prediction of the evolution of the hazard and its uncertainty. (4) Steering: Sensors are steered to new locations based on an effectivity index that incorporates sensitivities of the inversion with respect to sensor location, estimated uncertainty in the prediction, and population density factors.

Multicentury Drought Reconstructions from Guatemala and the Context for Past and Future Hydroclimatic Change. National Science Foundation awards #0852652 and #0852648. One year. Two grants. \$47,256 to principal investigator Kevin Anchukaitis, Columbia University, kja@ldeo.columbia.edu, and \$27,414 to principal investigator Matthew Taylor, University of Denver, m.j.taylor@du.edu.

Changes in regional hydroclimate will exacerbate threats to sustainable water supplies from growing populations, pollution, declining infrastructure, and resource conflicts. One robust prediction of the most recent

Intergovernmental Panel on Climate Change climate model ensemble is that precipitation rates will decrease over Guatemala and most parts of Central America in both the summer and winter under future increased greenhouse gas scenarios. The investigators will expand the geographic frontier of dendroclimatology into the mountains of Guatemala, identifying species and sites which show sensitivity to precipitation, and developing estimates of drought variability over the last several centuries. The research will provide a long-term context for drought variability that is critical for efforts to mitigate the consequences for vulnerable human populations from climate change.

Acquisition of GPS and Seismic Equipment for Phase 2 of a Plate Boundary Observatory, Nicoya Peninsula, Costa Rica. National Science Foundation awards #0842338 and #0842137. Three years. Two grants. \$65,913 to principal investigator Susan Schwartz, University of California-Santa Cruz, susan@es.ucsc.edu, and \$36,890 to PI Timothy Dixon, University of Miami, tdixon@rsmas.miami.edu.

This grant supports a collaborative effort between the University of Miami, the University of California Santa Cruz, UNAVCO and Costa Rican colleague Dr. Marino Protti at OVSICORI to acquire and deploy GPS and seismic equipment on the Nicoya Peninsula, Costa Rica. Observation from this network will directly feed into research efforts supported by the Margins Program. This grant will facilitate an augmentation and upgrade to a current but smaller network of GPS and seismic instrumentation on the Nicoya Peninsula, Costa Rica. The end result will be better constrained geophysical observations beyond that now being acquired.

Questions to be addressed by the data collected by these instruments include: (1) What is the relationship between slow slip, nonvolcanic tremor, strain accumulation and interplate earthquakes. (2) What is the role of temperature and fluids in tremor and slip generation? (3) Is the occurrence of fast and slow slip tremor spatially and/or temporally separated?

Simulation of Contagion on Very Large Social Networks with Blue Waters. National Science Foundation awards #0832599, #0832603 and #0832586. Three years. Three grants. \$18,999 to principal investigator Keith Bisset, Virginia Tech, kbisset@vbi.vt.edu, \$9,000 to PI Shawn Brown, Carnegie-Mellon University, stbrown@psc.edu, and \$8,999 to PI Douglas Roberts, Research Triangle Institute, droberts@rti.org.

This work will make available on Blue Waters computational tools and environments for social and biological research involving interacting automata at nodes of very large social contact networks. Such research includes the evaluation of mitigation strategies for contagion on realistic national and global scale social contact networks, worm propagation on the Internet, percolation processes, viral marketing, database replication, and social phenomena such as the propagation of fads and norms. The research will provide understanding of different strategies for dealing with emerging infectious diseases

Living in Liminality: Experiences of Displacement Among Involuntary Refugees. National Science Foundation award

#0851042. Eighteen months. \$14,670. Principal investigator: Eileen Anderson-Fye, Case Western Reserve University, eileen.anderson-fye@case.edu.

Case Western Reserve University doctoral student, Nadia El-Shaarawi will conduct research on how refugees who have not been resettled understand the nature of their displacement. The research will focus in particular on the role of the international institutions with whom the refugees interact in shaping refugee understandings, and the effects of these understandings on mental health. The research will be conducted among Iraqi refugees in Cairo, Egypt. The researcher will employ the social science concept of liminality to understand how refugees in Cairo experience and make meaning in a state of uncertainty between flight and a durable solution such as resettlement.

Forecast Generation and Dissemination for the Record Setting 2009 Red River Flood. National Science Foundation awards #0937874 and #0937757. One year. Two grants. \$41,482 to principal investigator Stuart Schwartz, University of Maryland Baltimore County, stu_schwartz@umbc.edu and \$56,493 to PI Allen Bradley, University of Iowa, allen-bradley@uiowa.edu.

The current unprecedented hydrologic conditions on the Red River of the North provide a rare opportunity to document the role and interactions of human forecasters in the forecast generation and dissemination process. The work will capture and archive key transient information needed to support future research on hydrologic forecast quality and forecast value for low-probability high-consequence events. The proposed activities will yield: (1) an archive of forecast information and operational forecast interpretation by human forecasters at the NWS, (2) an assessment of the baseline quality of forecast models and the value-added by the human forecasters, and (3) documentation of the users of these forecasts, including the participants and information flows from NWS forecast dissemination conference calls, and forecast uses institutionalized in emergency response plans.

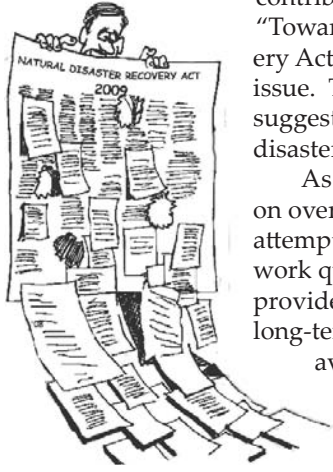
The Impact of Rural and Urban Flooding on Water and Soil Quality in the Red River Valley of the North. National Science Foundation award #0936065. One year. \$59,694. Principal investigator Thomas DeSutter, North Dakota State University, thomas.desutter@ndsu.edu.

Surface flow off agricultural and urban areas contains elevated concentrations of inorganic and organic chemicals compared to subsurface soil waters. Due to weather conditions during the fall of 2008, record snowfall in December of 2008, and a blizzard event in March 2009, the water level of the Red River of the North in the cities of Fargo, N.D., and Moorhead, Minn., reached 12.5 meters above the river bottom. The major flood level for Fargo is 9.1 m. This event is being classified as a 500-year flood. This research will quantify the effects of agricultural and urban runoff on water and soil quality upstream and downstream of a major urban area of North Dakota and Minnesota. The research will test two hypotheses: (1) that flooding-water quality will be impacted by the movement of this water through a large, urban environment; and (2) that post-flooding sediment deposited onto riparian and urban landscapes will have elevated chemical concentrations compared to the underlying soil.

Letters

To the Editor:

I would like to compliment the *Natural Hazards Observer* for the leadership displayed in inviting Ken Topping to contribute his excellent lead article, "Towards a National Disaster Recovery Act of 2009" to the January 2009 issue. The piece contains several suggestions for reform of the national disaster assistance system.



As someone who has worked on over two hundred disasters—attempting to both use all the “patchwork quilt” forms of assistance to provide immediate relief, as well as long-term safe and proper recovery available to disaster survivors—

I would like to comment on the topic of changes in disaster-related legislation and on the letters concern-

ing Topping’s article appearing in the subsequent March 2009 *Observer*.

Legislation to Improve Disaster Assistance

AS WE CONSIDER CHANGES in how we respond to disasters, I hope we keep foremost in mind that the best disaster response and recovery comes in proper planning, land use, and building codes that prevent the disaster from happening in the first place. The late, great Gilbert White famously observed, “Floods are acts of nature—but flood losses are largely acts of man.” White’s observation is supported by the recent United Nations 2009 *Global Assessment Report on Disaster Risk Reduction*. That report indicates worldwide losses from natural disasters are increasing as more people occupy disaster-prone places. A *New York Times* article on this 200-page report notes, “Education in local communities is needed to overcome a tendency to accept high disaster tolls as a matter of fate, instead of, for example, lax building codes or warning systems.” Research by Dr. Roger Pielke, as presented at the 2008 Natural Hazards Workshop confirms that the United States can expect huge increases in disasters due to current land use practices, irrespective of any additional toll which might be caused by climate change and sea level rise.

We in the United States should take the lead in “no adverse impact” solutions to increased flood damage, as advocated by the Association of State Floodplain Managers. We should expand that principle to reduce all forms of human-induced disaster damage caused by ignoring natural hazards. We must make every effort to stop disaster damage before it occurs. Then we should look at ways to design and engineer disaster relief and recovery as a fair, efficient, and sustainable process based on a foundation of recognition of natural disasters and mitigation.

Comments on the Letters

IN THE MARCH 2009 *NATURAL HAZARDS OBSERVER*, the editors printed comments on the article. In general, the com-

ments were favorable. One commentator, Elliott Mittler, offers some criticism of Topping’s recommendations and includes some statements which may benefit from a more complete examination.

- Mittler suggests that Ken Topping’s call for legislation providing for increased national emphasis on long-term recovery might not be well received by the Congress since, “When Congress has decided to engage in long-term recovery programs, it has always avoided amending the existing disaster assistance act to do so. If federal involvement in long-term community recovery is desired, then attempting to amend the Stafford Act is not a likely means of achieving that goal.”

As Mittler correctly points out, the Stafford Act is an amendment to the basic disaster legislation passed in 1974, PL 93-288. From its passage in 1974 to the time of the Stafford Act, PL 93-288 contained Title VII, “Economic Recovery for Disaster Areas.” Sections 801 to 806 of the law provided for a major program of long-term economic recovery, including loans, grants, technical assistance, and even the establishment of an Economic Recovery Council. That Title stated in Section 801 that its purpose was “to provide assistance for the economic recovery, after the period of emergency aid and replacement of essential facilities and services, of any major disaster area which has suffered a dislocation of its economy sufficient severity to require: (1) assistance in planning for development to replace that lost in the major disaster; (2) continued coordination of assistance available under Federal-aid programs; and (3) continued assistance toward the restoration of the employment base.”

While this portion of PL 93-288 was infrequently implemented, this section of the disaster act shows that Congress has long recognized the need for a form of long-term recovery following disasters. The Stafford Act did not continue the concepts of Title VII when it was passed in 1988. Instead, the Stafford Act replaced the concepts of Title VII with new and innovative hazard mitigation emphasis including funding for hazard mitigation in Section 404 as well as including in Section 406, an authorization to the president to actually require, and assist in paying for, Hazard Mitigation for Public Assistance projects. Ever since the passage of the Stafford Act, the Federal Emergency Management Agency has worked with stakeholders to implement various forms of long-term recovery assistance, many funded through the Stafford Act. This assistance is now more formalized in an entire emergency support function called EFF-14 Long-Term Community Recovery.

I believe that Topping’s call for legislation, which would have the effect of strengthening and establishing a uniform system of long-term recovery, would be fully consistent with nearly 35 years of both disaster assistance legislation and administrative implementation of the will of the Congress.

- Mittler also argues against Topping’s recommendation that legislation be passed to provide for special treatment in catastrophic disasters on the basis that “Congress actually divided disasters into two categories—emergencies and major disasters—in the original Disaster Relief Act of

1974. When the Stafford Act was passed in 1988 that distinction was eliminated."

PL 93-288, as passed in 1974, the Stafford Act, and the current version of the act now in effect all have provisions for both a presidentially declared disaster, at Title IV, Section 401 *et seq.*; as well as presidentially declared emergencies at Title V, Section 501 *et seq.*

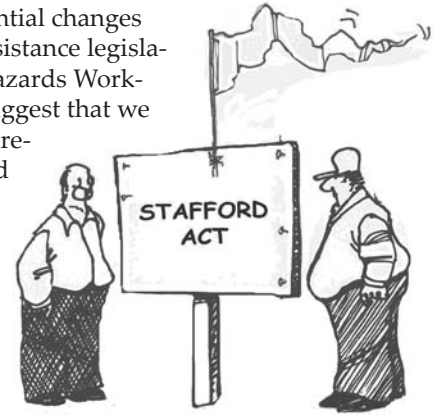
Presidentially declared disasters and emergencies have their own separate definitions and uses.

A person may well think that current legislation is adequate for any size disaster, as I do. Or she may agree with Topping that additional legislation is required. However, to indicate that catastrophic disasters need not have special legislative distinction because of purported legislation disestablishing the presidential authority to declare an emergency is not a correct basis for arguing against Topping's concept.

Suggested steps for the hazards community

I UNDERSTAND SHIRLEY LASKA and her team from the University of New Orleans will be presenting the prelimi-

nary results from a Ford Foundation-funded study of potential changes needed to disaster assistance legislation at the Natural Hazards Workshop in July. May I suggest that we listen carefully to the results of that study and then develop a single statement from the hazards community speaking with one voice about changes needed in the way the nation develops in hazardous areas, along with the provision of assistance when damage is caused to human occupancy from the inevitable actions of Mother Nature.



Edward A. Thomas
Quincy, Massachusetts





Conferences and Training

July 1-3, 2009

Third International Conference on Safety and Security Engineering

Wessex Institute of Technology

Rome, Italy

Cost and Registration: \$1,930, open until filled

This conference focuses on recent developments in safety and security engineering theory and practice, with a special emphasis on multifactor risk impacts. Conference topics include crisis management, natural and man-made emergencies and hazards, risk management, and mitigation and protection issues.

www2.wessex.ac.uk/09-conferences/safe-2009.html

July 8-9, 2009

2009 Regional Workshop

Pacific Public Health Training Center and California Centers for Public Health Preparedness

El Dorado Hills, California

Cost and Registration: \$118, open until filled

Workshop topics include social determinants of health, GIS and health for improved emergency preparedness and response, and using science to prepare vulnerable populations.

www.pphhc.org/regional2009/index.htm

July 9-14, 2009

Participatory Vulnerability and Risk Analysis Training Development Associates

Jessore, Bangladesh

Cost and Registration: \$400, open until filled

This training will analyze vulnerability and risk assessments so that disaster management programs can better develop and understand the relevance of disaster risk reduction. Course offerings include information on the impacts and consequences of disasters, the Hyogo Framework for Action, stakeholder participation, and disaster mitigation case studies.

www.da-bd.org/trainings

July 10-13, 2009

Fifth International Symposium on Management, Engineering, and Informatics

International Institute of Informatics and Systemics and others
Orlando, Florida

Cost and Registration: \$640, open until filled

Sharing research and experiences in engineering, management, and informatics is the goal of this meeting, as well as building interdisciplinary relationships. Session topics include risk management, supply chain management, communications, and informatics.

www.iis2009.org/wmsci/Website/default.asp?vc=12

July 13-15, 2009

International Disaster and Risk Conference

Global Risk Forum Davos

Chengdu, China

Cost and Registration: \$550, Open until filled

This year's conference will examine the Wenchuan earthquake as an entry into a larger conversation about capacity building in integrated disaster and risk

management and sustainable development.

www.chengdu2009.org/

July 13-17, 2009

International Geoscience and Remote Sensing Symposium

Geoscience and Remote Sensing Society

Cape Town, South Africa

Cost and Registration: \$930, open until filled

Geoscience and remote sensing issues related to disaster preparedness and response, global climate change, good governance, and the role of remote sensing in health and disease monitoring will be topics included in this conference.

www.igarss09.org/

July 19-23, 2009

Coastal Zone 2009

NOAA, FEMA, Massachusetts Partnership, and others
Boston, Massachusetts

Cost and Registration: \$475, open until filled

This conference explores changing coastal landscapes and provides information on coastal and ocean resource management. Three central tracks will be presented: coastal communities adapting to changing conditions, conservation in the face of change, and planning for the changing uses of the ocean and Great Lakes.

www.csc.noaa.gov/cz/

July 20-24, 2009

International Undergraduate Conference on Climate, Water, Weather, and Society

East China Normal University, University of Colorado, NCAR, and others

Shanghai, China

Cost and Registration: Free before June 10

Attendees will develop baseline skills needed to understand climate, water, weather variability, change, and extremes and get experience dealing with global change issues internationally. This conference promotes interdisciplinary understanding of science, technology, and civil society for undergraduates.

ccb.colorado.edu/shanghai/

August 5-7, 2009

Third Australasian Hazards Management Workshop Series

GNS Science, RMIT University, Massey University, and others
Melbourne, Australia

Cost and Registration: \$500, open until filled

This conference provides a forum to discuss the integration of hazard information and effective risk management. Sessions focus on best practices, developing effective warning systems, improving response and recovery efforts, and creating resilient communities.

www.hazards-education.org/ahmc/index.php

August 9-12, 2009

2009 National Conference on Community Preparedness

International Association of Emergency Managers and the Department of Homeland Security

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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/

Alexandria, Virginia

Cost and Registration: \$325 before June 15, open until filled

Attendees will share best practices in collaborative emergency planning, discuss preparedness outreach and education, discover innovative funding approaches, and receive updates on preparedness research. This conference is aimed at those seeking to create safer, stronger, and better-prepared communities, regardless of the hazards faced.

www.iaem.com/NCCP2009.htm

August 10-12, 2009

Third Annual HAZUS Conference: Connecting the Pieces for Mitigation

Federal Emergency Management Agency

Raleigh, North Carolina

Cost and Registration: See Web site for details

This conference will outline effective approaches for making decisions using HAZUS. Session topics include HAZUS in risk identification and communication, applying HAZUS to estimations and mitigation planning, and HAZUS and man-made hazards.

www.usfra.org/events/3rd-annual-hazus-conference

August 31 to September 4

2009 Homeland Security Conference

The Naval Post Graduate School, Booz Allen Hamilton, and Lockheed Martin

Monterey, California

Cost and Registration: \$795 before August 16, open until filled

Issues such as disease control, disaster response, environmental protection, and law enforcement will be addressed. The conference will focus on organizational and operating strategies that facilitate homeland security agency collaboration.

August 31 to September 4

World Climate Conference

World Meteorological Organization and the World Climate Program

Geneva, Switzerland

Cost and Registration: \$557 before July 30, closes August 19

This conference, arranged around a theme of climate prediction and information for decision making, will develop an international framework to guide the creation

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of climate services linking scientific predictions with risk management and adaptation.

www.wmo.int/wcc3/

September 7-10, 2009

Children and the Law: International Approaches to Children and Their Vulnerabilities

Prato, Italy

Cost and Registration: \$687 before July 31, 2009, Open until filled

This 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 and the ways 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 7-11, 2009

11th Plinius Conference on Mediterranean Storms

University of Barcelona

Barcelona, Spain

Cost and Registration: \$445 before July 20, open until filled

This conference provides an interdisciplinary forum to improve the understanding of hazardous storms in the Mediterranean. Session topics include the nature and physical processes of extreme events, possible changes in storm behavior resulting from anticipated changes in climate, advanced techniques to track and predict storms, and relationships between atmospheric and surface processes.

gama.am.ub.es/plinius/

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.



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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.

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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**.