

Exploring Links Between Natural Hazards and Global Warming

—Invited Comment

CROSS-FERTILIZATION BETWEEN THE NATURAL HAZARDS and climate change communities has enriched research and practice in both. Hazards researchers were among the first to address global warming, drawing on hazard themes like adaptive capacity, resilience, perception, awareness, and mitigation (Kates et al. 1985). But it is time to step up this collaboration. Global warming is now expressing itself in altered rates and intensities of weather and climate extremes (CCSP 2008). Recent projections suggest more rapid change in the near future (IPCC 2007), affecting hazards such as heat waves, storm surge, wildfire, and drought. The past is no longer a valid guide to the future of weather and climate hazards.

Climate and the Hazards Community

WRITING IN THE JULY, 2007 *NATURAL HAZARDS OBSERVER*, de Sherbinin et al. asked, "What does climate change mean for the hazards community?" The question was raised in opening plenary sessions at last summer's Hazards Workshop (see *Natural Hazards Observer*, Sept. 2008), but mostly dangled unanswered over the next three days of conversation. Some of the implications of global warming for natural hazards are obvious: (1) global warming will change the frequency and intensity of some natural hazards, worsening some and lessening others, thus complicating hazard planning standards like 100 year floodplains; and (2) global warming itself might occur at

(See "Warming," continued on page five)

Severe Weather Causes Most Hazard Deaths

Chronic everyday hazards account for the majority of natural hazards fatalities, and people in the Northern Great Plains and the South have the highest rates of natural hazard mortality, according to two University of South Carolina researchers.

In a paper in the *International Journal of Health Geographics*, geographers Susan Cutter and Kevin Borden tracked the mortality frequency of various types of hazards in the United States, and mapped the frequency by county.

"It was more confirmatory that the everyday hazards would in fact come up as a group being the leading causal agents—severe weather and heat," Cutter says. "Part of that is, I think, due to improvements in mitigation for seismic events. We don't really have that many people who die in earthquakes. That's related to improved building codes and so forth."

Heat and drought cause the highest percentage of hazard-related deaths in the United States, with 19.6 percent of the total. This is followed by severe summer weather (18.8 percent) and winter weather (18.1 percent). Earthquakes, wildfires, and hurricanes are responsible for fewer than five percent of hazard deaths. The study looked at data for the years from 1970 to 2004, so did not include fatalities from hurricanes Katrina, Rita, and Ike.

"The important message, what would really help move

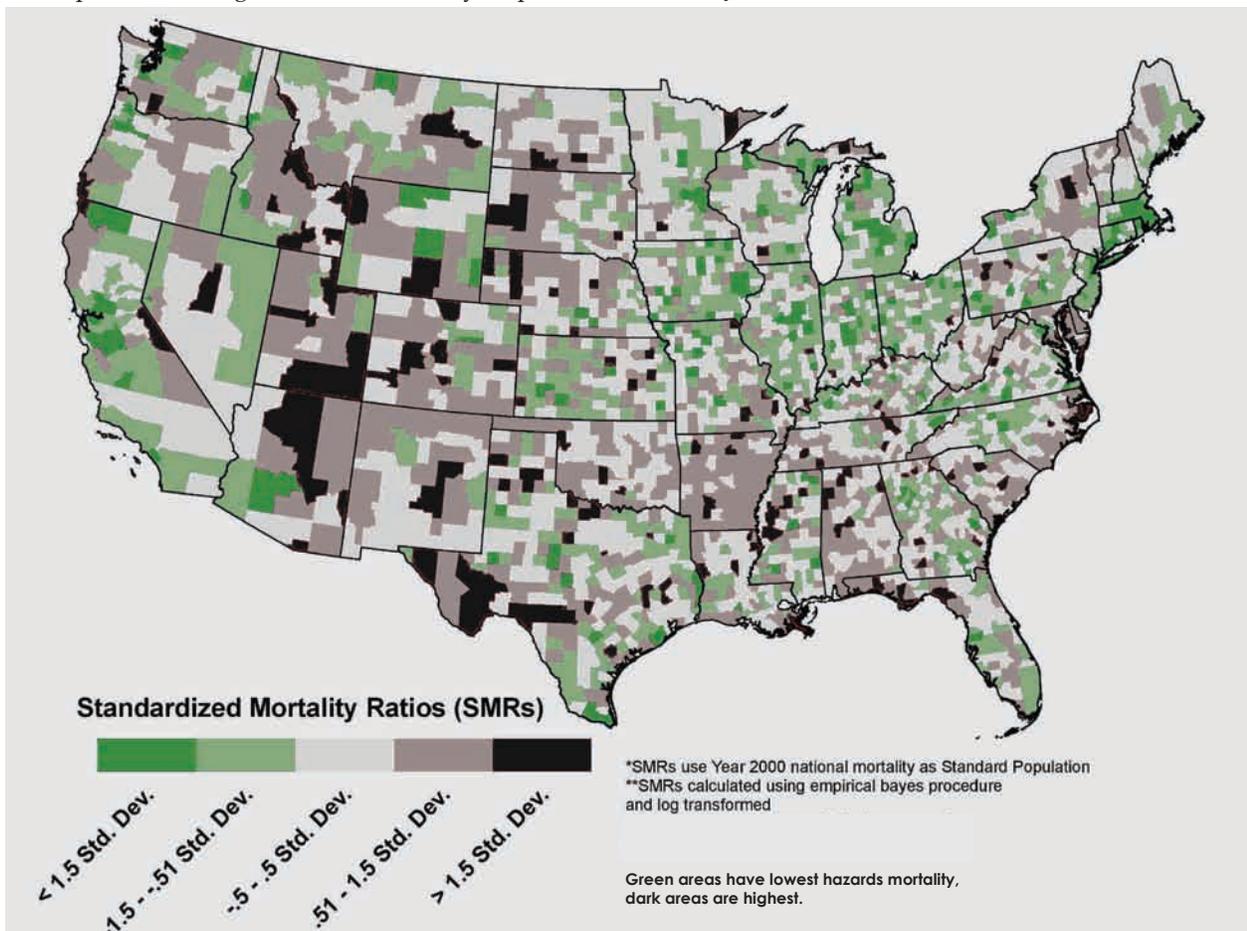
this along," Cutter says, "is basically we don't really know how many people die from natural hazard-related causes because the government doesn't keep good statistics. Don't you think we should? Hello?"

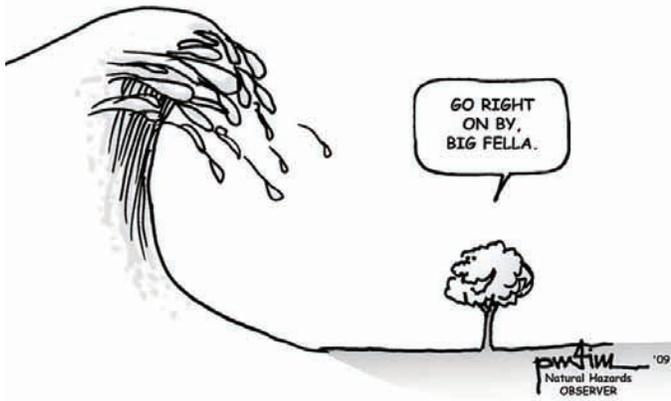
"How can you as a local emergency manager figure out if you're supposed to protect lives and lives are being lost in your community and you don't know how or why? That's a pretty important piece of information."

Cutter says, "If you're an emergency manager and most of the deaths in your area are related to heat, that's a very different strategy for mitigating that threat than if you thought most of the deaths were going to be attributed to flooding or hurricanes."

Cutter says that since the "death map" was published, she's gotten a number of calls from emergency managers who want the data for their communities. "We're in the process of downscaling it to the state level," she says, "and will probably do a web application so people can come in and look at their state and see what's contributing to it."

The problem is partly defining how to count natural hazard deaths. If a person has a heart attack shoveling snow after a blizzard, it's probably a hazards-related death. But not everyone in the medical community would report it that way.





To Tree or Not To Tree

The assertion that coastal tree barriers can reduce damage from a tsunami are “false and dangerous,” say a group of western Pacific region researchers. But another group of American scientists say their work shows wave damage can be reduced by coastal vegetation barriers.

In the wake of the 2004 Indian Ocean tsunami, a number of studies showed damage could have been reduced had coastal mangrove belts been left intact. Many mangroves were removed to allow for extensive coastal aquaculture.

But a study by Alexander Kerr of the University of Guam and colleagues concludes, “There is, as yet, no evidence that coastal tree belts can provide meaningful protection against a tsunami or, for that matter, storm surges produced by cyclones, such as the surge that followed Cyclone Nargis in Myanmar early this year (2008), which killed over 150,000 people.”

The findings, they say, have implications for civil defense and emergency planning. “The idea that planting ‘green belts’ can both protect coastal communities and enhance their environment has been widely accepted,” says co-author Andrew Baird of Australia’s James Cook University.

But University of Wyoming economist Edward Barbier, who has studied the Thai coastal environment, says that for waves under 6 meters (about 19.6 feet), there is considerable evidence that vegetation can stop wind and wave damage.

“The effectiveness of coastal vegetation in mitigating storm damage depends crucially on several things,” Barbier says. “One is the physical features that complement that vegetation. The second is how big are the waves? We know there are critical thresholds where very big waves won’t be attenuated by vegetation. But there are more frequent storm events that fall below those critical thresholds where vegetation does help reduce damages.”

Barbier says there is considerable evidence published that supports the value of vegetation for coastal protection. The smaller, intense storms in which mangroves and other vegetation do offer protection seem to be increasing. In a letter in the April 11, 2008 issue of the journal *Science*, Barbier and colleagues wrote, “Between 1975 and 1987, Thailand experienced, on average, 0.54 coastal natural disasters per year. Between 1987 and 2004, the incidence increased to 1.83 disasters per year. It is against these small, frequent, and economically damaging events that we are likely to see mangroves and other coastal interface habitats offer the greatest benefit.”

Nation at Risk of Bioterrorist Attack: Report

Terrorists will acquire and use a weapon of mass destruction—likely biological in nature—in the next five years, according to a recently released expert report commissioned by Congress. The effects are expected to be devastating.

The Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism, formed at the recommendation of the 9/11 Commission, issued the 160-page report in December. The report is the result of six months of research into U.S. activities, initiatives, and programs meant to prevent terrorism and the spread of weapons of mass destruction.

The commission concluded terrorists are more likely to obtain a biological weapon than a nuclear weapon because of the global spread of biotechnology, poor security of biological pathogens and technologies, and the U.S. government’s failure to emphasize bioterror attack prevention.

“The consequences of a biological attack are almost beyond comprehension,” commission chair former Sen. Bob Graham told CNN. “It would be 9/11 times ten or a hundred in terms of the number of people who would be killed.”

The U.S. government “needs to move more aggressively to limit the proliferation of biological weapons and reduce the prospect of a bioterror attack,” according to one of the panel’s 12 broad recommendations. Others include strengthening the international nonproliferation regime, ending Iranian and North Korean nuclear weapons programs, and restructuring Congress to better address intelligence and homeland security. The commission also stressed the importance of international diplomacy in building relationships and discouraging nuclear proliferation.

“Terrorist organizations are intent on acquiring nuclear weapons,” the report states. “Anyone with access to the Internet can easily obtain designs for building a nuclear bomb. Our crucial task is to secure the material before terrorists can steal or buy it on the black market.”

The current economic crisis is compounding the situation. According to a December report by Trust for America’s Health and the Robert Wood Johnson Foundation, the economic dive has had a negative impact on the nation’s preparedness for disease outbreaks, bioterrorism, and natural disasters.

“The economic crisis could result in a serious rollback of the progress we’ve made since September 11, 2001, and Hurricane Katrina to better prepare the nation for emergencies,” stated Jeff Levi, executive director of Trust for America’s Health, in a press release. “The 25 percent cut in federal support to protect Americans from diseases, disaster, and bioterrorism is already hurting state response capabilities. The cuts to state budgets in the next few years could lead to a disaster for the nation’s disaster preparedness.”

—Corey Reynolds

Quakes, Floods Doom Early Peruvians

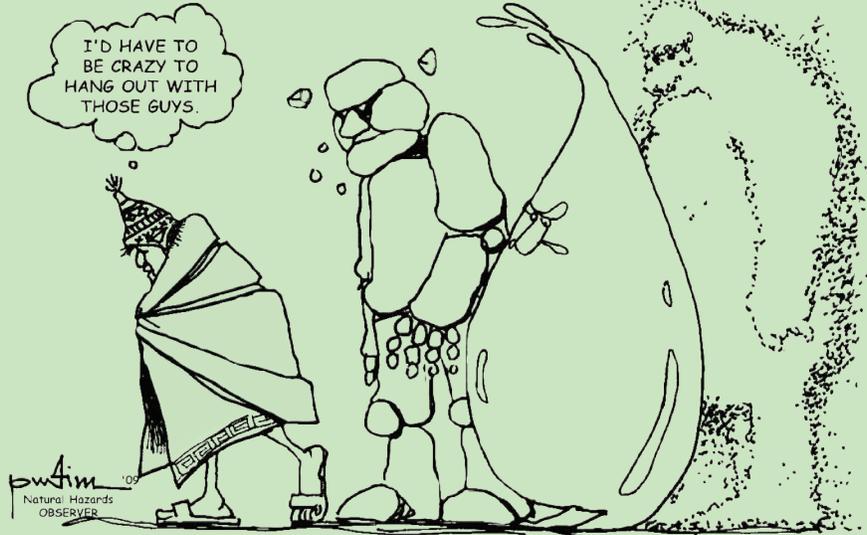
Earthquakes, torrential rains, and dust storms spelled doom for one of the earliest civilizations in the Americas, according to new anthropological research from the University of Florida.

Between about 5,800 and 3,600 years before the present, early coastal Peruvians in the Supe River Valley built a complex society along the arid coast, building elaborate stone pyramids thousands of years before the better known ones constructed by the Maya. The Supe civilization flourished for 2,000 years, but was apparently brought down in only a few generations by a succession of natural disasters, according to UF anthropologist Mike Moseley.

Around 3,600 years ago, an enormous earthquake—Moseley estimates its magnitude at 8 or greater—or series of earthquakes struck Caral and a nearby coastal settlement, Aspero.

The area was then hit by floods, and finally by "massive sand sheets that blew inland on the constant, strong, onshore breeze and swamped the irrigation systems and agricultural fields," according to the paper published in the *Proceedings of the National Academy of Sciences* for January 19-23, 2009.

With much of the world's population centers built in environmentally vulnerable areas, the Supe's demise may hold a cautionary tale for modern times, the researchers said. El Niño events, in particular, may become more common as global climate change continues, they say.



California 2008 Wildfire Costs Top \$1 Billion

About 1.4 million acres of California land burned in 2008, costing the U.S. government about \$700 million and state coffers more than \$1 billion, according to the *Los Angeles Times*.

Despite what California Department of Forestry and Fire Protection Director Ruben Grijalva called "unprecedented fires," no meaningful reforms emerged from either Sacramento or Washington, the paper said.

State legislation requiring high-risk fire areas to have two access roads and to demonstrate adequate water pressure and fire protection was vetoed by Gov. Arnold Schwarzenegger. The state Chamber of Commerce called the legislation a "job killer," the *Times* said, which could shut down suburban development in parts of the state.

"There is an absolute disconnect between requiring state taxpayers to take on the ever increasing burden of fighting fires when it's the decisions at local levels to put more homes and people in harm's way," said state Assemblyman Dave Jones, who sponsored the legislation.

Grijalva said one possible reform could be a massive education effort to promote a stay-and-defend program along the lines of residence protection used in Australia. Homeowners are trained to take precautions to make their homes fire resistant prior to a fire breaking out, then stay and protect them during a fire.

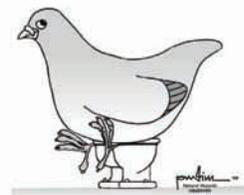
According to a study by researchers at Texas Tech University and the Institute for Business and Home Safety, in the 2007 Southern California Witch Creek fire, not a

single home burned in three study communities that followed "shelter-in-place" guidelines, including vegetation modification and building code provisions.

In contrast, two similar communities that did not shelter in place had 145 homes burn in the same fire.

In a 2005 paper in the journal *Environmental Hazards*, Australian researchers John Handmer and Amalie Tibbits said, "Evacuating at the last minute is often fatal and ... generally, a key factor in house survival during a wildfire is the presence of people in the building."

February bushfires in Australia, though, may force a reconsideration of the "stay and defend" policy. More than 180 people are believed to have been killed in the blazes.



Hazards We Hadn't Worried About Before

The collapse of a gas station awning in Yuma, Arizona, in December is being blamed on an excess of pigeon poop.

Four to five inches of pigeon excrement accumulated on the roof of a local Shell station awning, and was then soaked by rain, according to the sheriff's department. Sheriff's Maj. Leon Wilmot said the additional load apparently was too much for the structure.

The awning landed on a BMW and Hummer, but no one was injured, according to the Associated Press.

Warming...

(Continued from page one)



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such a rate and intensity (or cause sharp events like ice sheet disintegration and rapid sea level rise) as to constitute a hazard itself, demanding monitoring, prediction, warnings, and rapid responses. Other implications of global warming are subtle and indirect, as in de Sherbinin et al.'s notion that some social responses to global change (e.g., efforts to reduce greenhouse gases, taller sea walls, or large-scale migrations) might set up worsened hazard exposure. These scenarios put hazards in the same position as many other fields, grappling for better information, forecasts, and thinking about how to adapt to a changing baseline.

But the hazard field has much to give, and we can usefully turn the question around and ask: "What does hazards research mean for the climate change community?" Some implications of hazard research findings for global warming research have already been explored: hazards research was drawn on in early assessments of the potential impacts of climate change (National Academy of Sciences 1992) and more recently in the United Nations' Intergovernmental Panel on Climate Change process to help define human dimensions of vulnerability and adaptive capacity (Adger et al. 2007). Yet several logical linkages between the two fields of inquiry deserve more attention. Long-term recovery studies should be examined for what they reveal about resilience and adaptive capacity, thus improving the assessment of vulnerability in IPCC reports (see Colten et al. 2008; Mosser 2008). A key concern in climate change is differential vulnerability among groups, yet the early cross-cultural studies of hazard response have hardly been mined for insights. And the hazard field's long experience tracking and studying adaptation—especially identifying barriers to adaptation—must be shared with a climate research community just beginning to see responses in the systems they study, but facing a deluge of questions about what to do if warming projections play out.

Safe Development Paradox

CERTAINLY FURTHER CROSS-fertilization will be rewarding. Climate and society studies ask questions that all hazards researchers have considered. For example, how can we tell the difference between effective

adaptation and mal-adaptation? Here we come face to face with perhaps the most profound question in natural hazards research: Is there a universal levee effect? If

protective works—including insurance, disaster relief, and even warning and evacuation systems (Sorensen 2000)—create a "safe development paradox" (Burby 2006), if we often make losses worse in trying to reduce them, what then are the prospects for adaptation to global warming? Does the case of Katrina and New Orleans point mostly to worsening impacts (Kates et al. 2006)? Hazard and disaster diagnoses like these have something to say on time scale useful to climate change impact studies, and we can sharpen those insights by studying disasters with climate change in mind.

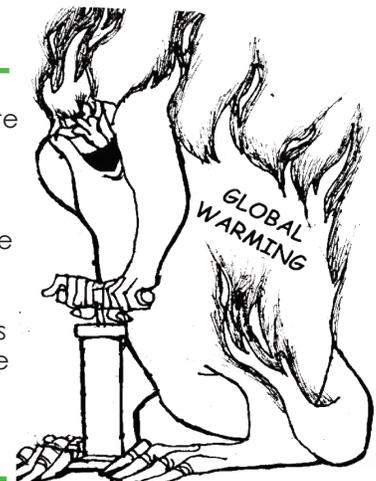
Climate change itself can be hazard. Climate researchers have raised the possibility of abrupt, extreme climate change that shifts global warming from the category of long-term, cumulative threat to a more hazard-like risk (Schellnhuber et al. 2006). Hazards researchers, of both natural and technological stripe, can offer basic insights into how society deals with low-probability, high-consequence risks. Faced with the potential for extreme climate change, some analysts are looking at prevention and protection options like blocking the sun's rays. Hazards researchers are quite familiar with this response pathway, and have keen insights into the problem of reliance on technological fixes—from levees to cloud seeding—insights most valuable now, at early stages in the exploration of geo-engineering solutions.

Finally, there are practical questions to be answered: Just how much climate change can our current systems of levees, sea walls, heat wave shelters, and water provisioning absorb? And how will we know that it is time to upgrade, enlarge, or change approaches? Consider the lowly culvert: here in Boulder we recently upgraded several drainages to pass the 500-year flood test. These oversized channels and culverts look a bit odd to the untrained eye, surely profligate public spending made concrete. But if rainfall intensities are changing, do these culverts still meet the city's goals? Are they already behind the curve of climate change, offering, perhaps, 400-year rather than 500-year performance in the highly non-linear world of relationships between frequency and intensity?

(See "Warming," continued on page six)

One premise holds that we know climate change will worsen hazards, causing more floods, droughts, and storms.

But another theme suggests that outside of a few topics we don't really know yet what global warming means to regional hazardousness and hazard loss trends may have little to do with climate change.



Warming...

(Continued from page five)

The Management Quandary

THOSE CULVERTS ALSO BEAR WITNESS to the quandary of hazards management in a changing world: When will we be sure enough that conditions are changing in a certain direction that we can change our plans? Regulations? In their excellent new book, *Global Warming, Natural Hazards, and Emergency Management*, Jane Bullock, George Haddow and Kim Haddow (2009) offer contributions from hazards professionals along with a range of advice. One premise holds that we know climate change will worsen hazards, causing more floods, droughts, and storms. But another theme suggests that outside of a few topics— e.g., sea level rise and heat waves—we don't really know yet what global warming means to regional hazardousness, and hazard loss trends may have little to do with climate change (Pielke et al. 2008). In this case, standard hazard planning and mitigation, if pursued more vigorously, will make communities not only more resilient to current extremes, but also to climate change, however it plays out.

That's a positive note. But is it always true? What if we adapt our communities closely to the current climate, then it changes? Many questions should be addressed as hazards and climate impacts researchers collaborate:

- Does adapting better to current hazards improve adaptiveness to longer-term climate change? And does the threat of climate change tip the balance in favor of increased mitigation of current hazards?
- What are the implications of the levee effect and safe development paradox for coping with climate change?
- What lessons from natural hazards research can inform our assessment of how to avoid or deal with "dangerous" climate change or abrupt climate change?
- What constitutes efficient adjustment to an ever-changing climate, in everything from levee heights to storm-water systems to evacuation plans?
- What can hazards research tell us about the logic of geo-engineering approaches to reducing global warming?
- What insights from hazard assessment and warning systems might apply to climate change?

Let me briefly take up briefly that last question. Could a climate change severity scale to sort out likely impacts and responses? It might start with the current climate (Level Zero) progressing through small changes only noticeable to statisticians (Level One), then those to which systems adapt by drawing on current flexibility (Level Two), then to changes to which adaptation must be much more aggressive by, say, redrawing flood zones or raising levees and sea walls (Level Three). Finally new climate regimes may evoke mass migrations, new development patterns, or geoengineering efforts to cool the planet (Level Four). The scale might need a Level Five. But I hope not.

—William R. Travis, William.Travis@colorado.edu

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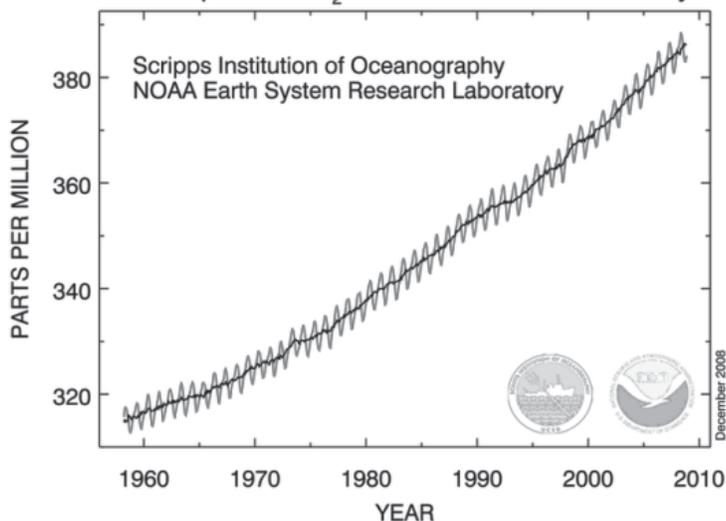
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Climate Change for the Compleat Idiot

Atmospheric CO₂ at Mauna Loa Observatory

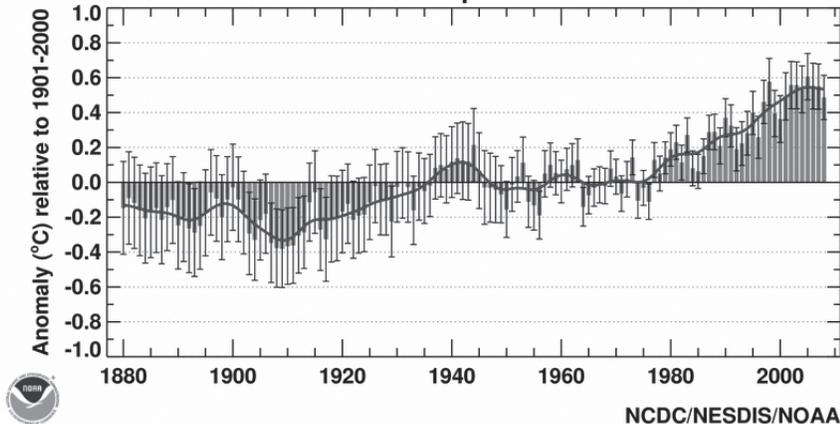


Without greenhouse gases in the atmosphere the earth would stabilize at its “black body” temperature, about three degrees Fahrenheit (-16° Celsius).

These gases—carbon dioxide, methane, water vapor, nitrous oxide, ozone and several other gases—trap heat in the atmosphere, helping to keep the earth at a relatively balmy global average of 59°F (15°C) prior to the 20th century. Since about 1850, reliable thermometer measurements have been available at thousands of sites around the globe. Since 1957, temperatures have been measured in Antarctica, and since 1980, satellites have sampled temperatures on the surface and in the atmosphere.

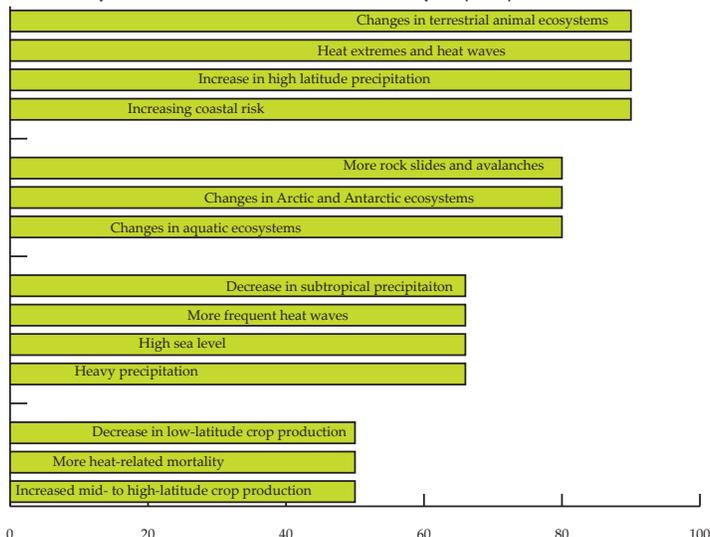
These records show that from the 1910s to the 1940s, average global surface temperatures increased about 0.63°F (0.35°C). A second burst of warming after 1970 raised average surface temps about another degree F (0.55°C). According to the Intergovernmental Panel on Climate Change, “An increasing rate of warming has taken place over the last 25 years, and 11 of the 12 warmest years on record have occurred in the past 12 years.”

Jan-Dec Global Mean Temperature over Land & Ocean



These temperature increases are caused by human activity, the IPCC says. Carbon dioxide is emitted in the burning of fossil fuels. Carbon dioxide is the most abundant greenhouse gas. Methane is also a very important one, about 20 times more effective at trapping heat in the atmosphere than CO₂, but there is less of it. The IPCC says, “The concentration of CO₂ is now 379 parts per million (ppm) and methane is greater than 1,774 parts per billion (ppb), both very likely much higher than any time in at least 650,000 years (during which CO₂ remained between 180 and 300 ppm and methane between 320 and 790 ppb).”

Minimum Percent Probability of Increasing Particular Hazards Under Climate Change Compiled from IPCC Fourth Assessment Report (2007)



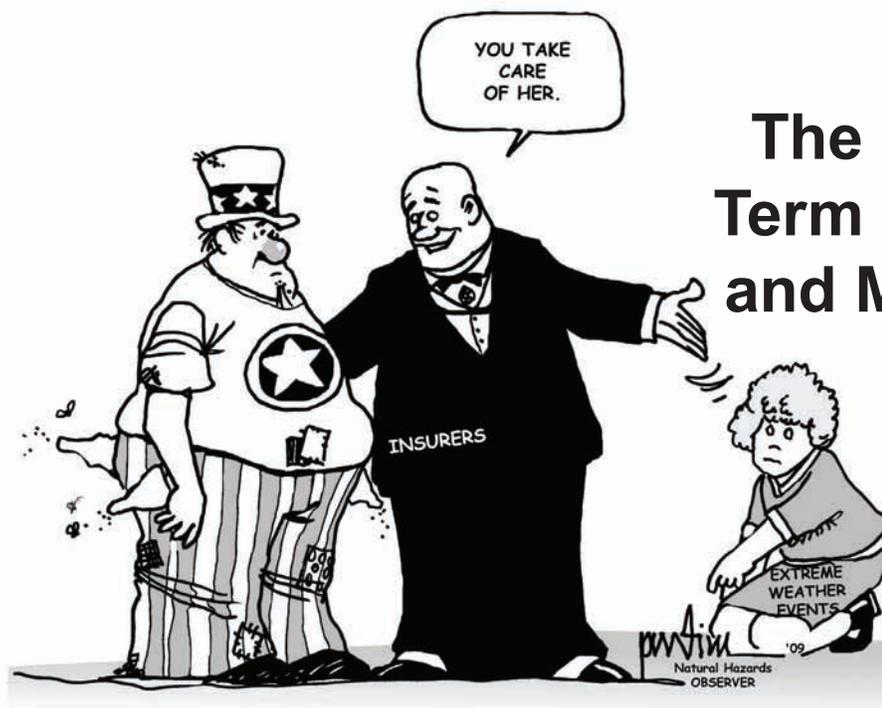
In 1896, Swedish chemist Svante Arrhenius estimated doubling atmospheric CO₂ would result in global warming of between 7°F-11°F (4°C-6°C). Arrhenius did his calculations of the entire globe by hand on a latitude and longitude grid. “I should certainly not have undertaken these tedious calculations,” he wrote, “if an extraordinary interest had not been connected with them.”

In calculations performed a little more quickly by modern computers, the “climate sensitivity”—as it’s now called—is estimated at between 4.5°F-7°F (2.5°C-4°C) of warming for a doubling of carbon dioxide.

IPCC reports estimate the likelihood of an increase or decrease of various recognized natural hazards that are influenced by climate.

The relationships are not simple, of course. Predicting the future is hard, even for panels of experts armed with large computers.

The chart at the bottom left is an unofficial compilation of those estimates from the pages of the IPCC’s Fourth Assessment Report for several recognized natural hazards.



The Need for Long-Term Flood Insurance and Mitigation Loans

—Invited Comment

THE PAST 15 YEARS HAVE WITNESSED A SERIES OF LARGE-SCALE CATASTROPHES that have inflicted historic economic and insured losses. One figure is eye-opening: of the 25 most costly insured disasters that occurred in the world between 1970 and December 31, 2008, 14 occurred since 2001, 13 here in the United States, and all were natural disasters except for the 9/11 terrorist attacks. The growing concentration of population and structures in high-risk areas, combined with the potential consequences of global warming, are likely to lead to even more devastating catastrophes in the coming years unless cost-effective risk reduction measures are put in place.

The challenge, however, is that many people do not invest in such measures voluntarily. Even after the devastating 2004 and 2005 hurricane seasons, a large number of residents had still not invested in relatively inexpensive loss-reduction measures with respect to their property, nor had they undertaken emergency preparedness measures. In 2006 the *New York Times* published the result of a survey of 1,100 adults living along the Atlantic and Gulf coasts undertaken in May of that year: 83 percent of the responders had taken no steps to fortify their home, 68 percent had no hurricane survival kit, and 60 percent had no family disaster plan. One of the principal reasons this is the case is that individuals are myopic. They tend to focus on returns only over the next couple of years so that preparedness measures are not viewed as financially attractive. Catastrophe risk insurance continues to be sold as one-year contracts, so it is hard for policyholders to take a longer view of how mitigation measures can reduce their damage. But it does not have to be that way.

Need for Long-Term Insurance

WE PROPOSE MOVING FROM THE STANDARD one-year insurance contracts for residential properties to long-term insurance (LTI) so as to encourage property owners to invest in cost-effective mitigation measures. Flood risk is a natural candidate for LTI as it is a national program, in contrast to homeowners insurance, which is state regulated.

We argue that the development of LTI should encourage individuals to invest in cost-effective mitigation

measures. Many homeowners do not invest in such measures because they are unwilling to incur the high upfront cost associated with these investments relative to the small insurance premium discount they would receive the following year—that discount reflects the expected annual benefits of the mitigation measure. If an LTI policy were coupled with a long-term home improvement loan tied to the mortgage (e.g. for retrofitting), the reduction in insurance premiums would exceed the annual loan payment if the mitigation measure was cost-effective. The social welfare benefits could be significant: there will be less damage to property, reduction in costs of protection against catastrophic losses by insurers, more secure mortgages, and lower costs to the government for disaster assistance.

Why Have a Long-Term Flood Insurance Policy?

IN 1968 THE U.S. CONGRESS CREATED the National Flood Insurance Program (NFIP) as a means of offering coverage on a nationwide basis through the cooperation of the federal government and private insurance companies. Today most coverage under NFIP is under the Write Your Own Program, where private insurers receive an expense allowance from the federal government to market annual policies and settle flood claims while the NFIP retains financial responsibility for underwriting losses.

It would be useful to consider whether flood insurance could be made long term by tying policies to mortgages. By instituting such a program, insurance would be connected to the property rather than to the homeowner. One might

also consider requiring everyone in flood prone areas to take out insurance just as those who own a car are required to take out insurance whether or not they are financing the purchase of that car. If a homeowner moved to another location, the flood insurance policy would remain with the property.

A long-term flood insurance program would offer homeowners residing in flood-prone areas a fixed rate for a specified period of time (e.g., 5, 10, or 20 years). If the homeowner moved from the area before the end of the policy period, then the policy would automatically be transferred to the new property owner at the same rate. For homeowners being charged subsidized rates because their homes were constructed before the community joined the NFIP, rates would be maintained for the length of the policy period. For homeowners who constructed homes after their community joined the program, their rates would be actuarially based.

There are a number of reasons why such a long-term flood insurance policy would be a great improvement over the current annual policies from the perspective of the relevant stakeholders: homeowners, FEMA, banks and financial institutions and the general taxpayer. By fixing flood insurance rates at a fixed price, homeowners would be provided with financial stability. They would also know they are protected against water damage from floods and hurricanes. This would reduce the legal problems that have plagued recent hurricane disasters (Florida hurricanes of 2004, Katrina and Ike). Homeowners would not have to argue their losses were due to wind so they could collect on their homeowners policy. There would still be a question as to whether the government would be paying for some of the loss because it was caused by water or whether private insurers would be responsible because it was wind-related damage.

Long-term flood insurance would also assure the spread of risk within the program since most homeowners in flood prone areas would be covered. If flood insurance were required for all homeowners residing in hazard-prone areas, then there would be even a larger spread of risk. Over time, this much larger policy base would provide much needed financial revenue for the program.

Long-term policies would prevent individuals from cancelling their policies after they have not experienced a flood for several years even if they are required to purchase the policy as a condition for a federally insured mortgage. The banks and financial institutions have often not enforced this regulation because few of them have been fined or the mortgages are transferred to banks in

(See "Insurance," continued on next page)

Consider the flood in August 1998 that damaged property in northern Vermont. Of the 1,549 victims of this disaster, FEMA found 84 percent of the homeowners in Special Flood Hazard Areas did not have insurance, even though 45 percent of these individuals were required to purchase coverage.



Insurers and Climate

Peter Levene, chairman of Lloyd's of London, told the San Diego *Union-Tribune* in 2004 that the issue with climate change "for insurers is natural disasters, which are a very great concern. And the impact of those disasters has been increasing because the climate has been changing."

Federal and private insurers paid out more than \$320 billion in weather-related claims between 1980 and 2005 under flood insurance and crop protection programs. Private insurers paid about 76 percent of this total.

According to the U.S. Government Accountability Office, "Assessment by key governmental bodies generally found that rising temperatures are expected to increase the frequency and severity of damaging weather-related events, such as flooding or drought, although timing and magnitude are as yet undetermined."

In 2007 before the U.S. House Select Committee on Energy Independence and Global Warming, GAO's John B. Stephenson said, "While both major private and federal insurers are exposed to increases in the frequency or severity of weather-related events associated with climate change, the two sectors are responding in different ways. Many major private insurers are incorporating elements of climate change into their annual and strategic risk management practices to reduce their exposure to catastrophic risk—that is, their vulnerability to extreme weather-related events and the associated financial losses.

"One consequence is that they are transferring some of their exposure to policyholders and to the public sector. Federal insurance programs ... have seen their exposure grow significantly—NFIP's total coverage has quadrupled from 1980 to 2005, nearing \$1 trillion, and program expansion has increased FCIC's (Federal Crop Insurance Corporation) total coverage nearly 26-fold to \$44 billion." (www.gao.gov/cgi-bin/getrpt?GAO-07-820T)

A 2007 report by Ceres (www.ceres.org/Page.aspx?pid=858), a coalition of investors, environmental organizations and investment funds, found that insurers both nationally and internationally have "a huge opportunity today to develop creative loss-prevention solutions" to climate change. The group identified "422 real-world examples from 190 insurers, reinsurers, brokers and insurance organizations from 26 countries."

For instance, Arkwright Mutual Insurance examined climate change and flooding. The Insurance Australia Group is working with the University of Oklahoma on high-resolution climate modeling. Insurance broker Willis is collaborating with researchers in the United Kingdom and Japan on next-generation climate modeling, with greater resolution to enable the evaluation of changing typhoon risks and associated insurance implications

Swiss Re and the Association of British Insurers have also coupled climate models with insurance loss models. Swiss Re projects an average increase in losses of between 16 percent and 68 percent from European winter storms between 1975 and 2085.

But GAO's Stephenson says that government programs are lagging: "The federal insurance programs have done little to develop the kind of information needed to understand the programs' long-term exposure to climate change."

—Dan Whipple

Insurance...

(Continued from page nine)



non-flood prone regions of the country that are not focused on the flood hazard risk. Consider the flood in August 1998 that damaged property in northern Vermont. Of the 1,549 victims of this disaster, FEMA found 84 percent of the homeowners in Special Flood Hazard Areas (SFHAs) did not have insurance, even though 45 percent of these individuals were required to purchase coverage.

If long-term loans for mitigation were offered by banks, individuals with long-term flood insurance policies would be encouraged to invest in cost-effective risk reduction measures. To highlight this point, consider the following simple example. Suppose a property owner could invest \$1,500 to floodproof his home so as to reduce the water damage by \$30,000 from a future flood or hurricane with an annual probability of 1 in 100. The NFIP should be willing to reduce the annual premium by \$300 (i.e., $1/100 \times \$30,000$) to reflect the lower expected losses that would occur if a flood or hurricane hit the policyholder's area. If the house was expected to last for 10 or more years, the net present value of the expected benefit of investing in this measure would exceed the upfront cost at an annual discount rate as high as 15 percent.

Weighing the Future

TODAY MANY PROPERTY OWNERS would be reluctant to incur the \$1,500 expenditure, because they would get only \$300 back next year and are likely to only consider the benefits over the next few years when making their decisions. If they underweight the future, the expected discounted benefits would likely be less than the \$1,500 upfront costs. In addition, budget constraints could discourage them from investing in the mitigation measure. Other considerations would also play a role in a family's

decision not to invest in these measures. The family may not be clear how long they will reside in the house and/or whether their insurer would reward them again when their policy is renewed. There may also be a failure to appreciate the interdependencies associated with floods, earthquakes, and other disasters. More specifically, by investing in mitigation measures, one will not only reduce the potential losses to one's own property but alleviate damage to neighboring structures.

If a 20-year flood insurance policy were tied to the property, then the homeowner could take out a 20-year, \$1,500 home improvement loan linked to the mortgage at an annual interest rate of 10 percent, resulting in payments of \$145 per year. If the insurance premium was reduced by \$300, the savings to the homeowner each year would be \$155. Alternatively, this loan could be incorporated as part of the mortgage at even a lower interest rate than 10 percent.

Long-term insurance and mitigation loans would constitute new financial products. A bank would have a financial incentive to provide this type of loan, since it would now be better protected against a catastrophic loss to the property. The NFIP knows that its potential loss from a major disaster is reduced. Moreover, the general public will now be less likely to have large amounts of its tax dollars going for disaster relief. Indeed, prior to the 2005 hurricane season, which inflicted nearly \$18 billion in flood claims, the NFIP had a cumulative deficit of about \$3 billion after 37 years of operation. Long-term flood insurance promises to be a win-win-win situation for all!

Given that the NFIP is up for renewal in Congress this spring there may be a window in the coming months for debating the merits and challenges of long-term flood insurance. The recent financial crisis has forced all of us to think about ways of overcoming our short-term horizons. Long-term contracts in the form of insurance and loans may be one way to encourage individuals to take steps to protect themselves in the long-run in ways that are financially attractive to them and other interested parties.

—Howard Kunreuther and Erwann Michel-Kerjan

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This column draws heavily on a paper by Kunreuther and Michel-Kerjan, "Market and Government Failure in Insuring and Mitigating Natural Catastrophes: How Long-Term Contracts Can Help," presented at the American Enterprise Institute Conference on Private Markets and Public Insurance Programs, Washington, DC, January 15, 2009.

Climate in Conflict

IN ABOUT 465 BCE, SAYS THE GREEK historian Thucydides, an earthquake leveled the city of Sparta, killing 20,000 Spartan citizens. In the midst of the panic caused by the calamity, the Messenian Helots—a much-abused underclass of slaves or near-slaves—revolted, entrenching themselves on Mount Ithome. The Helots held out for two years before the Spartans reconquered them.

Since this inauspicious beginning, the historical record offers many cases where rapid-onset disaster appears to be connected to subsequent political turmoil or civil conflict. Haiti in 1954 and East Pakistan in 1970 are examples where cyclones and hurricanes have been connected to political violence and change. Earthquakes have had impacts on civil unrest in Nicaragua in 1972, in Guatemala in 1976,¹ in Colombia in 1999 and the Indian Ocean tsunami in 2004.

Further back in the historical record, floods, drought, and famine have been noted as an important immediate cause in the Chinese Taiping rebellion of the mid-nineteenth century (Teng, 1971). In recent decades the role of drought and desertification in inter-communal conflicts in Africa has been well established, while it has also been put forward as an important factor in the onset of the Darfur conflict.

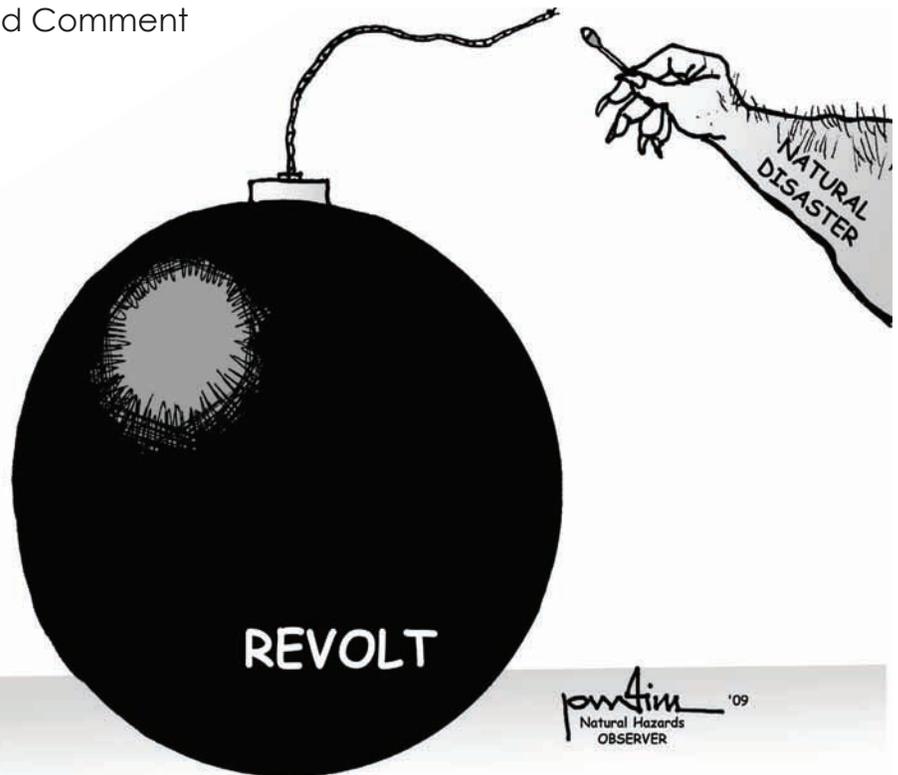
Not Disasters Alone

WHETHER OR NOT HIGH-IMPACT EVENTS resulting from changes in the global climate will become a security issue has increasingly become a topic on the agenda of those in the field. The Pentagon study *Abrupt Climate Change Scenario and Its Implications for United States National Security* (Schwartz and Randall 2003) brought the issue to the attention of many people. In its vision of climatic catastrophe, mass migrations and social disorder the piece was thought provoking. However, while social unrest is sometimes seen in the aftermath of disaster, it is unlikely that disasters alone—whether from climate change or other sources—will act as a root cause of large-scale political conflicts in developing countries in the future.

The risk of international conflicts arising from disasters appears slight—rather it is the potential for disasters to impact on civil conflicts that has increasingly claimed the attention of academics and security professionals. The body of evidence suggesting that natural disasters can either act on the course to civil conflict, or in transforming the path of ongoing conflicts is growing.

Spatial analysis suggests that lower than average rainfall is an important predictor of conflict (Levy et al. 2005). Statistically, the connections have also been made

¹ Information regarding these cases was kindly provided by Mark Pelling.



between disasters and conflict (Drury and Olsen 1998; Brancatti 2007; Nel and Righarts 2008), with initial findings suggesting that in at least the short to medium term, it is rapidly occurring disasters, rather than slow-onset ones, that have the highest conflict risk.

Using this body of evidence, several preliminary conclusions can be made regarding if and how an increasing number or intensity of climatic disasters may impact on violent political conflict—A question related to prevailing social, economic and political conditions.

Suffice to say disasters alone do not cause conflict. Those countries most likely to be affected by post-disaster instability appear to be those that already have the hallmarks of conflict risk before the disaster struck. Factors include poverty and slow economic growth, medium-to-high levels of inequality, poor governance, and the type of regime in place.

The single most important predictor of large-scale conflict in the aftermath of disaster is a history of conflict in the country in question (Nel and Righarts 2008). While many of these factors are related to both disaster vulnerability and the post-disaster context, if these conditions could be improved then the risk of post-disaster conflict would be greatly reduced.

The issue of how disasters might impact on conflict is explored through the lens of proximate (short-term or direct impacts) and structural (medium- to longer-term or indirect) impacts.² Structural impacts of disasters can be seen through the developmental consequences of disasters in affected societies, and their long-term socio-economic impacts. Here factors such as economic decline, increasing inequalities, population displacements, and the weakening of the state can result, all of which may increase conflict

(See "Conflict" continued on next page)

² As noted elsewhere, disasters have the ability to impact on the motives, incentives and opportunities for conflict (Nel and Righarts 2008). However for the sake of brevity, this article will take a broader approach to exploring disaster-conflict connections.

Conflict...

Continued from page eleven

risk in the longer-term.

Through the lens of proximate impacts, the consequences of disasters or decisions made in the post-disaster context, can be seen as: 1) a catalyst for action; 2) an enabling device for actors seeking avenues toward conflict, or to improve their position in an ongoing conflict; or 3) an accelerator of processes already under way. These three categories are not exclusive, but merely provide a broad explanatory framework for the processes involved when disasters and conflict can be linked. When a disaster does impact on conflict onset, or the course of an ongoing conflict, it is likely that it will do so through more than one of the categories above.

In regard to disasters acting as a catalyst, three points should be made. First, existing social divisions and grievances are generally present. That is, disasters do not manufacture large-scale political conflict, but rather, in certain situations can act to amplify existing tensions, providing the trigger for conflict. Documented localized conflicts between nomadic and sedentary populations in Africa during times of drought would be a good example here. When it comes to political conflicts, often it is the action or inaction of governments which amplify such tensions. Second and directly related, how

authorities react to disaster is often crucial, with cases such as Pakistan, Bangladesh and Nicaragua suggesting that biased, ineffectual or corrupt government response can incite unrest or even rebellion. Third, the strength of governmental control over the population is important. Murmurings of discontent and imminent unrest have been heard coming from Myanmar in the aftermath of the catastrophic Cyclone Nargis (Procter 2008), yet the prospect of large-scale conflict seems unlikely given the government's vice-like grip on the population.

Avenues of Conflict

AS TO WHEN THE POST-DISASTER CONTEXT can enable actors to undertake conflict, three points can be made. First, disasters can open avenues toward conflict when actors take advantage of the resultant destitution or desperation of groups within society. The Darfur conflict is good example: the Sudanese government appears to have used the environmental situation to mobilize militias, preying on both their increasing destitution and the increasing animosity between nomadic and sedentary portions of the population (although this hardly provides a thorough explanation of the situation).

Second, when state capacity is stretched in the aftermath of disaster, this can create a space for insurgent groups to either undertake conflict, or further engage in existing conflicts. For example, in 1999 an earthquake shook

U.S. Considers Climate, Hazards, and Civil Strife

U.S. planners are beginning to consider the disaster impacts of gradual-onset climate change as a catalyst for civil and international conflict.

In *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change* from the Center for Strategic and International Studies, the authors write that even under the lowest expectations for climate change by 2040, an average global temperature increase of 1.3 degrees Celsius, "National security implications include: heightened internal and cross-border tensions caused by large-scale migrations; conflict sparked by resource scarcity, particularly in the weak and failing states of Africa; increased disease proliferation, which will have economic consequences; and some geopolitical reordering as nations adjust to shifts in resources and prevalence of disease. Across the board, the ways in which societies react to climate change will refract through underlying social, political, and economic factors."

In the report *A Climate of Conflict: The Links Between Climate Change, Peace and War* (www.international-alert.org/pdf/A_Climate_Of_Conflict.pdf), authors Dan Smith and Janani Vivekananda wrote for International Alert, "Many of the world's poorest countries and communities thus face a double-headed problem: that of climate change and violent conflict. There is a real risk that climate change will compound the propensity for violent conflict, which in turn will leave communities poorer, less resilient and less able to cope with the consequences of climate change. There are 46 countries—home to 2.7 billion people—in which the effects of climate change interacting with economic, social and political problems will create a high risk of violent conflict."

Handled properly, however, dealing with climate change has the potential to aid in conflict resolution. The International Alert report suggests the steps for adaptation to climate change can work hand-in-hand with peacemaking efforts. The authors write, "A society that can develop adaptive strategies for climate change in this way is well equipped to avoid armed conflict. And a society that can manage conflicts and major disagreements over serious issues without a high risk of violence is well equipped to adapt successfully to the challenge of climate change. Climate change could even reconcile otherwise divided communities by posing a threat against which to unite and tasks on which to cooperate."

—Dan Whipple



Colombia. In the aftermath of the disaster, government legitimacy in the eyes of the population was compromised. At the same time the army was forced to refocus its attention away from rebel groups (in particular FARC) to emergency relief work. This stretching of capacity reduced the military's ability to respond to both rebel attacks and counter attacks by right wing paramilitary groups, both of which intensified in the post-disaster period (Brancatti 2007; Rohter 1999).

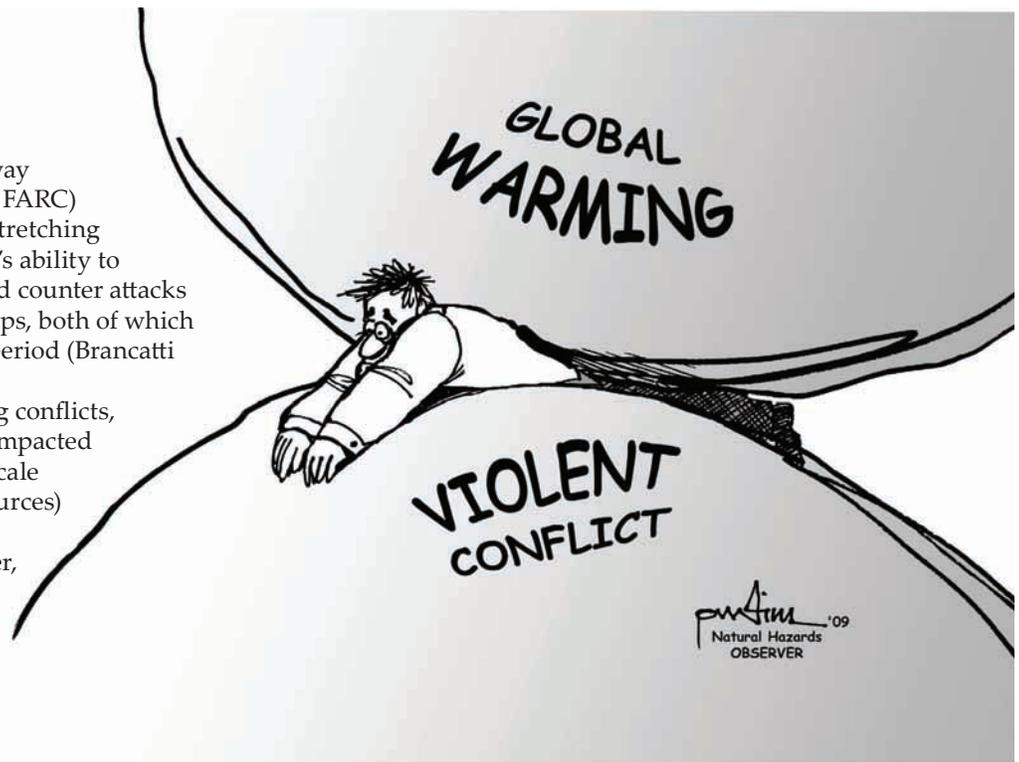
Third, in the case of ongoing conflicts, how warring parties are either impacted (e.g., being weakened by large-scale casualties or destruction of resources) or react to disaster is important. Often in the aftermath of disaster, advantage can be gained by taking control of aid resources, or the population. For example, the Tamil Tigers have been accused of taking advantage of the 2008 floods in Sri Lanka to forcibly recruit soldiers and workers (BBC 2008).

In certain situations disasters can accelerate changes already afoot. When this is the case, the acceleration can be related to various factors, including the role of external forces or the urgency of the situation. What is important to note is that the course of events does not markedly change from that which they were already on, although they may be interpreted differently. The Indian Ocean Tsunami's connection to increased levels of violence in Sri Lanka, and even more so the move toward peace in Aceh, Indonesia, appears to be a good example. In both Sri Lanka and Indonesia, the course of events accelerated after disaster struck but did not change path from the direction they were already headed (Parks et al. 2007). In such cases it is not that disaster does not have important ramifications for conflict (or peace), just that it should not be misinterpreted as a cause of change.

The Intergovernmental Panel on Climate Change says some of the types of disaster that have impacted on civil unrest are likely to increase. For instance, the likelihood of more flooding in Africa and Asia is predicted with "very high confidence" (greater than 90 percent); increasing coastal risks, "very high confidence;" decreasing low latitude food production, "medium confidence" (greater than 50 percent likelihood); increased intensity of typhoons and hurricanes, "likely" (greater than 66 percent); and increases in heat extremes and heat waves, "very likely" (greater than 90 percent).

By understanding past processes we gain insights into how future disasters may impact on political stability and conflict. Disasters do not create large-scale political conflict. However they can act to increase the risk of such incidents through amplifying existing social tensions, altering power balances or opening avenues which willing actors may take toward conflict. Disasters can also act to accelerate the pace at which events occur.

Whether or not an increased number or intensity of



climate-related disasters will result in increased conflict hinges more on political and socio-economic processes within developing countries than on the occurrence of the actual disaster. However, given trends toward increased inequalities within countries, ongoing issues of capacity and governance in the developing world, and a recent trend toward increasing numbers of violent civil conflicts, the prospect that disasters may act to further destabilize politically weak countries cannot be ruled out.

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Washington Update

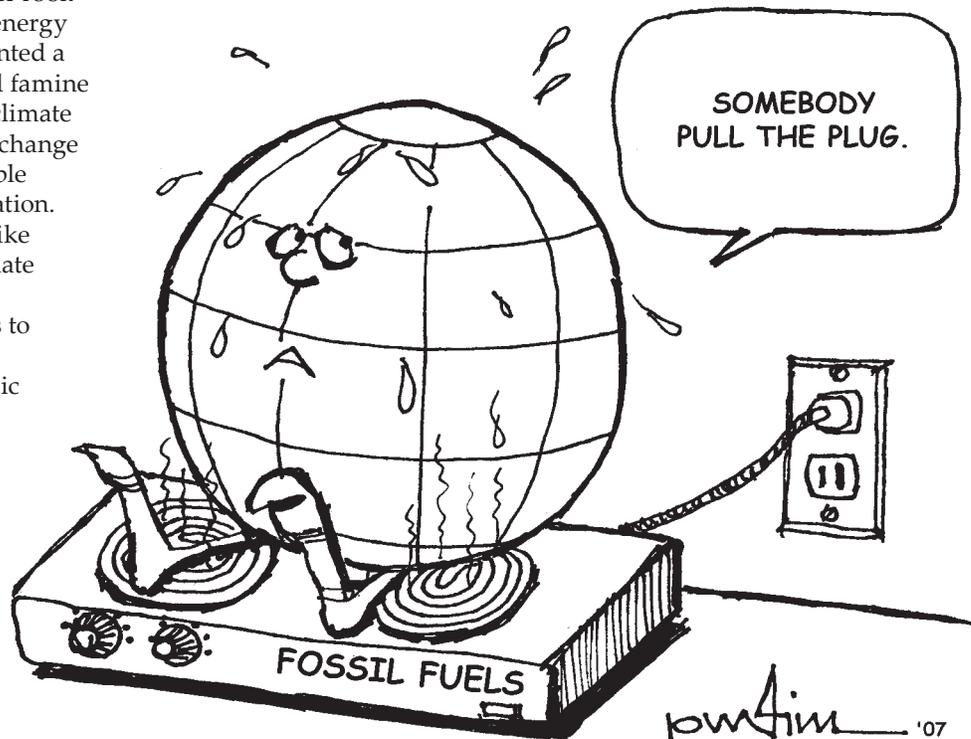
Taking Back the Climate Front

Senate Committee Prioritizes Cap-and-Trade System

SINCE PRESIDENT BARACK OBAMA TOOK OFFICE, his newly appointed energy secretary, Steve Chu, has painted a pessimistic picture of drought and famine without immediate action on the climate front. Even recognition of climate change as a severe problem is a considerable shift from the previous administration. Some congressional Democrats—like Barbara Boxer, the chair of the Senate Environmental and Public Works Committee—have ambitious plans to tackle the problem.

In early February, Senate Public Works Committee Democrats issued a set of principles to guide climate legislation. Though thin in detail, the committee set establishment of a cap-and-trade system as a mechanism to reduce greenhouse gas emissions “to levels guided by science to avoid dangerous climate change.”

Some Republicans are less than enthusiastic about the plan, though. Sen. James Inhofe (R-Okla.), the panel’s ranking Republican and the Senate’s leading climate change skeptic, said the Democratic proposal “will impose a long-term multi-trillion dollar energy tax on families and workers,” adding, according to a story in the *Washington Post*, “As demonstrated last year, when it comes to drafting comprehensive climate legislation, the devil is in the details. These principles offer nothing more than a punt on all of the difficult issues that Americans expect to be honestly debated.” Republican antipathy to action on climate is not universal, however. Republican presidential nominee and Arizona Sen. John



McCain sponsored the first-ever Climate Stewardship Act in 2003, which would have established a cap-and-trade system. That bill was voted down in 2003 and again in 2005.

Public opinion polls have shown a dip in environmental concern as a primary issue overall, taking a back seat to the economic recession. A January 22, 2009 poll by the Pew Research Center for the People & the Press found global warming came in dead last among 20 “top domestic priorities for Obama and Congress.” Thirty percent of those polled listed global warming as a “top priority,” down from 38 percent in January 2007. Eighty-five percent listed “strengthening the nation’s economy” as

priority number one.

Obama has cited clean renewable energy as a potential weapon to fight the economic recession, but the lack of economic growth has recently prevented the expansion of wind and solar power industries and has forced factories to lay off workers. On January 28, former Vice President Al Gore delivered an updated version of his “inconvenient truth” to the Senate Foreign Relations Committee. One goal is to build support for Obama’s economic stimulus package, which includes plans to steer the nation away from its dependence on carbon-based fossil fuels.

Democrats are using scientific recommendations to set goals and reduce greenhouse gas emissions through the enactment of strict federal carbon caps. Although some Republicans have praised the Senate Environment and Public Works Committee’s proposed legislation for agreeing to reach areas of common ground, many criticize the goals for imposing increased energy taxes on families and workers and failing to implement cost-containment mechanisms. Local and state officials—like Mary Nichols, head of the California Air Resources Board—are working to include greater restrictions on tailpipe and greenhouse gas emissions in their state plans.

Sound Science?

WHILE THE NEW ADMINISTRATION SEEMS MORE committed to basing policy on “sound science” than the past one, there has been a curious shift in public attitudes about climate. While the scientists of the Intergovernmental Panel on Climate Change say with “very high confidence”—that is, greater than 90 percent certainty—that human activity is the cause of global temperature increases, only 41 percent of U.S. voters think so, according to a Rasmussen poll released in mid-January. Forty-four percent of Americans told the pollsters that the increases are the result of long-term planetary trends.

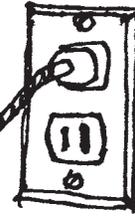
So while scientists are more certain than ever that humans are changing the climate—the 1995 IPCC Summary for Policymakers only said cautiously, “the balance of evidence suggests that there is a discernible human influence on global climate”—the public trend is going in the opposite direction. Some analysts are blaming—what else?—the Internet for the reversal. The mainstream media has generally stopped including the false “balance” between the vast majority of climate scientists whose findings on anthropogenic climate change are unequivocal and the small band of climate skeptics for whom no amount of evidence seems to be enough. This means the “junk science” coverage has migrated to the Internet, where the people who write about it, in general, don’t understand the issues as well. But it’s also where most people now get their information.

The website Desmogblog.com notes a “very significant upswing in online activity” in global warming misinformation during 2008 (www.desmogblog.com/2008-stats-global-warming-denial-blogsphere). Writes site commentator Kevin Grandia, “Outside of a small band

of ideologically motivated outlets, the majority of the mainstream media is unwilling to cover the nonsensical junk science of the right-wing think tanks and their cadre of scientists for hire. With this the case, the internet is exploding with such information. And at the same time that we’re seeing significantly more of this misinformation

“At the same time that we’re seeing significantly more of this misinformation being spread about global warming online, we’re also seeing more people than ever using the internet as their main source of news and information.”

—Kevin Grandia



being spread about global warming online, we’re also seeing more people than ever using the internet as their main source of news and information.”

The D.C. Climate Fire Drill

In Washington, numerous reports have been drafted on the subject of climate change producing competing, duplicate, and often inconsistent recommendations on exactly how to tackle the problem. The Environmental Protection Agency said in a report issued by the agency’s inspector general that no standardized plan has been developed in order to ensure consistency of climate change strategies across regions, which then threatens to waste federal resources due to conflicting and duplicate efforts. “EPA has not issued interim guidance to give its major components consistent direction to ensure that a compatible national policy—when it emerges—will not result in wasted efforts,” the inspector general says.

Other debates continue about whether it is more practical to take an adaptive versus a mitigative approach to climate change legislation—prepare and plan for the inevitable or try to slow or halt the changes through emissions controls or technological solutions?

EPA recently released a report, *Coastal Sensitivity to Sea-Level Rise*, on the impacts of projected sea level rise on coastal communities and habitats. The report provided recommendations on how these areas can adapt and plan. The report confirms the rising global oceans from warming and melting of glacial ice sheets. However, the focus of the report specifically discusses the greatest expected impacts of climate change to the Mid-Atlantic region. Not only will rising waters threaten these regions, but an increased number of coastal storms coupled with high concentrations of populations along the coast are expected to add to their vulnerability. For many, climate change will disrupt local home environments, leading to psychological and anxiety disorders, comparable to past generational threats of nuclear war or the spread of AIDS, the report says.

Global warming is not just a national, regional, or local issue that must be dealt with in the neat confines of domestic legislation. The Intergovernmental Panel on Climate Change predicts that there will be 200 million refugees due to climate change by the year 2050. Bangladesh, which is affected by deadly floods and cyclones each year, has started a fund with the help of environmental and disaster managers to identify the impacts of climate change and to devise policies that will help to protect lives and infrastructure from inevitable future damage. The Obama administration has already shown enthusiasm toward joining the global community in

(See “Update” continued on next page)

Update...

Continued from page fifteen

treaty talks in an attempt to reverse years of inaction under the Bush administration. The United States is expected to start negotiations at the U.N. meetings in Denmark sooner rather than later.

Climate change has not been a strictly partisan issue, with Democrats on one side and Republicans on the other. It might, in fact, be an issue on which the new president can rally his much-touted bipartisanship. Many Republican members of the Senate Foreign Relations Committee supported Gore's assertion that urgent action must be taken in order to avoid catastrophe. Sen. Richard Lugar

(R-Ind.) said that climate change can be coupled with economic opportunities, not just constraints. The "pro-active" and "pro-growth" solutions that Lugar recognizes as opportunities signal the overall promising stance of the new U.S. administration toward pro-active domestic and foreign policy. Since Lugar is a Republican, his efforts may signal a shift in the way the federal government tackles climate change. Although several key supporters of ambitious climate change policies now chair important committees, action will depend on Washington's ability to combine steps to combat climate change with economic incentives during this deep recession.

—Alexandra Jordan

MARY FRAN MYERS AWARD 2009 NOMINEES SOUGHT

DEADLINE: APRIL 15

Nominations are now being accepted for the 2009 Mary Fran Myers Award. The award recognizes disaster professionals who continue Myers' goal of promoting research on gender issues, disasters, emergency management, and higher education.

As co-director of the Natural Hazards Center, Myers recognized that vulnerability to disasters and mass emergencies is influenced by social, cultural, and economic structures that marginalize women and girls, as well as exposing boys and men to harm. The Natural Hazards Center and the Gender and Disaster Network established the award in 2002 to honor the women and men whose advocacy, research, or management efforts have had a lasting, positive impact on reducing disaster vulnerability.

Individuals eligible for the award will have added to the body of knowledge on gender and disasters, made significant contributions to gender theory or practice, or furthered opportunities for women to succeed in the field. The selection committee is especially interested in soliciting nominations from outside the United States.

The award winner will be invited to participate the Natural Hazards Research and Applications Workshop in Broomfield, Colorado on July 15-18. Travel, accommodations, and workshop fees will be covered. The winner is also invited to serve on Mary Fran Myers selection committee for one year and is encouraged to chair the committee in the next year.

To make a nomination, submit the following:

- Your full name, mailing address, e-mail, telephone, and fax, and that of the nominee
- The nominee's current resume or curriculum vitae
- A nomination letter detailing specifically how the nominee's work fits the award criteria described above
- An optional one-page letter of support from another person or organization

Nominations should be submitted by APRIL 15, 2009 to Kristinne Sanz of the Gender and Disaster Network at mfmawards2009@gdnonline.org. Questions can be directed to Elaine Enarson at enarson@gmail.com or to Sanz at kristinne.sanz@northumbria.ac.uk.

Complete nominations will be forwarded to the selection committee chairwoman and 2008 award winner Cecilia Castro, who will facilitate the review process and make the award announcement.

To learn more about Castro and other previous award winners, visit the Natural Hazards Center Web site at www.colorado.edu/hazards/awards/myers-award.html.



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 and/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

Data Against Natural Disasters: Establishing Effective Systems for Relief, Recovery, and Reconstruction. Samia Amin and Markus Goldstein, editors. 2008. ISBN: 978-0-8213-7452-8. 340 pp. \$35 (paper). World Bank Publications. www.worldbank.org/publications.

It's difficult to think about collecting data in the midst of a natural disaster, but knowledge about what data is needed and where is critical to mounting an effective relief and recovery effort. **Data Against Natural Disasters** outlines what information is needed to coordinate relief efforts and discusses the limits of that data.

"However generous the support provided to the affected population, there is always a gap between needs and resources," according to the book. "Proper data management ensures that priorities are set and enforced."

The book contains extensive case studies from Guatemala, Haiti, Indonesia, Mozambique, Pakistan, and Sri Lanka. Even well-funded disaster response can face difficulties without proper information management (see **Large-Scale Disasters**, below).

"The response to the Asian tsunami was particularly generous and, in fact, overwhelmed many humanitarian actors," the book states. "This assistance amounted to over \$8,000 per displaced person, supplying, in principle, the response and recovery actors with an incentive and ample resources for proper data management and evidence-based decision making."

Global Catastrophic Risks. Nick Bostrom and Milan Ćirković, editors. 2008. ISBN: 978-0-19-857050-9. 554 pp. \$50 (hardcover). Oxford University Press. www.oup.com.

In the hazards field, you get used to thinking about the unthinkable, but maybe not to the same extent of the authors represented in this volume. Very large, very unlikely hazards—asteroids smashing into the planet, hostile artificial intelligence run amok, catastrophic climate change, invasion by space aliens, catastrophic nuclear terrorism—get in-depth analysis in this book that examines a vast scope of remotely possible global hazards that could annihilate human existence.

Despite the fact most chapters touch on the extinction of human life, the volume is remarkably entertaining and readable. For instance, "Cognitive biases potentially affecting judgment of global risks," by Eliezer Yudkowsky, a research fellow at the Singularity Institute for Artificial Intelligence, offers a clear overview of why people tend to underestimate their risks and what biases influence those perceptions. The disconcerting conclusion is biases are difficult—and perhaps impossible—to overcome. This is somehow strangely reassuring. We're all rowing the same boat.

The book gives a long overview on how we think about global risks and surveys the likelihood of various natural and man-made catastrophes. It's risk assessment meets science fiction. One chapter, for instance, addresses a War of the Worlds scenario in which we face the possibility of global conflict with hostile extraterrestrial intelligent beings.

"The reality of the risk depends on ... 1. The feasibility of conflict over huge interstellar distances; 2. The magnitude of threat such a conflict would present...and, 3. Motivation and willingness of intelligent communities to engage in this form of conflict."

The convergence of these factors inspiring hostile intergalactic takeovers seems remote, the chapter concludes. That's a relief.

Global Catastrophes and Trends: The Next Fifty Years.

By Vaclav Smil. 2008. ISBN: 978-0-262-19586-7. 320 pp. \$29.95 (cloth). The MIT Press. mitpress.edu.

The future, Vaclav Smil helpfully reminds us, is hard to predict. In fact, even predicting the past can be tough. Estimates of the frequency of near Earth objects—asteroids and such that might collide with the earth—vary by as much as an order of magnitude, he notes. The threat from megavolcanoes also can be difficult to interpolate from past records. The Yellowstone caldera has exploded catastrophically three times in the last 2.1 million years, at fairly regular intervals.

"There are three ways to interpret this sequence," Smil writes. "First, it has too few members to allow for any conclusions. Second, the interval between the Yellowstone hotspot eruptions has actually decreased from about 800,000 years to 660,000 years; a repeat of the last interval leaves only 20,000 years before the next event is due. Third, the three events had an average interval of 730,000 years, and hence there are still some 90,000 years to go before the most likely repeat."

Smil does not argue we should ignore risks, but rather that we should assess them properly and be aware that we seldom, if ever, incorporate all the factors that influence events. The possibility of a million deaths from influenza—along with a 100,000 from tsunamis and volcanoes—in the first half of the 20th century is a near certainty, he states. On the flip side, there is a 50 percent chance of one person dying from an asteroid collision.

"In affluent countries one person out of a million dies every hour," he writes. But "most people tolerate activities that temporarily increase the overall risk of dying by 50 percent or that may even double it." Driving a car, for instance, adds a 50 percent risk of death to the baseline figure, and smoking nearly doubles it. Terrorism adds only a very slight risk—one-thirtieth of the risk from driving.

(See "Resources" continued on next page)

Resources...

Continued from page seventeen

While he argues that there's little we can do about low-probability natural catastrophes like mega-eruptions or mega-tsunamis, "we can do much to be better prepared for a number of anticipated catastrophes, and we can take many steps to moderate negative impacts of some of the most worrisome trends."

Among these preparations, Smil includes a program to deflect near Earth objects, planning for pandemic influenza, protection of biodiversity, and lowering carbon dioxide emissions. "We should act incrementally as prudent risk minimizers and pursue any effective no-regrets options."

Large-Scale Disasters: Prediction, Control, and Mitigation. Mohamed Gad-el-Hak, editor. 2008. ISBN: 978-0-521-87293-5. 576 pp. \$150 (hardcover). Cambridge University Press. www.cambridge.org.

The term "gargantuan disaster" might not have entered the technical lexicon yet, but in this volume it's helpfully defined as a disaster affecting 10,000 people or more. The book delves into highly technical disaster detail, including formulas covering fluid mechanics, heat transfer, and turbulent flows.

Chapter five deals with relief logistics, beginning with this quote: "The most deadly killer in any humanitarian emergency is not dehydration, measles, malnutrition or the weather, it is bad management."

The chapter illustrates some of the information needs mentioned in **Data Against Natural Disasters** (above). "Unless a relief organization already has a process in place for identifying and preventing unsolicited and inappropriate donations from entering their system, the extra effort of separating, prioritizing, transporting, and storing these items results in delays and increased logistics costs," writes author Neziha Altay in **Large-Scale Disasters**.

Altay cites the delivery of diet pills and winter coats to the Dominican Republic after Hurricane Georges, clothing donations that rotted for lack of warehouse space after Katrina, and wagonloads of useless quilts delivered to northern India, among others. The book is a thorough, technical look at every aspect the disaster cycle.

What is a City?: Rethinking the Urban Landscape After Hurricane Katrina. Phil Steinberg and Rob Shields, editors. 2008. ISBN: 978-0-8203-2964-2. 233 pp. \$64.95 (cloth). \$19.95 (paper). University of Georgia Press. www.ugapress.uga.edu.

Is New Orleans a cosmopolitan hub? An insular backwater? An African-American city? A sinking town? This book examines these and other images of New Orleans in the wake of Hurricane Katrina to examine the large questions of what cities are and how they function.

The work of 13 writers, academics, and activists combine in this volume to explore issues raised by urban life and a serious hazard like Katrina.

In his essay on Creole urbanism, University of Missouri-Kansas City Urban Planning Professor Jacob Wagner writes, "Rather than attracting us to New Orleans as some exceptional case, the idea of Creole urbanism should send all of us back to our own neighborhoods in search of the forgotten place identities in whatever locations we call home."

The Forgiving Air: Understanding Environmental Change. Richard C.J. Somerville. 2008. ISBN: 978-1-878220-85-1. 202 pp. Second edition. \$22 (paper). American Meteorological Society. www.ametsoc.org

This readable, entertaining guide for the educated layperson covers all things atmospheric, from the ozone hole to acid rain to topics such as climate change, smog, and sulfates. Somerville finds reason for optimism in the way that the issue of the "ozone hole" has been dealt with. "In the case of stratospheric ozone," he writes, "the problem was quickly recognized, and decisive action did eventually occur."

Although that approach offers hope for dealing with pressing problems of the future, Somerville warns that we will "be concerned with determining which actions are wise and prudent, given incomplete scientific information. In some cases, there may still be time enough to act to avoid serious planetary change."

Costs of Inaction on Key Environmental Challenges. Organisation for Economic Co-Operation and Development. 2008. ISBN: 978-92-64-04577-4. 213 pp. \$62 (paper), \$43 (e-book, PDF format). OECD. www.oecd.org/publishing/corrigea.

Policy arguments about the high cost of changing things—from alleviating climate change to instituting universal healthcare coverage to bailing out banks—are fairly frequent. We hear less often about the cost of doing nothing, which can also be pretty substantial. This OECD publication attempts to delineate the costs of failing to solve the critical environmental problems of the early 21st century.

Perhaps because the goal is so ambitious, the volume delivers less than its title promises. For instance, the chapter "Costs of Inaction with Respect to Environment-Related Industrial Accidents and Natural Disasters," doesn't really tell us how much is at stake if we fail to deal with these issues. It is a summary of high-priced disasters we've already experienced, such as Hurricane Katrina, the *Exxon Valdez* spill, and so on. "The costs of inaction with respect to environment-related industrial accidents and natural disasters are an issue of increasing importance," the chapter concludes. But we already knew that.

What the book does deliver is an excellent reference for the economic impact of a wide variety of environmental problems, including climate change and air quality, as well as hazards. The largest oil spill since 1967? *Atlantic Empress*, 1979, off Tobago, West Indies, 287,000 metric tons. Percent of total health costs related to pain and suffering from bronchitis? Fifty percent. Discounted present value of damages from climate change with "no policy?" \$22.65 trillion. And so on.

Costs of Inaction can also be a little maddening in its use of referential shorthand. In the discussion of regional health risks due to climate change, the book describes scenarios in World Health Organization regions like Africa-D or Europe-B, but doesn't elaborate on what nations or latitudes those regions encompass. Similarly, the book portrays estimates of sea level rise, increased vulnerability to hunger, and other climate issues based on Intergovernmental Panel on Climate Change scenarios, but never explains what those scenarios represent.

Understanding Environmental Issues. Susan Buckingham and Mike Turner, editors. 2008. ISBN: 978-0-7619-4236-8. 274 pp. \$42.95 (softcover). Sage. www.sagepublications.com.

The brief chapter on natural hazards by Iain Stewart and Katherine Donovan is an effective short course on modern-day hazards. Each chapter begins with a box of “learning outcomes” which are then explored in detail. The book is directed at undergraduates and graduate students in geography, environment, and ecology.

Design of Highway Bridges Against Extreme Hazard Events: Issues, Principles and Approaches. George C. Lee, Mai Tong, and W. Phillip Yen, editors. 2008. ISSN: 1520-295X. 102 pp. \$25 (softcover). MCEER, University of Buffalo, New York. wmceer.buffalo.edu.

Bridges must be able to withstand a lot in the course of their existence—flooding, storm surges, landslides, explosions, vehicles collisions, and flaming gasoline tankers are but a few of the fates that might befall them. This book provides guidance for engineers in establishing “multi-hazard design principles and guidelines for highway bridges” in the face of “so many interrelated parameters” clamoring for importance and priority.

TORNADOES

Paths of Destruction: The Story of West Michigan’s Worst Natural Disaster, the Tornadoes of April 3, 1956. By Ernest J. Ostuno. 2008. ISBN: 978-0-9617706-3-1. 126 pp. \$29.95 (softcover). Grand Rapids Historical Society. www.grhistory.org.

Eighteen people died in an F5 tornado—designating winds in excess of 200 mph—that hit Flint and western Michigan on April 3, 1956. This book, commemorating the event’s 50th anniversary in 2006, combines meteorological detail, newspaper accounts, and interviews with people who survived. A DVD covering the disaster is included.

CLIMATE

Climate Extremes and Society. Henry F. Diaz and Richard J. Murnane, editors. 2008. ISBN: 978-0-521-87028-3. 340 pp. \$140 (hardcover). Cambridge University Press. www.cambridge.org.

A furious debate over whether hurricane frequency and intensity will increase as oceans warm as a result of global climate change is complicated by inability to predict incidences of future climate extremes—although events are rare, the stakes are high in potential loss of life and money.

This book uses climate models and observations to examine the effects of global warming on hazards. Climate scientists write mostly in Part One of the book, which examines the existing evidence for climate extremes. Social scientists discuss the human impacts in Part Two.

Climate Code Red: The Case for Emergency Action. By David Spratt and Philip Sutton. 2008. ISBN: 978-1-921372-20-9. 304 pp. \$27.95 (paper). Scribe Publications. www.scribepublications.com.au.

Human civilization has developed during the Holocene, that is, over the past 11,500 years or so. During that period “temperatures have varied within a one-degree (Celsius) band, although the variation has been,

for the most part, considerably less,” according to **Climate Code Red**. “Sea levels have been almost constant over the last few thousand years of human civilization and, more significantly, over recent centuries, when most climate-sensitive infrastructure has been built.”

In short, the comfort of civilization has depended on a relatively stable climate. Now, global average temperatures are expected to increase between 1.4°C and 5.8°C by 2100, according to the Intergovernmental Panel on Climate Change.

“The earth is already too hot, and there’s already too much carbon dioxide and other greenhouse gases in the atmosphere,” the authors argue. They urge immediate and rigid measures to curb emissions, including eliminating all fossil fuels from the transportation sector, using renewable energy in electricity transmission, investing in energy efficiency, and other efforts.

Climate Code Red is a call to arms for immediate and drastic action in the face of what some see as unstoppable global warming. Not everyone worries quite so much about these changes, of course. In the reissue of the 2007 book, **Unstoppable Global Warming: Every 1,500 Years** (Rowman & Littlefield, \$19.95 paper), Fred Singer and Dennis Avery argue warming is natural and has often occurred without dire consequences to humanity.

In the wider world, the climate debate has passed Singer and Avery by. Almost no one outside of the climate-skeptic community pays much attention to their argument anymore. Their case is based largely on the premise that, in the past, the sun caused global warming. While the fact that the sun affects weather and climate isn’t in dispute, many studies have examined the contribution of solar irradiance to the current warming cycle without finding increased solar input that would explain the modern increase in global temperatures. The firm conclusion is that it can’t be explained without calculating in the human impacts.

But the jury is still out on the question of “How hot is too hot?” In an essay in **Global Catastrophic Risks** (Above), David Frame and Myles Allen write, “In terms of global climate, potential catastrophes and putative tipping points retain a sort of mythic aspect: they are part of a useful way of thinking about potentially rapid surprises in a system we do not fully understand, but we find it hard to know just how incorporate these suspicions into our strategies.”

Climate Chaos: Your Health at Risk. By Cindy L. Parker and Steven M. Shapiro. 2008. ISBN: 978-0-275-99858-5. 220 pp. \$49.95 (hardcover). Praeger Publishers. www.praeger.com.

After a brief primer on the basics of climate change science, this book offers a practical guide to health issues that might arise in a warming world and advice on how to deal with them. The biggest source of human health problems in a warming world is likely to be heat. The 2003 heat wave in Western Europe was blamed for the deaths of 45,000 people, while a 2006 heat wave killed 140 people in California and another 140 in New York. The question of whether these events were caused by climate change remains, but the predicted increase in global average temperatures in the coming century is expected to increase

(See “Resources” continued on next page)

Resources...

Continued from page nineteen

the frequency, duration, and intensity of heat waves.

Average summer temperatures in cities like Washington, D.C., and Atlanta could see daily highs ranging from 100-110°F by late in this century. **Climate Chaos** offers tips for staying healthy (and alive) in the heat, as well as dealing health hazards such as air pollution, infectious diseases, and other issues that could loom in a warmer climate.

Global Warming, Natural Hazards, and Emergency Management. By Jane A. Bullock, George D. Haddow, and Kim S. Haddow. 2008. ISBN: 978-1-4200-8182-4. 282 pp. \$59.95 (softcover). CRC Press. www.crcpress.com.

This book is heavy on Sierra Club influence—one of the authors is the club's communications director and Executive Director Carl Pope co-wrote the introduction. Hence its subsequent direction: identify the problem, then solve it through political action.

After beginning with a brief examination of the onset of climate change and its impact, the authors look at several lengthy case studies describing how recurring hazards such as flooding and earthquake protection have been addressed at the community level.

The book's case study of flooding in Tulsa, Oklahoma, is particularly instructive of the tenacity and long-term political involvement needed to deal thoroughly with even the most obvious and universally acknowledged hazard. The city has been plagued by life- and property-destroying flash floods since its founding, but development pressures and inertia made progress to defend against this hazard slow. The perseverance of community activists and a few courageous politicians finally addressed most of the issues, but it wasn't until 2002 that the authors felt comfortable designating the city's flood plan "sustainable."

The book offers a wide variety of additional resources on climate change and hazards, though not, curiously, the Natural Hazards Center. Heck, we mentioned them.

The Long Thaw: How Humans Are Changing the Next 100,000 Years of Earth's Climate. By David Archer. 2008. ISBN: 978-0-691-13654-7. 180 pages. \$22.95 (hardcover). Princeton University Press. press.princeton.edu.

If you have time in your busy schedule to read only one book on climate change and climate science basics, this would be a good choice. Archer, an oceanographer and University of Chicago geosciences professor, has written a conversational, engaging, and short (remember, you're busy) book that covers the last 500 million years or so of the Earth's climate. He explains how these changes are (and are not) relevant to the understanding of the modern climate crisis.

Climate researchers must spend a lot of their time being cold, because ice in its many manifestations—melting, accruing, sliding, glaciers, floating ice shelves, calving icebergs, or simply lying there—plays an important role in the dynamics of climate and in our understanding of it. The clearest pictures of past climate come from ice cores taken from the Greenland ice sheet. The slow accumulation and sometimes rapid melting of ice sheets have provided

an engine of past climate warming and cooling, along with many other "forcings," as the climatologists say.

There is little doubt that accumulating carbon dioxide in the atmosphere is a critical driver of climate. "The similarity between CO₂ and the temperature in Antarctica is jaw-dropping," Archer writes. "Nature simply doesn't work so cleanly most of the time. I get the impression from reading the newspaper that the tiniest correlations in shotgun-blasts of medical data are enough to change the diets of millions of concerned people. Are eggs good for you or bad for you this year? ... Even the link between cigarette smoking and cancer, kind of a gold standard in the medical world, is not as tight as the correlation between CO₂ and Antarctic temperatures."

One impression you get from reading Archer's book, and many others that take the long view on climate, is that over the past 10,000 years or so, the earth's climate has been warmer and more stable than in most of the last 80,000 years. Temperatures have been constrained within a relatively narrow band. This is the period in which humanity has developed to our present condition. The next question is how well we'll do as temperatures rise higher than the warm upper bound of the band—as Archer says it will almost certainly do, given the dynamics of ocean, atmosphere, and, of course, ice. We know our species does well under current conditions. How well will we adapt to the coming environment?

"Humankind has the potential to alter the climate of the Earth for hundreds of thousands of years into the future," Archer writes. "That, I feel, can be said fairly confidently. But will we? ... This is much harder to predict. Technologically, I believe that it is possible to avoid dangerous climate change, if we so choose. But making a decision: there's the tricky part."

Climate Change and Globalization in the Arctic: An Integrated Approach to Vulnerability Assessment. By E. Carina H. Keskitalo. 2008. ISBN: 978-1-84407-528-7. 254 pp. \$101 (hardcover). Earthscan. www.earthscan.co.uk.

The effects of global climate change will be especially marked in northern latitudes. This book looks at the potential impacts of climate change on forestry, herding, and fishing practices among native populations in northern Scandinavia. The author interviewed people whose livelihood was intrinsically tied into these occupations to draw his conclusions.

"This relatively open-ended design is intended to make possible a stakeholder assessment of vulnerability, of the communities' socioeconomically and politically delimited adaptive capacity of the adaptations that are being or might be undertaken, and if climate change impacts figure in people's priorities," Keskitalo writes.

She concludes climate change will have the most profound impacts on reindeer herders. Forestry and fishing—which are more heavily regulated—may not experience as many negative outcomes.

Contracts and Grants

Below are descriptions of 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/

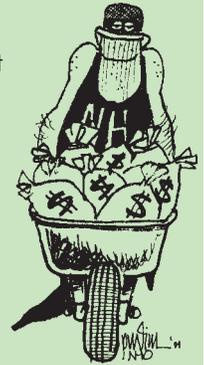
Economic Package May Stimulate Scientific Research

As the *Natural Hazards Observer* was going to press, President Barack Obama's economic stimulus legislation was still being considered by both the U.S. Senate and House of Representatives. Senate legislation contained \$23.8 billion for scientific research, development, and capital funding. The House version had \$26.4 billion.

The National Science Foundation, which funds much hazards and disasters research, was in line for \$1.4 billion in the Senate bill and \$3 billion in the House. The total fiscal year 2008 budget for NSF was about \$6 billion. According to an analysis of the legislation by the American Association for the Advancement of Science, "Within Research and Related Activities, NSF's core research account, \$2.0 billion in the House bill would go to research grants distributed through NSF's regular peer review process, enough to dramatically raise success rates for grant competitions from 20 percent or below in recent years. The Senate would provide \$1.0 billion, half the House's appropriation."

The National Institutes of Health would receive \$3.9 billion from both the House and Senate versions of the stimulus package. NIH's FY 2008 budget totaled \$29.5 billion.

The legislation also includes \$2.75 billion for the Department of Homeland Security, including \$1 billion for airport security, \$430 million for border points of entry, \$210 million to build fire stations, \$300 million for port, transit, and rail security, \$280 million for border security technology, and \$240 million for the Coast Guard.



Understanding Spatiotemporal Dynamics of Community Response to Natural Disaster. Funding Organization: National Science Foundation. \$44,484. One year. Principal investigator: Kathleen Stewart, University of Iowa. kathleen-stewart@uiowa.edu.

While the magnitude of natural disasters can be great, community responses to calamitous events are significant. Community response includes both top-down and bottom-up activities, activities coordinated by elected or appointed community leaders, and the efforts of neighborhood residents to self-organize.

This project examines the dynamics of community response to the June 2008 flood of the Iowa River in Iowa City, Iowa, a flood that crested at a level more than 9 feet (2.7 meters) above the river's flood level of 22 feet (6.7 meters) and 20 feet (6.1 meters) above the river's median gauge height for mid-June.

The investigators will collect time-sensitive data to provide a foundation for modeling community response to the disaster. They will focus first on data about the community's physical response to the flood—for instance where, to what height, and when did sandbagging operations occur. They also will collect data on strategies followed to protect local buildings by conducting interviews to ascertain why sandbags were deployed to particular locations and what influenced decisions to allocate resources.

These interviews will be conducted with City of Iowa City administrators and University of Iowa facilities management staff to gather details about the sequence of actions associated with their attempts to save property and reduce damage and disruption. Data will be used as input for the development of spatially explicit simulation models that integrate physical flood characteristics with the spatiotemporal characteristics of top-down and self-organized community responses.

This project will enhance basic understanding about the ways that communities respond to natural disasters like floods, with results that can be generalized to

other locations and other types of disasters. The project will be especially valuable for helping to compare the characteristics of the actual response to stated objectives to understand how objectives shift during a disaster. The project will provide valuable education and training opportunities for a number of students, and it will help city and university administrators evaluate what transpired during the June 2008 flood.

A Short-term Site Investigation of the 2008 Midwest Floods. Funding Organization: National Science Foundation. \$50,000. Six months. Principal investigator: Makarand Hastak, Purdue University. hastak@ecn.purdue.edu.

Recent floods in the Midwest have caused widespread damage in cities and towns in Iowa, Illinois, Missouri, and Indiana. The disaster killed 24 people and injured 150. Experts say the fundamental reason for the widespread damage was infrastructure failure. Collapse of critical infrastructure affects the industries and communities that rely on it. Therefore, disaster impact data should be collected to determine vulnerable infrastructure and its impact on industries and communities. This analysis will lead to better protection of associated communities and industrial services during floods, hurricanes, tornadoes, and earthquakes.

Since such data vanishes over time, it is important to collect it as quickly as possible after the occurrence of disasters. This short-term exploratory research will conduct case studies in the flood-affected regions in the Midwest to obtain the ephemeral data about the affected infrastructure. Obtained from personal interviews and questionnaires, data will include locations and circumstances of damaged infrastructure, the level of damage, and duration of service failure right after the natural disaster, along with its impact on industries and communities.

This project will enhance understanding of interrelationships among infrastructure, industries, and communities in disasters. The case studies conducted

through this research will be an effective tool for graduate and undergraduate students to understand the role of infrastructure. The results of this research will help public agencies, industries, and communities to better prepare natural disaster mitigation strategies as well as provide an effective tool to handle the disaster-related resources.

Integrated Optimization of Evacuation and Mass Care Sheltering for Hurricanes. Funding Organization: National Science Foundation. \$750,000. Three years. Principal investigator: Rachel Davidson, University of Delaware. rdavidso@udel.edu.

This project will improve understanding of and decision support for evacuation and mass care sheltering in hurricanes. The task of moving tens or even hundreds of thousands of people from a wide geographic area in only a few days or hours under uncertain, dangerous conditions, getting them to safe locations, and keeping them safe until they can return home is an extraordinarily complicated process. As Hurricane Katrina made clear, the stakes are high. Despite a lot of progress, population growth in hurricane-prone regions assure us that many challenges remain.

The traditional approach of evacuating everyone thought to be at risk is no longer feasible in many areas. There are simply too many people and too little transportation capacity. We propose a fundamentally new approach.

In the past, mathematical modeling has been limited to estimating the time required to clear a region, assuming many characteristics of the problem are uncontrollable input (e.g., shelter locations). We will develop sophisticated optimization models with an expanded decision frame that focuses on higher-level objectives, such as minimizing life loss, cost, and inequity. The model considers the full range of strategic and operational evacuation and sheltering strategies in meeting those objectives, including, for example, vertical evacuation and strategically locating shelters.

The project has 5 main steps: (1) determine a set of hurricane scenarios for use in evacuation and shelter models which appropriately represent the full range of possible events, but are few enough to allow detailed analysis; (2) conduct focus groups of key decision makers and stakeholders to identify objectives, constraints, assumptions, and evacuation and shelter management strategies; (3) using the focus group input, develop two mathematical optimization models—one long-term strategic and one short-term operational—for evacuation and sheltering decisions; (4) conduct surveys of affected citizens to ensure that the optimization model assumptions and results make sense; and (5) demonstrate the models through case studies in North Carolina and Florida.

By collaborating throughout the project with state and local emergency management departments, and the American Red Cross—the key agencies in charge of hurricane evacuation and sheltering—we will ensure that study results are disseminated to practitioners quickly. Three graduate students will participate in all aspects of the research.

The Interactions of Climate Change, Land-Management Policies, and Forest Succession on Fire Hazard and

Ecosystem Trajectories in the Wildland-Urban Interface. Funding Organization: National Science Foundation. \$1.1 million. Four years. Principal investigator: Bart Johnson, University of Oregon. bartj@uoregon.edu.

This project will identify ways to reduce wildfire hazard and the loss of imperiled ecosystems by exploring the joint effects of climate and land use changes in western Oregon's Willamette Valley ecoregion. Three hypotheses will be tested: climate change will increase fuel loads and wildfire hazard; land development will increase the area of wildland-urban interface and alter vegetation in ways that increase the risk of wildfire and loss of imperiled ecosystems; and some management options will be more robust than others in mitigating fire risk and sustaining imperiled ecosystems across a range of future climate scenarios.

The work will employ a biophysical model that downscales from the coarse spatial scales of current climate change models to the fine spatial scales at which human land use and management decisions are made. It then scales back up to represent the landscape-scale effects of human actions on vegetation and fire hazard. The biophysical model will be coupled with an agent-based model in which decision makers on individual land parcels respond to climate, land use regulation and incentives, land markets, perceived fire hazard, land management costs, and aesthetics.

The risk of catastrophic wildfire in the wildland-urban interface is a growing nationwide threat that projected climate change is likely to exacerbate. This project supports emerging national, regional and local initiatives by providing tools to forecast risks and mitigate the impacts. Global climate change models have become increasingly mechanistic, sophisticated and spatially explicit. However, the development of interactive models of how biological and human cultural systems will respond to climate change at the spatial scales at which land use and management decisions are made is in its infancy. This research will produce a transferable methodology for modeling such systems that is tractable, spatially explicit, and directly linked to policy-based decision-making.

"Climate change is likely to have major impacts on wildfire, biodiversity and people in the Pacific Northwest," Principal Investigator Bart Johnson said. "Predicting the effects of climate change on people and ecosystems, though, is difficult because of the uncertainties—not just about the magnitude of climate change, but about how ecosystems will respond to those changes and, in turn, how people will respond to those changes in ecosystems."

Health and Weather: UCAR Weather Forecasts Aim to Reduce African Meningitis Epidemics. Funding Organization: Google.org. \$900,000. Three years. Principal investigator: Rajul Pandya, University Corporation for Atmospheric Research. pandya@ucar.edu.

Epidemics of bacterial meningitis break out periodically across sub-Saharan Africa's so-called meningitis belt, which stretches across the continent from Senegal to Ethiopia. The disease affects the meninges, the thin linings that surround the brain and spinal cord, and is often fatal. In Africa, more than 250,000 people fell ill and 25,000 died in 1996 and 1997 in the world's largest recorded outbreak of epidemic meningitis.

The University Corporation for Atmospheric Research (UCAR), working with an international team of health and weather organizations, launched a project in November to provide long-term weather forecasts to medical officials in Africa to help reduce outbreaks of meningitis. The forecasts will enable local health providers to target vaccination programs more effectively for this disease, which is correlated with dry and dusty conditions.

NCAR meteorologists will begin issuing 14-day forecasts of atmospheric conditions in Ghana in 2009 by analyzing computer models run by such agencies as the European Centre for Medium-Range Weather Forecasts and the U.S. National Centers for Environmental Prediction. To make reliable predictions, they will use statistical techniques to zero in on the meningitis belt, giving greater weight to models that generate the most accurate forecasts under specific conditions. The forecasters will also look at upper-atmospheric patterns that could indicate the impending start to the rainy season.

During the subsequent two years, UCAR plans to work closely with health experts from several African countries to design and test a decision support system that will provide health officials with useful meteorological information.

SBIR Phase II: Autonomous Sensor Network to Manage West Nile Virus Epidemics. Funding Organization: National Science Foundation. \$448,148. Two years. Principal investigator: Agenor Mafra-Neto, Isca Technologies. president@iscatech.com

This Small Business Innovation Research (SBIR) Phase II proposal seeks to develop an automated sensory system (AMSS) for gathering and processing of mosquito vectors of West Nile virus fever (WNV). AMSS captures mosquitoes, macerates them with solvents, processes the fluid using a sensory array, relays wirelessly the information to a centralized Internet hub where data is hosted and managed, and reports are created and distributed. There are four main parts to the proposed AMSS: (1) Design and development of the robotic device that sucks and crushes the insect; (2) Design and development of the sensor array; (3) Development of methods to determine presence of WNV in the circulatory fluids of the insects; and (4) Automated wireless system for transmitting data. The AMSS can also be decoupled from the mosquito trap providing the user with a handheld sensing system to detect WNV in samples derived from vectors (e.g., mosquitoes) or hosts (e.g., humans and vertebrates in general).

If successful, detection of the WNV pathogen at a very early stage of its occurrence is of significant benefit to public health agencies and may allow for diversion of future epidemics. Early detection is the only form of early epidemic prevention. Current detection procedures invariably fail to detect introduced pathogens before disease or epidemics become widespread.

Storm Surge Deposition in Coastal Wetlands. Funding Organization: National Science Foundation. \$29,648. One year. Principal investigator: Robert Turner, Louisiana State University. euturne@lsu.edu.

This project will quantify the amount of sediments introduced to the Louisiana wetlands inundated by

hurricanes Gustav and Ike during the late summer of 2008. These recently deposited inorganic sediments will be easy to recognize in the wetland sediments for the next two to four months. The objective is to sample 100 to 150 locations within these coastal wetlands to obtain a statistically significant estimate of sediment deposition. The goal of the proposed activity is to understand how and why the deposition rate varies across the coastal environment, and to compare these results to the 2005 analysis of sediments accumulating during hurricanes Katrina and Rita. An opportunity exists, as a result of these storms, to examine how vegetative structure affects sediment deposition. Large storm surges may overwhelm the ability of the vegetation to trap sediments. This sampling effort will address this.

Stratigraphy, Sedimentology, Microfossil Content and Preservation of Hurricane Ike Storm Surge Deposits in Southeast Texas and Southwest Louisiana. Funding Organization: National Science Foundation. \$12,185. 1.5 years. Principal investigator: Harry Williams, University of North Texas. HarryF.Williams@unt.edu.

This project will study the effects of the storm surge of Hurricane Ike in southeast Texas and southwest Louisiana. Specifically, the research will examine the sediments resulting from the surge, and their distribution within the coastal environment. By comparing these deposits to similar sediments from hurricanes Katrina and Rita, this project will provide quantitative estimates of the significance of these extreme events in reshaping the coastal environment. The project will collect sediment cores from lakes that had already been sampled prior to the hurricane landfall. Comparison of pre- and post-hurricane deposits will provide a very clear picture of the exact nature of sediments and microfossils that were transported onto the lake beds before this evidence is potentially obscured by bioturbation. It will also provide a baseline for identifying hurricane deposits that have occurred in the region over the past several hundred years.

The results of the study will contribute to a better understanding of the effects of storm surge on the coastal environment. These include more reliable assessments of the recurrence interval of hurricane strikes and associated hurricane risk, an improved record of the geographic variability of hurricane strikes along at-risk coastlines, and the documentation of prehistoric hurricane activity that can be used to assess the relationship between the frequency and strength of hurricanes and climate change.

Resiliency of Agricultural Communities after the 2008 Mississippi Floods. Funding Organization: National Science Foundation. \$19,699. One year. Principal investigator: Heather McIlvaine-Newsad, Western Illinois University. h-mcilvaine-newsad@wiu.edu

The researchers will model resiliency of agricultural communities in western Illinois after flooding during summer of 2008 using the community as the unit of analysis. They will conduct semi-structured interviews and focus groups with 60 families and community meetings. Transcriptions of these materials will be analyzed to determine how people talk and think about the focus variables. Results of the qualitative analysis will be used to develop a structured survey to be mailed to 2000 families in 20 different communities within one year after the floods.

Letters

To the Editor,

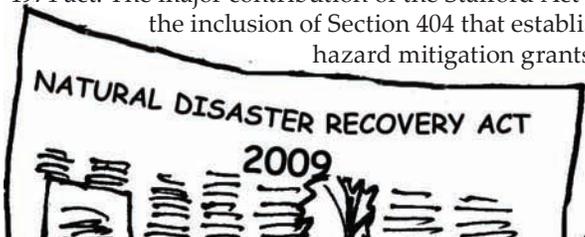
In the aftermath of the damage caused by hurricanes Katrina, Rita, and Ike, many have commented negatively about the federal response to help both the victims and the affected communities recover. Ken Topping's invited comment in the last *Natural Hazards Observer* (Jan. 2009) supporting a revised Stafford Act is the latest. Overall, his arguments for change are sound. However, his analysis of the Stafford Act and his interpretation of the relationship between long-term community recovery and the Stafford Act contain factual errors and questionable assumptions underlying the reforms he proposes.

First, the title of his comment, "Toward a National Disaster Recovery Act of 2009," is misleading. Since Congress first enacted a disaster relief act in 1950, the federal response to major disasters has focused exclusively on emergency assistance and relief. Congress has avoided including the term "recovery" in any disaster assistance act. Federal disaster relief acts have emphasized disaster response, preparedness, prevention, and mitigation, but never included recovery as a principal task. Congress expects potential victims (both communities and individuals) to prepare for disasters—including the development of recovery plans and the purchase of insurance—and to participate in activities that lessen expected future losses. In the current version of the Stafford Act, the word "recovery" is used as a synonym for "restitution" or the recovery of assistance either issued due to fraud or misinterpretation of funding regulations.

Because disaster relief acts do not include long-term community recovery does not mean that the federal government has never been engaged in long-term recovery. For example, following the 1964 Alaskan earthquake, Congress enacted Public Law 88-451, which actually did create a recovery program for the state of Alaska. The actions of the federal government helped communities rebuild and aided in the recovery of the fishing industry. However, this program was enacted as an amendment to the Alaskan Omnibus Act, not the existing disaster assistance law.

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.

Second, the Stafford Act was not the landmark legislation Topping suggests. It was actually an amendment to the Disaster Relief Act of 1974. Most of the elements in the Stafford Act were originally included in the 1974 act. The major contribution of the Stafford Act was the inclusion of Section 404 that established hazard mitigation grants.



Third, Topping questioned the ceiling on individual and household assistance grants (\$28,000 in 2008) as being insufficient for victims of a catastrophe. Typically the average grant awarded by FEMA is far less than the maximum, generally below \$10,000. For the vast majority of victims, the ceiling does not serve as a barrier. In



order for Topping's suggestion to raise the ceiling to be valid, the federal government would have to agree to pay for many expenses that are not currently permitted in the law. He suggests this in his proposed reforms by advocating federal payments for recovery activities. Again, it seems unlikely that the Stafford Act would be the proper vehicle for this change.

Fourth, there is an argument that the federal share of public assistance projects is too high and should be lowered. The law establishes the minimum that the federal government will pay. After most major disasters since Hurricane Hugo, the president and Congress have permitted communities to pay much lower amounts. Currently the federal government pays 100 percent of public assistance for communities affected by Hurricane Katrina. To my way of thinking, the current law appears flexible enough to accommodate circumstances where communities are unable to fund their local match.

Fifth, in his first proposed reform—catastrophic provisions—Topping argues that catastrophes be distinguished from other disasters and be subject to a different set of federal protocols. 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. There were three apparent reasons for the repeal: (1) it was not equitable as victims of different levels of disasters were treated differently, (2) the distinction between an emergency and a major disaster was difficult to establish, and (3) the repeal eliminated charges of political favoritism. Consequently, a similar reform has been tried and found wanting.

Topping argues for two things: amending the Stafford Act, which affects disaster assistance and relief, and increasing federal involvement in the long-term recovery of communities affected by a catastrophe. These are discussed as if they are inseparable parts of the same decision. I believe it makes more sense to separate the two topics and discuss each independently. Since 1950, Congress has consistently excluded federal recovery responsibilities in disaster assistance and relief acts, including the current Stafford Act. After almost 60 years of revising and amending disaster assistance and relief acts, it seems unlikely Congress will change its long-held position. If federal assistance and relief programs are to be debated, then one should concentrate on Stafford Act provisions. If recovery is to be debated, then one should find a more appropriate vehicle. The first step should be to

(Continued on next page)

Letters...

(Continued from previous page)

find all the existing laws that impact long-term recovery to develop a baseline from which a proper evaluation can be made and recommendations for improvements generated.

Elliott Mittler
Woodland Hills, California

To the Editor,

Ken Topping has proposed changes in the Stafford Act that many of us have suggested post Katrina. Katrina exposed the limitation of the Stafford Act when there is a large scale disaster. With global climate change and increasing risk from man-made disasters we have to develop sweeping changes to the Stafford Act similar to those suggested by Ken Topping. New Orleans is on the way to recovery by making difficult and painful sacrifices that would not have been required had the kinds of suggestions included in Topping's reform been in place.

Ed Blakely

To the Editor,

This is to second Ken Topping's call for a new approach to post-disaster recovery. The current system works adequately after moderate disasters, and/or in places with high levels of local capacity. But it is clear to many researchers and practitioners after the Gulf Coast experiences of the past few years that the system needs to be revised, primarily because it is poorly suited for catastrophic disasters. The most commonly cited problems are as follows:

- The public assistance program needs to be revised from a reimbursement system to a cash advance, followed by accounting and auditing.
- Local governments need to be able to immediately access substantial loan funds so that they can continue to pay personnel in the days and weeks following the disaster, when trained city staff are most needed.
- Currently, the public assistance program has a perverse disincentive against improving facilities over their pre-disaster condition. It allows jurisdictions to build differently such as stronger, or in a more logical or safer location but penalizes them by as much as 40% of the pre-disaster value. It makes more sense to offer incentives for betterment.

It also would be helpful to have prompt completion by FEMA (or preferably HUD) of the Disaster Recovery Strategy and Housing Recovery Strategy (draft version released for public comment in August 2008); both strategies were required as part of the Post-Katrina reforms to the Stafford Act.

And, just as we require hazard mitigation plans, in order to facilitate appropriate spending actions following disasters, so we should provide incentives for recovery plans, as well as establish a legal framework for states to form recovery authorities in advance of disasters, similar to the Louisiana Recovery Authority established after Hurricane Katrina.

Rob Olshansky
Champaign, Illinois

Ken Topping replies:

Elliott Mittler's letter reflects considerable effort and thought. Unfortunately he misses my basic message that the Stafford Act *was* visionary legislation when passed in 1988 precisely because of its comprehensive nature.

The Stafford Act for the first time recognized—at least, to a degree—all disaster management functions: preparedness, response, recovery, and mitigation. Mittler attempts to distinguish between the term "recovery" vs. "relief" and "assistance." This distinction would be lost on people in the Gulf Coast, Midwest, and West seeking to restore lives and rebuild communities disrupted by recent hurricanes, floods, and wildfires under current patchwork legislative provisions.

With widening consequences of climate change and increasing probabilities of a catastrophic seismic event in the western states ahead, the need is urgent for Congress to fully address the federal role in *actively facilitating* recovery as well as investing in hazard mitigation which reduces losses *before* disasters happen.

To the Editor,

Thank you for the excellent article in the January, 2009 *Observer* regarding the "un-Merry Winds of Windsor." This was the first time ESF-14 Long Term Community Recovery had been deployed ever in FEMA Region 8. It is an ongoing effort in Windsor with our ESF-14 Steering Committee still in place and continuously working on community recovery issues.

Jon R. Wallace
Federal Emergency Management Agency
Denver, Colorado

Web Sites of Interest

Communicating On Climate Change

metcalfinstitute.org/Communicating_ClimateChange.htm

Communicating on Climate Change: An Essential Resource for Journalists, Scientists, and Educators was based on a series of workshops designed to start a dialogue—in understandable terms—between journalists and climate scientists. The resulting book, which is available for free download, contains essays on how both groups, as well as educational institutions, can bridge the climate change communication gap.

StormSmart Coasts

www.mass.gov/czm/stormsmart/index.htm

Massachusetts isn't playing dumb when it comes to managing coastal hazards—it's created the StormSmart Coasts Web site to aggregate information and tools for coastal floodplain management. A wealth of information on storms, floods, climate change, and sea level rise is arranged into categories of planning, emergency services, legal and regulatory issues, infrastructure, and grants and funding. Even smarter, healthcare workers, building and public works officials, planning managers, and other stakeholders can browse the site in sections dedicated to their occupational needs.



Conferences and Training

March 18-20, 2009

Fourth Annual Emergency Preparedness & Service Restoration for Utilities Infocast

Houston, Texas

Cost and Registration: \$1695, open until filled

This summit features lessons learned from utility industry practitioners who have been responsible for restoring service after hurricanes, ice storms, fires, and other disasters. Topics include preparedness and planning best practices, how to run a good emergency drill, communicating major events, and case studies of storms.

www.infocastinc.com/index.php/conference/prep09

March 22-26, 2009

Wildland Urban Interface 2009

International Association of Fire Chiefs and Firewise

Reno, Nevada

Cost and Registration: \$325 before February 1, open until filled

This meeting will present best practices and innovations in preparedness and response and discuss topics such as firefighter safety, engaging stakeholders, and new technology to address wildland-urban interface issues.

www.iafc.org

March 29-April 1, 2009

DRJ Spring World

Disaster Recovery Journal

Orlando, Florida

Cost and Registration: \$895 before January 29, open until filled

This conference will provide business continuity solutions. Sessions include the future of disaster recovery, community pandemic preparation, and management plan assessment. A mock disaster exercise will also be held.

www.drj.com

March 30-31, 2009

Summit on America's Climate Choices

The National Academies

Washington, D.C.

Cost and registration: Not posted

Climate Choices Committee and panel members will interact with scientists, engineers, public health officials, members of Congress, and federal agency officials. Summit attendees will frame the study questions for the committee, which was formed in response to a congressional request for advice on addressing the changing climate.

americasclimatechoices.org/summit.shtml

March 30-April 3, 2009

Earthquake Disasters: From Rapid Response Toward Mitigation

University of Geneva

Geneva, Switzerland

Cost and Registration: \$654 before March 20, open until filled

Meeting objectives include resolving rapid response and reconstruction issues in seismic contexts and integrating mitigation into response plans.

www.unige.ch/formcont/piah/form-spec.html#earthquake

April 8-10, 2009

2009 International Conference on Climate Change

Hearland Institute

New York, New York

Cost and Registration: \$720, open until filled

This conference showcases an alternative viewpoint on climate change. Economists, legal experts, and climate specialists counter claims that earth's warming during the 20th century primarily is man-made or is a crisis.

www.heartland.org/events/NewYork09/newyork09.html

April 12-14, 2009

International Symposium on Disaster Management Saudi Arabia Ministry of the Interior

Riyadh, Saudi Arabia

Cost and Registration: Not listed

This symposium uses the experience of local and international disaster managers to improve disaster management skills. Topics include monitoring domestic and international disaster efforts, reviewing threats and risks, mobilizing volunteers, and developing cooperation.

www.isdm.gov.sa/en/Default.aspx

April 14-15, 2009

Partners in Emergency Preparedness

Washington State University Center for Distance and Professional Education

Tacoma, Washington

Cost and Registration: \$300 before March 20, closes March 26.

This conference promotes effective emergency preparedness through partnerships. Expert speakers will showcase information on earthquake research, planning, school preparedness, technology, news media, and health.

capps.wsu.edu/conferences/emergencyprep/

April 16-17, 2009

The Fifth Magrann Conference: Climate Change in South Asia—Governance, Equity, and Social Justice Rutgers University

New Brunswick, New Jersey

Cost and Registration: Not posted

Environment and development scholars in science and social science disciplines will meet to discuss climate change issues faced by South Asia. Themes include cultural, social, and gender implications of climate change; natural resource management and land use practices; and vulnerability and adaptation in cities.

magrann-conference.rutgers.edu

April 17-19, 2009

Third Annual Wildland Fire Litigation Conference

Reno, Nevada

Cost and registration: \$575, open until filled

Federal Emergency Management Agency employees, insurance adjusters, firefighters, forensic experts, and others will address wildland fire litigation issues. Sessions include post-fire cleanup, the law of damages, backfires, controlled burns, and wildland fire arbitration.

www.wildlandfirelitigation.com/index.html

May 4-8, 2009

Sustaining the Millennium Development Goals

International Center for Remote Sensing of Environment, The Joint Centre of the European Commission, and others

Stresa, Italy

Cost and Registration: \$509 before March 6, open until filled

The symposium focuses on the use of earth observation systems and airborne techniques to manage the environment and natural resources. Sessions will examine disaster reduction and response, risk assessment and mitigation, warning systems, and emergency response.

isrse-33.jrc.ec.europa.eu/welcome.html

May 5-7, 2009

National VOAD Conference

National Voluntary Organizations Active in Disaster

Little Rock, Arkansas

Cost and Registration: Not posted

This conference, titled "Life Elevated—A Celebration of Service," will offer presentations on disaster services to

improve VOAD members' skills, services, and practices.

www.nvoad.org

June 22-24, 2009

Earthquake & Tsunami: Civil Engineering Disaster Mitigation Activities Implementing Millennium Development Goals

World Council of Civil Engineers, the European Council of Civil Engineers, and the Turkish Chamber of Civil Engineers

Istanbul, Turkey

This conference covers civil engineering disaster mitigation activities surrounding earthquakes and tsunami, focusing on saving lives and reducing material losses. The conference will emphasize Millennium Development Goals.

www.imo.org.tr/eqf2009

Mary Fran Myers Scholarship Request for 2009 Applications

Mary Fran Myers was co-director of the Natural Hazards Center at the University of Colorado for 16 years until her untimely death in 2004.

Each summer, the Natural Hazards Center hosts an invitational Natural Hazards Research and Applications Workshop in Colorado. The Workshop brings together more than 400 members of the hazards community who are working to alleviate the pain and loss inflicted by disasters.

One of Mary Fran's primary concerns was ensuring all ages, professions, and communities be represented at the Workshop. Mary Fran recognized that many people and organizations that could benefit from and contribute to Workshop activities. The Mary Fran Myers Scholarship is awarded annually to at least one potential Workshop participant, who is then formally invited to the Workshop.

Eligibility and Application Procedure

All hazards researchers, students, and practitioners are eligible for the Mary Fran Myers Scholarship. However, preference is given to individuals with demonstrated financial need and those who have not previously attended the Annual Hazards Workshop.

More information, submission requirements, and a complete Mary Fran Myers Scholarship 2009 Application Form is available from the Natural Hazards Center's Web site at www.colorado.edu/hazards/awards/myers-scholarship.html

An application form can also be requested by calling the Natural Hazards Center at (303) 492-6818 or by e-mailing Lori Peek at lori.peek@colostate.edu.

Application Deadline: Applications must be received by Monday, March 30, 2009.

Special Thanks

The Mary Fran Myers Scholarship was made possible by generous contributions from numerous individual donors as well as support from the Association of State Floodplain Managers (ASFPM), the Extension Disaster Education Network (EDEN), the Public Entity Risk Institute (PERI), and the Red River, North Dakota, High School Classroom Teachers Association.

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

www.colorado.edu/hazards/

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Support the Natural Hazards Center

The success of the Natural Hazards Center relies on the ongoing support and engagement of the entire hazards and disasters community. The Center welcomes and greatly appreciates all financial contributions. There are several ways you can help:

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

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

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

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

To find out more about these and other opportunities for giving, visit:

www.colorado.edu/hazards/about/contribute.html

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

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

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

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Observer cartoons are drawn by Rob Pudim.

Send items of interest to the Natural Hazards Center, University of Colorado at Boulder, 482 UCB, Boulder, CO 80309-0482; (303) 492-6818, (303) 492-2151 (fax); hazctr@colorado.edu. The deadline for the next *Observer* is **March 24, 2009**.



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