

Natural Hazards Observer



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To Flee or Not to Flee?

That is the question...



An invited comment by Joan Webster

***T**O FLEE OR NOT TO FLEE—whether 'tis nobler in the mind to defend your home from wildfire?*

That is the question authorities and residents have been asking in Australia since settlement began.

Two watershed moments in understanding were the extreme fires of 1983 and 2009. Each triggered a different official approach to public safety and the “stay-or-go” policy.

The areas of Australia vulnerable to bushfires fringe the southeast of the continent, along the narrow, mountainous, densely vegetated strip that divides the coast from the arid interior, the Great Dividing Range. This takes in the states of New South Wales, Victoria, the island of Tasmania and eastern South Australia, plus the southwestern corner of Western Australia. The predominant flora is highly flammable eucalypts.

Most vulnerable is the 91,749 square mile (237,629 square kilometers) southeastern corner of Victoria—my own patch.

In the summer of 1982-83, 3,500 bushfires burned in Victoria. On February 16, a day called Ash Wednesday, weather conditions peaked. Wildfires that day were among the worst experienced anywhere in the world. Relative humidity dropped as low as 5 percent. Temperatures rose to 110 degrees F (43 degrees C). Superheated air, seared by the hot plates of central Australia's deserts, funneled southeast with gale force winds that reached 100 km/h (62 mph) with bursts of up to 178 km/h (111 mph). They helped raze 418,000 hectares (1,032,920 acres) of scenic bushland and coastal resorts in Victoria and South Australia, annihilating 2,072 homes, 76 human lives,

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

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Letters

TO THE EDITOR,

REGARDING LEWIS AND KELMAN'S INVITED COMMENT, "Creating Disasters," in the July 2013 *Observer*, I offer a speculation and a recommendation, with gratitude for their summary, and sadness that we still need champions of these ideas which have been urged for so many years.

Lewis and Kelman are following a long tradition of increasing the number of variables that are considered in the explanation of complex phenomena such as disasters. With climate change aggravating the already terrible toll of foreseeable losses of life, well-being and property, it is clear that factors outside of local control are relevant to the outcomes suffered. But these factors are human choices as well as environmental conditions. The speculation is that loosening these out-of-control links from larger to local and regional scales may be increasingly important for increasing local and regional resiliency, in the general sense of resistance to lasting damage from hazards.

This is not to say that such lessening of influence is easy, but that it is increasingly being undertaken, in my judgment based on the recent Natural Hazards Workshop, the first National [Climate] Adaptation Forum, and other readings.

Vulnerability is increased by multiple social sources, starting with land uses that disregard natural hazards. Other vulnerability magnifiers include exposures to chemical and industrial hazards, the dismantling of traditional ways of life and hard-earned local understanding, and the political economy and power concentration of uneven wealth distribution. But sources of strength may be sought in the linkages and interactions in which we live. The interactions of social choices with natural conditions have brought us to the edge of catastrophe, but perhaps also the chance to back away.

I want to briefly note a few of many highlights in the development of this understanding. Perhaps explicit publication of work on "unnatural disasters" may have begun in 1976, with the piece by Phil O'Keefe, Ken Westgate, and Ben Wisner, "Taking the naturalness out of natural disasters" (*Nature* 260: 566-567).

A personal favorite landmark was Kenneth Hewitt's introduction to the essential 1983 collection of works from cases around the world, *Interpretations of Calamity*. After that, a host of superb books followed. All of them had roots in many fields of study and sources dating far back, but there was something politically important in this line of work, perhaps because it brought so many threads into a new design with unpleasant implications about social choices made with or without concern for their consequences.

Social creation of vulnerability

At the 1997 Natural Hazards Workshop, a session on social creation of vulnerability played to a packed house. Ken Hewitt stated the case for social solutions to social problems, saying it is false to consider the "everyday" as somehow different from the unexpected, uncontrolled moments of disaster, rather than continuous with those moments, and creating the conditions in which the event of the moment is a disaster for some or an inconvenience for others.

Walter Peacock noted the progress in documenting creation of vulnerability, in the work on Hurricane Andrew and gender differences in access to help, and the insurance industry's differential treatment of neighborhoods. Steve Bender reported that progress in Latin America was coming, too slowly, from the bottom up. Failure to invest in basic services and needs such as school safety is a subsidy for the preferred projects of the elite, paid for in loss and misery. He thought there had probably been more progress clarifying the ideas in Latin America than in the United States.

After that review, others oriented their remarks to cases. Louise Comfort described "the earthquake of the poor" in Ecuador, in which almost all of the losses were to substandard housing and the people living in it. Susan Cutter reviewed development of major research programs showing the intersection of risks, exposures, with lack of capacity and access to services, literally and metaphorically mapped on outcomes of storm and flooding events.

Ben Wisner continued the discussion with summary of a large United Nations University set of studies, which showed that the roots of the social creation of vulnerability insight were in rural studies and often work on what we used to call "under-development." Not failure to develop along some promoted ideal, but worsening of conditions for people. The disregard for the vulnerability accumulating and worsening in urban populations is a serious challenge to democracy.

In retrospect, these deeply rooted views were all too accurate, and the 2013 Hazards Workshop presentations and discussions on Hurricane Sandy and the very uneven recovery efforts and capacity seemed to confirm our need to take the social creation of vulnerability and the social choices for reduction much more seriously.

The speculation is that seeing the linkages between the scales and kinds of social structures is not only needed for diagnosis of the problems, but seems to be helping with working for remedies. Thinkers in hazards and disasters have stimulated their own groups, from anthropology to wetland management, and they have steadily sought more complete views of the interaction of the social and physi-

cal environments. Now, we also have the late Elinor Ostrom and her colleagues, **developing** ways to think about the whole picture using categories that are not specific to any academic discipline or group of professionals (2007, A diagnostic approach for going beyond panaceas, *Proceedings of the National Academy of Sciences*, 104(39):15181-15187). That is a powerful tool to help all willing stakeholders in the emerging efforts to find, communicate and loosen those social links that limit efforts to reduce vulnerability and increase capacity to recover—or best of all, to avoid the hazard entirely.

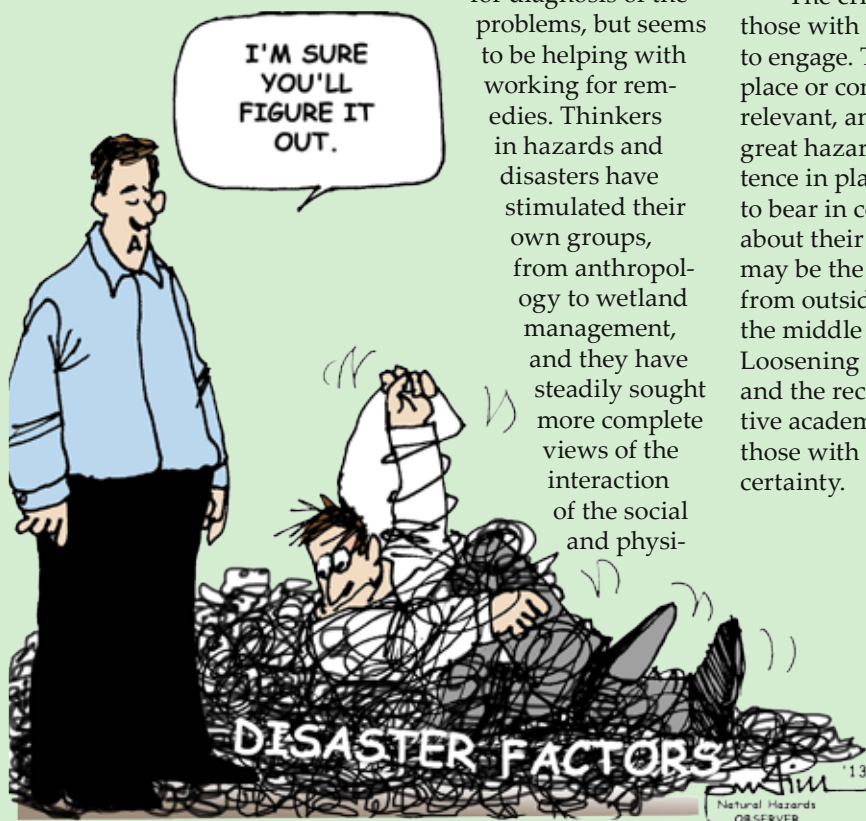
Potential for reorganization

The issues of conflicting goals, power, and influence at the global, the multinational, the national, the state, the regional and the local scales of different social organizations are hard to untangle. But as they reveal the extent of social creation of vulnerability by remote social structures, they also suggest that local and regional efforts to loosen links offer a way forward. Reviving respect for traditional and local knowledge includes recognition of the success of systems which maintained cultures and sustained resources for tens of thousands of years, even with some failures here and there. Reviving respect for human beings includes recognition that we live in cultures and sets of rules and institutions that are choices that can be changed.

The potential for reorganization by loosening some links and creating some others is increasing with social media communication. Hazards and disasters researchers are on the frontier, also, as the Hazards Workshop has shown for many years. But the explosion of communication imposes a new challenge for managers and researchers. It is not enough to debunk the disinformation and creation of communities of belief in the improbable, and sometimes the malignant, however emotionally mobilized.

The critical role of trusted referee is sorely needed from those with good access to information, analysis, and time to engage. To serve in this way, one must be known in a place or community of interest to be credible, to find the relevant, and to show the legitimacy of the information. The great hazards researchers have a long tradition of persistence in place, of bringing their best efforts and insights to bear in communities and with people, not only writing about their understandings and observations. Participation may be the key to achieve reorganization, using the view from outside as well as inside, and from the bottom and the middle rather than only the top of the social structures. Loosening some links may be necessary in many places, and the recommendation is that people outside of competitive academics may welcome humane participation from those with different experiences without demanding false certainty.

John Wiener
University of Colorado Boulder



Social connections make the recovery go

Social capital sustains communities—
but at what price?

THE MOST IMPORTANT FACTOR in successful community recovery after disasters is the social capital built up and sustained in the affected communities, says Purdue University professor and hazards researcher David Aldrich.

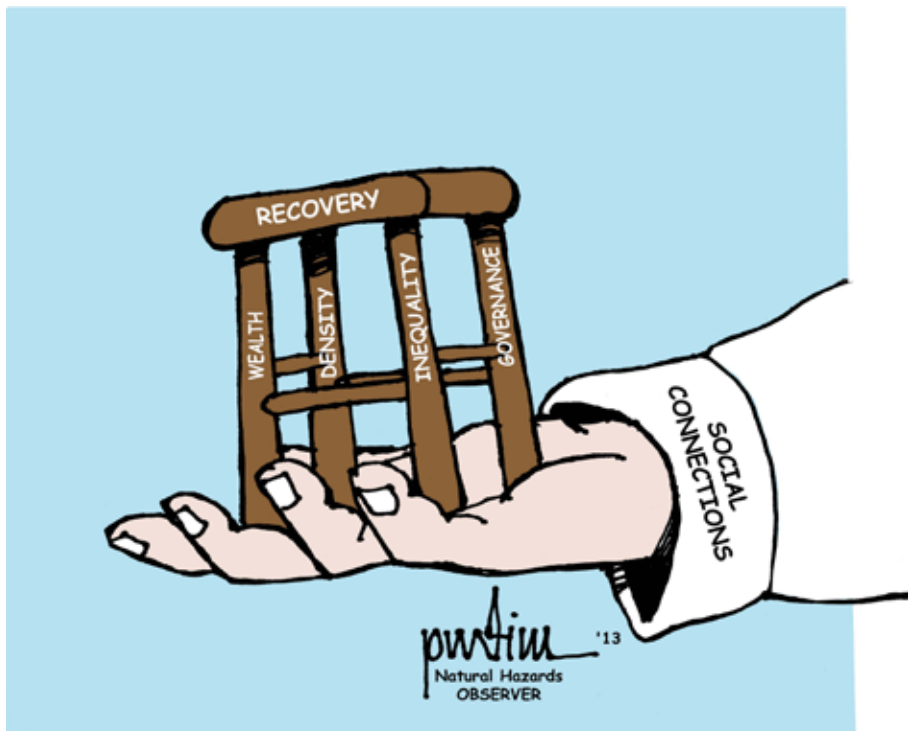
Aldrich notes that there are five theories that govern most of the research and practice in disaster recovery. The most common theory focuses on the wealth of the affected community, another on governance, on to density of the area, to inequality.

“None of these theories tell us about the internal organization, the cohesion of these communities,” Aldrich says. Aldrich conducted research on four major disasters, the 1923 Tokyo earthquake, the 1995 Kobe quake, the Indian Ocean tsunami, and Hurricane Katrina. He found that places with stronger ties—where neighbors knew neighbors, or people had lived longer in the community, or a number of other ties that bind people together—recovered better and remained more cohesive than places that had not developed those ties.

“The only variables that proved consistent across the models were those measuring social connections,” he says. Social connections encouraged collective action, which in turn lead to better recovery. Aldrich reached some counterintuitive conclusions from this, for instance that there isn’t a strong correlation between good local government and social capital. In fact, he says, places where people did not expect the government to step in and help them actually led to stronger collective action by survivors.

Columbia University’s Irwin Redlener points out that this social capital investment may lead people to reinhabit places that perhaps would be better abandoned, like floodplains and areas below sea level in New Orleans.

Aldrich acknowledges that there may be an “unescapable tradeoff” between strong attachment to community that helps in disaster recovery and the desire to rebuild in areas that are



dangerous. But, he says, in these dangerous places with strong social ties, the population will do better in the next disaster.

Aldrich says his research points the way to new policies governing hazard mitigation. The first thing is to get to know your neighbors. While this is mostly a personal social activity, local government can encourage it by providing funds for, for instance, block parties and other neighborhood gatherings.

Cal Poly’s Kenneth Topping responded that while “bonding helps you get by, wealth helps you get ahead.” But wealth by itself or aid by itself can be harmful in some cases, Aldrich says. He cited an effort after the Indian Ocean tsunami to give every individual fisherman a boat. While the sentiment was good, fishing in the community was really a social activity, so giving each individual a boat disrupted that social fabric. The catch was actually lower than it had been.

Aldrich gave the keynote speech at the 38th Annual Natural Hazards Workshop sponsored by the University of Colorado’s Natural Hazards Center in Broomfield, Colorado. Aldrich spoke on Sunday, July 14, 2013.

They Said It ...

“The fire season has lengthened substantially, by two months, over the last 30 years.”—Craig Allen, a research ecologist at the United States Geological Survey station at Bandelier National Monument in New Mexico, **quoted in the New York Times, July 1, 2013.**

“How we live on the land, what we decide we put on public and private lands, how we do things and don’t do

things on the land, changes its combustibility.”—Stephen Pyne of Arizona State University, **quoted in the New York Times, July 1, 2013.**

“Even if we could just stop global emissions tomorrow on a dime, Fort Lauderdale, Miami Gardens, Hoboken, New Jersey will be under sea level.”—Climate Central researcher Benjamin Strauss, **quoted by the Guardian, July 29, 2013.**

Hurricane Sandy exposed!

And what it exposed were weaknesses in the system

HURRICANE SANDY EXPOSED the fragility of the hospitals in New York, demonstrating that the nation is woefully unprepared for a major disaster, according to Columbia University's Irvin Redlener.

Redlener says there were many acts of heroism by individuals and organizations during Sandy, but "I want to distinguish between acts of heroism when a crisis is happening versus actual policies that make us safer."

He cited the case of one New York hospital which, even after the lessons from Hurricane Katrina, had only six hours of fuel to run its emergency generators. "Why on earth we had to evacuate a hospital that didn't understand we need more than six hours of fuel?" he asks rhetorically. "They saw Katrina

and they saw basement level generators flooded out. They put the generators on upper floors, with six hours of fuel supply, and then the pumps to move the fuel from the basement got flooded, so they couldn't replace the fuel" to run the generators.

Redlener said that the fragility of the hospital infrastructure was "grossly unacceptable," and that they are not in better shape now than they were in October when Sandy hit. But the hospitals were only part of the systemic problems affecting New York during and after the storm. "This fragility of many of our systems is really a big problem," he says. The evacuation of flood-prone areas was poor, the prolonged downtime of systems like gas and electrical was unacceptable.

A major problem was also the inability to serve vulnerable populations. Nearly half of the population—elderly, handicapped, children, prisoners, and so on—experience some enhanced vulnerability. Emergency response and planning handle these challenges very poorly, however.

The level of coordination and cooperation among agencies was "way suboptimal" in New York, he says. "I'm not sure that if this happened again tomorrow that we'd be better able to deal with it. We're addicted to siloization."

This lack of coordination among agencies and organizations leaves survivors who need help organizing their own disaster recovery. They should be able to go to a central point to be directed to the help they need. Instead, they are forced to make their own phone calls, do their own research.

Redlener cited numerous megadisasters that the United States is unprepared for, including a pandemic, nuclear terrorism, a "cyber situation" which could affect the electrical grid, and a major urban earthquake.

While Sandy exposed the weaknesses of New York City's disaster infrastructure, it highlighted meteorologists' ability to predict the strength and path of the storm, says Accuweather's



er's Mike Smith. The storm was weather forecasting's "finest hour," Smith said.

Usually when an Atlantic storm turns northeast, it continues to the northeast. Only about four times in 100 does a storm follow a track like Sandy did, veering back to the U.S. East Coast. But improved weather models did uncover this path, enabling early warning of the potential destructiveness of the storm. While there were 73 deaths from Sandy, Smith says that without the accurate weather forecasting, the country may have seen "9/11 levels" of mortality. Forecasting of large storms is actually more accurate and reliable than people perceive it to be. Getting them to take the warnings to heart remains a problem, however.

"How do you communicate in a way to get people to confirm the warning and act on the warning. Even the people who took it seriously didn't have plans," Smith says. The New Jersey transit, for instance, knew the storm was coming, he says, but they didn't have a plan for moving their rolling stock. They left their locomotives and passenger cars in an area vulnerable to the storm. Consequently, they lost one-third of their locomotives and one quarter of their passenger cars, he says.

Redlener and Smith spoke at the 38th Annual Natural Hazards Workshop sponsored by the University of Colorado's Natural Hazards Center in Broomfield, Colorado. They participated in a plenary session about Hurricane Sandy on Sunday, July 14, 2013.



Sleeping through the earthquake risk

Smaller quakes may help predict the arrival of "the big one"

SCIENTISTS EXPECT a major earthquake in the Cascadia region of the United States sometime in the not-distant future, but the lack of regular seismic activity in

the area makes it hard to convince residents of the risk.

The California earthquake advisory plan, which was developed to assist emergency managers in the face of anomalous seismic activity, could be adapted to the Cascadia region, says James Goltz of the California Emergency Management Agency. The idea, however, has met with objections from the science community.

The idea is that large earthquakes—Mw 9.0 or so—are sometimes preceded by smaller shocks. About six percent of the time, there are precursor warnings. The California plan has been acted on about 30 times since it was established.

Evelyn Roeloffs of the U.S. Geological Survey says the Cascadia subduction zone is capable of a magnitude 9.0 earthquake. "There's geologic data that shows there have been a number of these at intervals of 230 to over 600 years." Over the last 6,500 years, the average recurrence interval is about 500 years. The last one was 314 years ago. This means that either we are due for a large quake or we still have 200 years to the next one, depending on how you read the statistics.

The Cascadia zone has been very quiet, but a system like the California effort may provide some small early warning for large quakes. "Can we provide any advance warning of a Cascadia quake? Can we make use of signals the earth might send us?" Roeloffs asks.

Some quakes are preceded by smaller earthquakes, foreshocks, a few minutes to hours to days before a larger one

hits. Only one-third to one-half of the quakes are preceded by foreshocks. The worst damage would probably come from a tsunami. "It would behoove us in the scientific community to have some words of advice," Roeloffs says. Science can't predict the timing of earthquakes precisely, "Whenever you have an earthquake, the chance of a larger earthquake following it is temporarily enhanced," she says.

Some scientists object to the idea of warnings for this kind of potential earthquake hazard, however. Roeloffs said, "Outside of California, the practice of issuing these earthquake advisories is almost unknown among scientists." Many scientists aren't even aware of the statistical studies showing enhanced probabilities of a quake after a foreshock. Roeloffs said that scientists fear there will be "mass panic" if, for instance, a beach evacuation warning is issued—although all the evidence collected by social scientists contradicts this notion. Because of a lack of knowledge about emergency management practices, some scientists believed that this was the only alternative available to emergency managers. They were also concerned about panics and rumors. A review of the California program did not find any evidence of this, she says, although no formal social science evaluation of such warnings has ever been done.

Roeloffs spoke at the 38th Annual Natural Hazards Workshop sponsored by the University of Colorado's Natural Hazards Center in Broomfield, Colorado. She participated in a session about the Cascadia subduction zone on Sunday, July 14, 2013.

Psyched out by radiation

Radiation may arouse postdisaster psychological symptoms lasting longer than those from fires, earthquakes, or hurricanes.

THE PSYCHOLOGICAL EFFECTS on a population living near a nuclear power plant accident are considerably greater than any physical effects from radiation. Despite the fact that there have been very few cancer deaths or other illnesses attributable to radiation since the Chernobyl reactor meltdown, people from the area still have elevated anxiety levels about the dangers, according to University of Colorado hazards researcher RoseMarie Perez Foster.

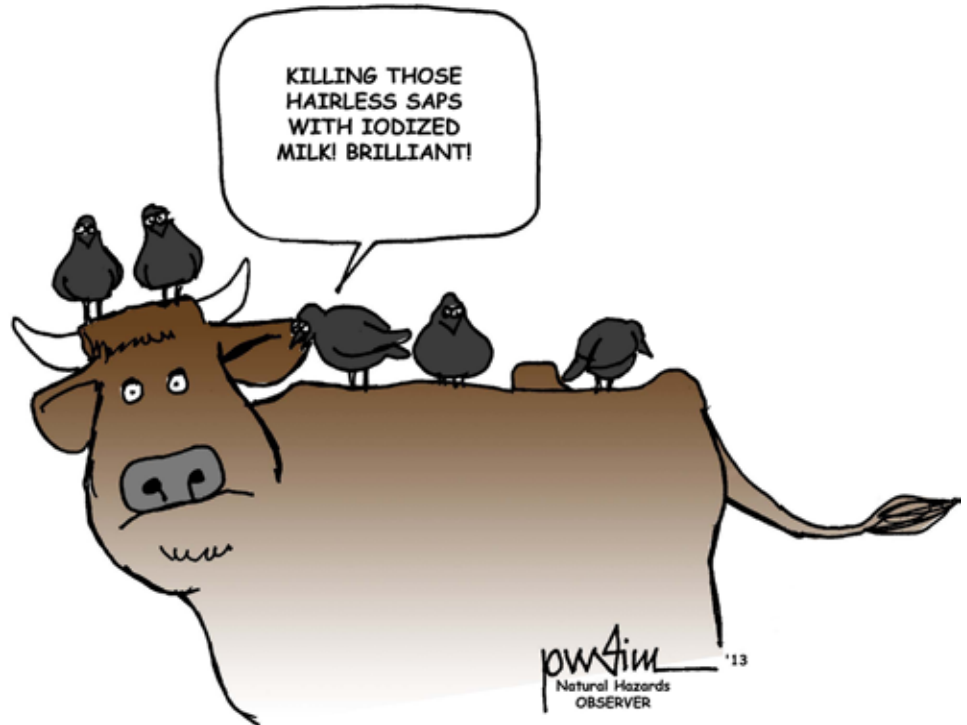
"There's now evidence to show that toxic—and specifically radiation—disaster may arouse postdisaster psychological symptoms that are longer lasting than natural hazards or physical events such as fires, earthquakes or hurricanes," Perez Foster said in a panel discussion at the 38th Annual Natural Hazards Workshop sponsored by the University of Colorado's Natural Hazards Center in Broomfield, Colorado.

The doses of radiation received by most people as a result of the nuclear plant accident in Chernobyl on April 26, 1986 were quite low. An explosion and fire at the plant released a large amount of radiation both in the immediate area and over western Europe. The maximum dose received by people around Chernobyl was 31 millisieverts, and the average was one millisievert. For comparison, an average person gets three millisieverts of radiation from background radiation, and about the same amount from medical diagnostic tests like CT scans.

"We found that in 1986 at the time of the accident," Perez Foster says, "perception of risk shot up a tremendous amount. However, unlike other post-disaster outcomes where perception of harm and hazard decreases over time, this high perception of risk has sustained over 27 years post-disaster." People who were exposed to Chernobyl radiation tend to attribute virtually any illness to radiation exposure, including those which naturally occur in any aging population.

The most serious health outcome from the Chernobyl disaster was a spike in thyroid cancers among children under 16 years of age. This was the result of the way that one of the radiation products, iodine, was taken up by humans. According to Colorado State University physicist Thomas Borak, who has studied the human health effects of radiation, "One of the most abundant radionuclides was iodine. It has an interesting pathway into humans." Iodine was deposited on the ground, then taken up by the grass. The grass was eaten by cows, who excreted the iodine into their milk. The milk was then drunk by children—mostly on their own farms—who contracted elevated levels of thyroid cancer.

After Japan's 2011 earthquake and tsunami disaster that



ruptured the Fukushima nuclear plant, officials were aware of this problem from the the Chernobyl experience, so they prevented youngsters from drinking milk from the area.

Radiation physicist Ward Whicker studied the ecological impacts of the Chernobyl meltdown on the surrounding, coming to what many would consider a surprising conclusion. He says, "To my knowledge, there will be no long-lasting ecological effects. That's because even though there are vast genetic changes, those are likely to be selected out by natural selection. The plant and animal distribution [in the Chernobyl exclusion zone] will be the same as it would have been without the accident. It's not a nuclear wasteland."

Whicker said that after about a year, the area had recovered quite well ecologically. It even looked like a "wildlife paradise." This was in part because the humans had been evacuated from the area, which allowed animals to recover without interference.

Perez Foster, Borak, and Whicker spoke at a panel at the 38th Annual Natural Hazards Workshop held on Tuesday morning, July 16, 2013.



We know what to do. Why don't we do it?

The time has come to mitigate and adapt

An invited comment by Bob Freitag

THE WARMING WORLD PRESENTS the primary risk and opportunity for our generation and our children's generation. It is time we accept our responsibility to do what emergency managers do best—mitigate the causes and adapt to those impacts for which we cannot mitigate.

After six years of silence on the subject, President Barack Obama proposed a plan to address climate change. Notably, Speaker of the House John Boehner (R-Ohio), in his June 20, 2013 response to the president, did not question the science. Rather he said the administration proposal is “absolutely crazy” because it will kill jobs. But he didn't argue—and this is critical—that the plan is based on faulty science. More about jobs later.

In the mid-2000s, when we were researching material for our book *Floodplain Management: A New Approach to a New Era*, climate change was our driving theme. Today, we know climate change brings unique challenges. They can only be understood if global warming is profiled as a primary hazard, not merely as “extreme events” that are only an amplification of known hazards like flooding, landslides, winter storms, hurricanes, tornadoes, and even earthquakes. Recent research suggests reduced polar ice may trigger earthquakes.

To understand the advantages of addressing climate change directly, it is important to review a little physics, some ecology, and their contribution to resilience. But, in doing so, please excuse my limiting the profiling of climate change frequency, magnitude, timing, and location mostly to examples from the Pacific Northwest.

First, a little physics ...

THE FIRST LAW OF THERMODYNAMICS SAYS when you add energy to a system you get work (something happens). For example, when you heat a kettle of water you make steam. Then you can convert the steam to mechanical energy by routing it through a steam engine. If the engine is connected to an electric generator, you can then remove some heat to power, say, a refrigerator.

Greenhouse gasses in the atmosphere trap energy from the sun. This energy creates work, but in this case, work is weather. More energy, more weather. Weather can take many forms. The energy can be used immediately (kinetic energy) as rain or wind, or water stored in upland lakes or trees (potential energy).

In the Northwest, west of the Cascades, we enjoy a marine environment resulting from moist sea air blocked by the mountains. There is a lot of precipitation here, but historically it has been more mist than rain. Global warming is adding energy, and our weather systems and lives are changing.

In the Northwest:

- More rain is falling in the winter and it is more intense.



- Less snow is being stored in the Cascades and this contributes to greater winter discharges in our developed coastal areas.
- Summer flows are decreasing.
- Higher discharges are increasing channel erosion.
- Higher temperatures are melting glaciers and historically frozen soils, increasing sediment mobilization.
- Higher flows and more sediment in the river are causing more flooding to our low-lying cities.

It is not helpful to say this change in energy will create more flooding where there is current flooding, more drought where there is now drought, more heat where it is currently hot, or ultimately, describe the phenomenon as just anomalous “extreme weather” without connecting the dots. Climate change-induced impacts, such as flooding, are different. The impacts are unique. Evaluating these unique climate change attributes will direct us to developing better adaptive actions.

Second, some ecology ...

ECOLOGY IS THE STUDY OF RELATIONSHIPS between physical and biological processes. This can be viewed as the study of how everything is connected to everything else. Understanding interdependences is crucial to understanding how our world is changing and how we can adapt. Northwest ecology is mainly a reflection of our slowly evolving post-continental glacier landscape beginning some 13,000 years ago. Climate change is ramping up the speed of ecological and evolutionary successional processes. For instance:

- The Cascades are warming and forests are drying out, resulting in more fuel for forest fires.
- With the loss of spring and summer snow packs, more trees are drying, increasing the risk of forest fires.

- These new successional systems often store less water than the established forests being replaced, contributing to even greater wildland fire risks.
- Invasive species are moving north as the climate warms. The pine bark beetle is destroying forests, reducing the forest's ability to store water and resulting in more frequent and severe downstream flooding.
- Forest fires clear vegetation, decrease storage, reduce water absorption, increase sediment mobilization, and cause more flooding.
- Burnt forests retain less runoff, increasing downstream flooding.

It is not sufficient to address these impacts within the isolated context of flooding, drought, landslides or winter storms. The interdependent nature of these ecological changes would be lost if climate change were a footnote to other hazards, limiting the discovery of viable solutions to reducing risk.

Third, resilience ...

IF WE ARE TO ADAPT TO A CHANGING CLIMATE, we must be resilient. There are many definitions of resilience. Here I will borrow from the field of social ecology, defining resilience as the ability of an individual or community to adapt or transform in response to stress and shocks—rather than just “bouncing back,” undergoing undesirable change, or collapsing.

Important to this definition is that resilience demands a focal point. What is resilient to one stressor may not be resilient to others. One's resilience may depend on another's collapse. Any change may bring benefits to some, hardships to others. Climate change will make some rich and others poor. For instance, global warming demands that we reduce carbon emissions. This change will hurt the fossil fuel industry, help the alternative fuel sector. But we know from basic physics that energy and work are related. With more energy in the atmosphere, there is more energy to exploit. Technologies are emerging to harvest atmospheric energy such as windmills, solar cells, and bio-carbon approaches.

Change brings both adversity and benefit. Climate change mitigation will reduce some jobs and increase others. It may seem counterintuitive to think of change as a job creator, but after we bombed the daylight out of Germany and Japan during World War II, we watched their economies surpass others, in part because we removed encumbrances associated with older infrastructures. Think Pony Express to telegraph to telephone to internet. Opportunity can accompany change.

Social ecologists discuss resilience science within the context of five variables: remembering, revolt, feedback, thresholds, and transformability. The terms may seem a little awkward at first but you will quickly see their value in both reducing risk and identifying opportunities.

Remembering. This occurs when the potential for recovery is accumulated and stored. A fire burns a forest but seed stocks remain, allowing for the forest to regenerate. Global warming is changing ecology. The forests remembered are not necessarily the ones emerging. Stressed forests are not storing adequate seed stocks. A great example, although not one involving climate change, is the recovery of Santa Cruz, California following the Loma Prieta earthquake. Here this tightly knit community exploited their social and intellectual capital

and reconstructed a new and more vibrant commercial center. East Coast barrier island communities may not be afforded the same opportunity.

Climate change is rendering remembering inexact for many communities damaged by Hurricane Sandy. Reconstructing as they remember it is not sustainable. As Yogi Berra is reputed to have said, “The future ain't what it used to be.” Remembering helps with traditional flooding. False remembering may represent the greatest climate change detriment to resilience.

Elevating homes on a coastal floodplain might make perfect sense when addressing traditional flooding. Building on the “remembered” seeds would increase resilience. But this approach would prove expensive and decrease community resilience where global warming is causing increased sea levels, storms, and greater losses in protective natural capital.

Revolt. This occurs when forces or events overwhelm recovery. Burnt forest attempting to reestablish itself may be overtaken by more resilient competitors such as Scotch broom



Any change may bring benefits to some, hardships to others. Climate change will make some rich and others poor.

or Himalayan blackberry, preventing the establishment of the pre-change ecology. For East Coast barrier island communities, “revolt” could come in the form of a changing landscape. Global warming is increasing storm magnitude and frequency. Protective offshore buffers like reefs and gradually slopping bathymetry are disappearing. Migrating sands that created these islands are relocating. Revolt, or any of these variables for that matter, has a focal point and can be positive or negative. We have destroyed countless forests in order to build houses and plant orchards. Our resiliency depended on the lack of resiliency of a forest.

Prescribed burning along with rehabilitation of native plants will reduce wild fire risks increasing resilience if climate change is not a factor. But for stressed forests, spending money to reestablish native species may prove futile.

Feedback. Resilient communities have self-organizing feedback mechanisms. The commercial market offers many examples of self-correcting feedback. A flood damages a home in Snoqualmie, Washington. Most homes are elevated and the owner sees a lifestyle and market advantage of elevating the home above future flood levels even without the incentives of the National Flood Insurance Program. However, along the east coast of a New Jersey barrier island, using limited resources to elevate your home may create a destructive feedback if the grounds wash away from under your home and you have exhausted your financial resources. The market does not respond well to “false remembering.”

Depending on market driven incentives to re-establish an ecologically dependent resort would waste resources where the ecology and natural capital incentives are changing.



It has been estimated that there is \$527 billion dollars of coast property at risk from sea level rise and coastal storms. We do not have the resources to continually “bounce back,” rebuilding pre-event communities following each disaster.

Tipping Point. This is a point at which a relatively small change in external conditions causes a rapid change. Change is seldom linear. A one-degree change in temperature can melt a protective ice shelf, removing a vital buffer for an Alaskan community.

Acknowledging thresholds and tipping points can provide support for profitable interim uses. For instance, ski resorts located in the lower Cascades may prove extremely profitable over the next few years as warmer air absorbs more moisture and falls as snow. However, as the mountain snow line rises above these resorts, skiing will no longer be profitable. To continue they will have to exploit other natural capital.

Climate change is forcing many systems across thresholds. Little ones, such as our traditionally cool northwest system, are becoming warmer and more attractive to mosquitoes. Big ones are altering coastal currents.

James Hanson of the Goddard Institute of Space Studies has identified 350 parts-per-million of CO₂ in the atmosphere as a safe upper limit if we are to avoid a variety of climate-related tipping points. We are currently at 400 ppm, and if all the current oil drilling leases were exercised and the stored CO₂ was emitted in the atmosphere, we may well exceed 500 ppm.

Reinforcing levees would remove risks associated with coastal agriculture. However, with increasing sea levels, the salinity of these areas will reach a threshold where traditional crops will not survive. Farms will have to plant salt tolerant crops and universities will have to push evolutionary processes to create new salt tolerant varieties.

Transformability: This is the capacity to create a fundamentally new system when conditions make the existing system untenable—where organizations are capable of exploiting new opportunities. *New York Times* economic pundit Paul Krugman, writing at the end of June this year, said, “Environmental action could actually have a positive effect [in creating jobs]. Suppose that electric utilities, in order to meet the new rules, decide to close some existing power plants and invest in new, lower-emission capacity. Well, that’s an increase in spending, and more spending is exactly what our economy needs.” Transformability may also come in the form of interim strategies. Think of our ski resort example. Will they be able to attract visitors to pay for a different experience?

Rebuilding better is a popular risk reduction mantra, but “better” may mean building temporary transitional structures and land uses that have small economic footprints, generating fast lifecycle returns on investment.

And, finally ...

WE MUST ADDRESS CLIMATE CHANGE DIRECTLY if we are to be resilient and develop sustainable risk reduction solutions. The discovery of sound adaptation measures is only possible if we

discuss global warming as the focus of our concern—the primary hazard in our mitigation, response, recovery, and preparedness planning. When writing hazard mitigation plans, coastal area plans, comprehensive land use plans, or conducting “discovery” meetings, doing benefit-cost analyses or environmental assessments, we need to address global warming as the driver of change and not some ancillary effect of another hazard. Only then will sound sustainable adaptation measures emerge.

This will support climate change policies that are opportunistic and positioned to exploit market and disaster recovery forces. Policy and funds must be in place to buy valuable floodplain capital when made available by willing sellers or as the result of changes provided by disaster events. It has been estimated that there is \$527 billion dollars of coast property at risk from sea level rise and coastal storms. We do not have the resources to continually “bounce back,” rebuilding pre-event communities following each disaster.

And lastly, we don’t know how our culture will survive high levels of carbon in the atmosphere. If we are to avoid extreme tipping points, we must reduce our emission of greenhouse gasses. This must begin immediately. We can begin now at the local level by reexamining our development patterns, land uses and transportation systems, and restoring our natural capital.

Addressing global warming as a secondary hazard will prove ineffective, if not futile, as will restricting our energy to adaptation alone.

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Training for disaster with the Urban Shield



An invited comment by Tony Ellis

ON THE DAY OF THE EVENT, I arrived at 6:00 a.m.—about three hours early. There was nothing for it but to take a seat and eavesdrop on the small planning groups, trying to learn how to be the best victim I could be. The Travis County Expo Center in Austin, Texas, was going to be hit with a bomb explosion, followed by a chemical agent attack. I am going to be one of the victims of that attack.

In early December of 2012, I was one of about 600 volunteers for Urban Shield training in Austin. Urban Shield, based in Northern California, is a “comprehensive, full-scale regional preparedness exercise assessing the overall ... response capabilities related to multidiscipline planning, policies, procedures, organization, equipment, and training,” according to its Web site. (<http://www.urbanshield.org/>)

There were at least three different military-style uniforms present, along with representatives from the Department of Homeland Security, the Federal Emergency Management Agency, Texas Search and Rescue, the Austin Police Department, and many emergency service and volunteer groups. In all, 25 different Texas agencies were involved.

I’m a researcher in disaster resilience in rural communities. I was looking forward to seeing the disaster unfold in real time. The only thing I knew so far was that I was supposed to dress comfortably.

Some scenarios had already been played out at different venues around the area. One involved people trapped in a collapsed building. Local fire departments responded, working together to get people out safely. Another staged a sniper attack requiring a SWAT team response. Urban Shield strives to make the drills as realistic as possible. Several Boston area police officers took Urban Shield training prior to the explo-

sions that rocked the Boston Marathon this past spring.

The volunteers began arriving—not everyone was three hours early—and we were ushered to the bleachers and briefed. Each volunteer received a card indicating his or her assigned group. Some were bomb blast casualties, some suffered from chemical agents, others were dazed and confused. Details about behavior and how to simulate injuries were included on the cards. As we read about our symptoms, our discussions turned to how to act, what to say.

I was a chemical agent victim, suffering from very low blood pressure, nausea, headaches, and difficulty staying conscious. Now that I had my role, I had to consider how to perform for the responders. I went over my symptoms, thinking over what I would do and say to the fire, police, military, or medical personnel I came in contact with. I wanted to make it as realistic as I could.

The efforts at realism were, um, realistic. Many people had makeup and fake injuries (mouflage) applied to provide visual impact. Some people had simulated burns, others more serious injuries. One young woman’s eye injury was so well-done she became a favorite “photo opportunity” for volunteers and responders alike. Other injuries included protruding bones, shrapnel, and lost limbs.

Since my symptoms were low blood pressure and heart problems, I didn’t need a lot of makeup. I was given a grayish face and a few scratches and bruises. This gray-faced cardiac patient, barely hanging onto life, was ready to go.

At about two p.m., we moved into the staging area and were given last-minute instructions. While we waited, people took photos of each other. The mood was of excited anticipation. A few minutes later a huge “flash-bang” went off,

simulating the bomb. We were told to run outside and “make it real.”

We evacuated the building, occupying a small grassy area near the parking lots. There, event coordinators walked around, telling people which way to go and providing general information on how to perform. I grabbed my chest, yelled for help, stumbled around. Other people were pretending to vomit, wandering aimlessly, crying, or simply holding a collapsed friend. A woman walked by, moaning, asking if anyone had seen her husband.

The Deadline Live show said on its Web site after the event, “Scattered across the lawn outside among the bloodied and bruised with stage makeup, Sam Dykes and her family waited for help. ‘Trauma, severe trauma,’ Dykes said, pointing to an oozing sore on her neck and scrapes across her forehead. ‘My husband’s dead.’”

Three other young men huddled together trying to comfort each other. One had lost a leg, the second had a lot of burns, and the other couldn’t seem to stand or walk. In another group, a man and woman were running away and trying to leave the area. That’s when I realized we were surrounded.

Military and police had formed a circle around everyone and were not letting anyone out of the grassy area. Any person trying to leave was directed back into the group and told to stay there. As people cried for help, we were told medical personnel would be arriving soon. About that time, a helicopter flew overhead. People waved, but the pilot didn’t descend. Fire engines, ladder trucks, and a couple of ambulances began to show up. This was at least 20 minutes into the disaster. People were starting to panic and move toward the responders. Again, military and police worked to keep people back.

A few people finally broke through the line and ran to get help. At least one was airlifted away, others transported by ambulance. The fire department set up a ladder truck and hose as a shower. Once the hose was in place, some of the people were herded like cattle under the water. After being drenched, the group was moved to another staging area.

People were falling down around me, pretending to die or to have their symptoms worsen. I wandered around grabbing posts, trashcans, or other people for support. I complained of difficulty breathing, upset stomach, and sleepiness. No one was interested in me since they all had problems of their own. I approached the barrier and see if I could get help from one of the police officers.

A young SWAT officer told me to stay back. I asked for help, stumbling forward. He said he couldn’t help me, but medical personnel were on the way. I said I couldn’t wait and needed to leave. He put me in an armbar—a jiu jitsu move—then escorted me to a grassy area, told me to stay put and wait for medical personnel.

I walked over to a nearby building and was greeted by a man playing the role of a triage doctor. He said I required hospital care and to get on the bus parked outside. I joined about 20 other people already on the bus and once the bus was full, we left the event area and headed to a hospital. On the way, we were told we were going to the new Se-

ton facility, in Kyle, Texas. About 30 minutes later, we arrived and were greeted by hospital staff.

A young woman explained our role. We would all be staged outside the emergency room. From there, several groups would enter at intervals to simulate “waves” of ambulances arriving with casualties. The goal was to overload the ER staff so they could see how a real disaster might play out. When seen by the staff, we were to play our roles, demonstrate the appropriate symptoms, responses to medication, and so on.

I was in the second group. I was met by a male nurse. He asked my name and told me to sit down so he could take my vitals. Instead, I collapsed and clutched my chest. The nurse immediately moved to support me, calling for a gurney. After getting me on the bed, I was wheeled to the ER. Another nurse came in and asked about my symptoms, so I showed her my card. She made some quick notes and called for a doctor.

I watched as nurses scurried to get patients logged in and triaged. I heard someone yell, “I need a doctor. Amputee!” I watched a couple other people being moved from beds to wheelchairs. There was a lot of activity, but everyone seemed to be pretty calm at this point. Then the next wave of injured people arrived and it all hit the fan.

With no more bed-space, patients were lined up along the counter and walls. More nurses were appearing and at least two more doctors came in. Although the room appeared to be chaotic, the staff remained focused and did their jobs. Doctors asked which patients needed to be seen, new nurses were taking directions from those already there, but no one seemed to be in charge.

About this time, I saw something I had not seen since my Navy days. One person stepped up and, although not in the exact words, declared she was in charge. This is the type of leadership needed to handle such situations. The woman excelled. I later found out she was the charge nurse, Marianne. She called out to everyone in the area, “We need to get organized. Everyone listen up!” She proceeded to assign specific jobs to each nurse, provided patient information to the doctors, and outlined a plan to take care of all the injured people.

As the rest of the ER came to order, a doctor entered to treat me. He asked how I felt and I replied by showing my



symptom card and complaining about chest pain. The doctor reviewed the card, commented that he understood my injuries and told me what he would do if this were real. He ordered some tests, an IV, nitroglycerin, and pain killers for me. He said a nurse would be in to administer the medications and to check on me soon, then left the room.

Two nurses came in to take vitals, administer medications and to start the IV. I heard someone say one of the patients had died. Another patient was moved past my bed with bandages on her face. It looked like the staff was catching up with the rush of patients. The doctor returned and asked how I felt. I asked if I should feel better. He smiled saying, "With what I gave you yes, you should feel real good." Going along with that, I told him I could breathe easier now and my stomach was not upset anymore. The doctor said he was going to send me to pre-op for further evaluation, but I would be okay.

The original male nurse came back to get me. He moved me out of the emergency room and up to the floor where I was to be admitted. As I was being checked into the room, we got word the event was completed, so I walked down to the ER to wait for instructions.

I joined the group there. We were escorted back to the waiting room. Sandwiches and sodas were waiting for us. The woman who had greeted us came in to thank us for our participation. We loaded onto the bus and returned to the event site, for checkout. Once there, it was a quick trip through the line to check out and get our t-shirt.

When I was wandering around, "injured" on the grassy area, I thought the ambulance personnel had failed to show up. In hindsight, I think we experienced what would really happen. Quarantining of the injured to prevent the spread of



One person stepped up and, although not in the exact words, declared she was in charge. This is the type of leadership needed to handle such situations. The woman excelled.

whatever they were exposed to, delays in response because of the size of the disaster, media coverage, responders becoming overwhelmed at the scene and contending with aggressive or uncooperative victims. The time delays seemed very long at the time, but I was later informed only 30 minutes had passed. Again, this was a very realistic simulation of response to a disaster of this magnitude.

I learned a great deal from my participation and hope to do it again next year. As a researcher, first-hand experience is one of the best ways to learn. From a citizen perspective, I helped responders, military, and other professionals practice their skills and abilities. Now, should a real disaster occur, those coming to help have had the opportunity to see what could really happen. From my perspective, this can only help them understand what to expect and how to respond. This type of training will save lives.

Tony Ellis is a United States Navy veteran. He is currently pursuing a PhD at Texas A&M University, focusing his research on disaster resilience in rural communities. He can be reached at tony.ellis@tamu.edu.

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Bushfires ...

(Continued from page one)

and countless animals.

Studies clearly showed that most deaths occurred when people were outside.

Evaluating the effectiveness of the “stay-and-defend or leave early” policy, researchers noted that while early evacuation was a valid survival strategy, no mass evacuation was likely to be carried out early enough to be achieved safely. Large-scale evacuation invariably leads to a markedly higher loss of property and belongings. And deaths while “staying,” were not due to home defense, but to uninformed, inactive shelter or personal infirmity (Haynes et al. 2008; Lazarus and Elley 1984; Wilson and Ferguson 1984).

A government instigated inquiry concluded (Miller 1983):

Evacuation ... under severe conditions is not a desirable option. Limitations of visibility due to heavy smoke, exposure to high levels of heat radiation [and] traffic congestion ... all indicate the hazardous nature of such evacuation and the extremely high risks.

General indications are that people who understand what to do in the face of bushfire threat and have made adequate preparations stand a good chance of surviving when they stay with their homes.

Up to and after the 1983 event, the question of fight or flee in the face of a bushfire threat had been dealt with differently by different states. Victoria favored personal decision. New South Wales favored mandatory evacuation.

Best practice had been to use the evening weather warning as the trigger to implement preplanned emergency action. Capable adults transported children that evening to friends in

a safe area and returned to prepare their home, ready to defend if necessary. Prudent evacuees closed up the house and left at that pre-fire stage.

Ash Wednesday

On Ash Wednesday many successfully defended, many successfully fled. Some died defending. Too many died fleeing too late. Too many homes were lost.

The 1983 deaths and injuries of so many people and animals, the destruction of homes and precious possessions within them, the ensuing homelessness, the horrors of last-minute escape stories, caused me great distress. I could not bear it that so many had suffered—most through lack of knowledge.

The public had little bushfire safety information available to them at the time. New South Wales had a small pamphlet. Other states were equally minimalist. Any books were for firefighters (Luke and McArthur 1986). The Victorian Country Fire Authority had a useful small booklet titled *Summer Peril*, aimed at those on the land. But heavily timbered, previously lightly populated areas in near-city foothills—what is called the wildland-urban interface in the United States—were rapidly becoming cluttered, heavily timbered, semi-suburban localities, endangered every summer.

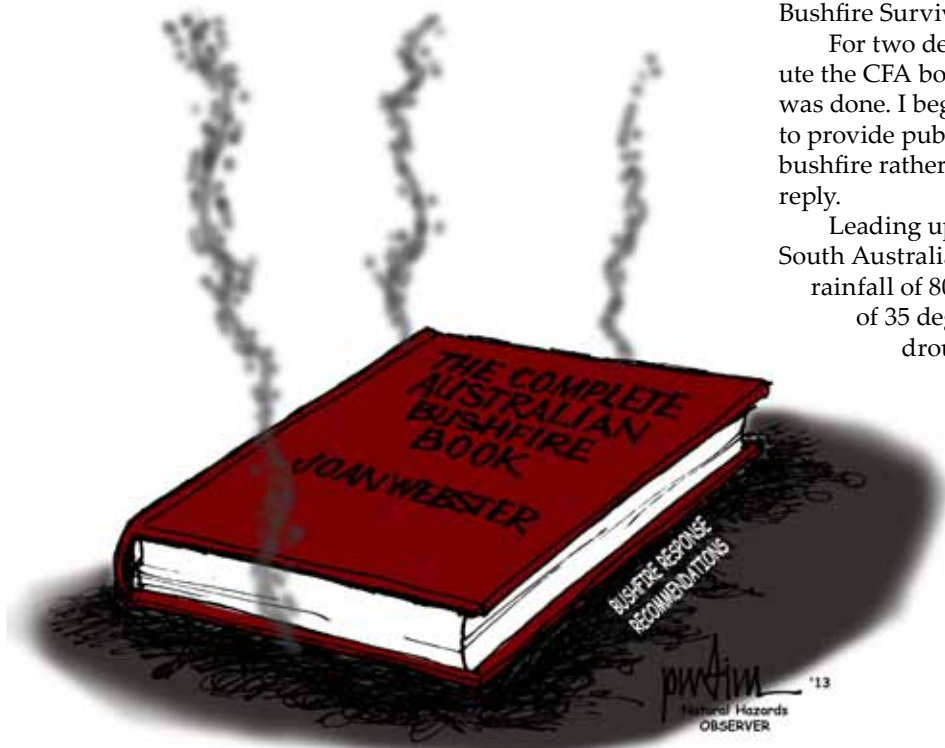
In 1983, I lived close to the area then regarded as the most bushfire vulnerable in Australia, if not the world—bush-clad, hilly, increasingly populated Warrandyte. I was then a journalist of 20 years experience with a lifelong interest in safety. As a girl of eleven, I had put out a small grass fire that threatened our home. As a young mother, I had saved neighbor's homes threatened by fire advancing from adjacent bush. My newspaper work involved close collaboration with rural fire officers in covering bushfires and writing articles on preparation and safety. I was a founding member of our local municipal organization for civil defense for bushfire—the first one in the world—which brought insight into the dangers inherent in mass evacuation. In 1964, after dashing to protect those neighbors' homes in far too flimsy clothes, I'd devised a personal Bushfire Survival Kit of protective clothing.

For two decades I had urged my local council to distribute the CFA booklet *Summer Peril* to rural residents. Nothing was done. I begged the Australian Counter Disaster College to provide public education on the real annual attacks of bushfire rather than on hypothetical nuclear attacks. It did not reply.

Leading up to the February 16, 1983 fires, Victoria and South Australia had experienced drought for over a year, with rainfall of 80 percent below average, and air temperatures of 35 degrees to 40 degrees C (97-104 degrees F). The drought was so bad that the week before that tens of thousands of tons of powder-dry topsoil were vacuumed up from grazing areas by wild winds, then emptied in an ominous dust cloud onto the capital city, Melbourne. It spread over 300 meters high (990 ft) and 500 kilometers long (312.5 miles).

I was so concerned that a tragedy was about to happen that on February 15, I hand-delivered a letter to the Victorian premier, urging better public education in bushfire safety. He would not see me.

My elder daughter, artist-photographer Katherine Seppings, lived in an old farm-



house surrounded by dense forest, with ramshackle sheds and many animals. All that summer we talked over bushfire safety. On that terrible day, she urged me to educate the public myself, to write a book ... for people like her. And that she would illustrate it.

Two weeks after the Ash Wednesday fires, I set myself the task. A surprise first stumbling block was my attempt to sort the advice in official information brochures. They contradicted each other—and often themselves.

As I researched, wrote, and thought, I assembled a network of experts in every bushfire-related authority, who answered questions, checked drafts, and discussed my safety ideas. I came up with the concept of protective window shutters on houses to minimize ember entry; originated the family bushfire safety plan; prepared action lists of what to do for safety at every stage of bushfire threat; suggested a survival kit; offered methods of protecting precious possessions; developed holiday and caravanning safety steps; and brought attention to the special needs of children, the frail and pets.

Saving homes

After three-and-a-half years, I had a comprehensive book on bushfire safety for the public. This had never been done before. It influenced official policy. Brochures proliferated. Authorities adopted my safety innovations as standard advice. Though created for householders, fire and emergency authorities and government departments throughout Australia used *The Complete Australian Bushfire Book* as a resource. U.S. fire and forestry departments in several states—California, Wisconsin, Florida, and Washington—obtained it. The Australian Fire Protection Association presented me with its Community Service Award.

Its effectiveness on the personal level is exemplified in the story of a brave and determined young woman.

On January 21, 1997, temperatures soared to 41.2 degrees C (106 F), northerly winds gusted to 70 km/h (43 mph), 250 bushfires burned across Victoria and 1,500 firefighters strove to control a 3,700 ha (9,139 acre) blaze in a densely forested national park in the Dandenong Ranges. Scattered through which were densely vegetated small townships.

In the threatened hamlet of Upwey, the Wright family had been, as their mother told me, “reared on *The Complete Australian Bushfire Book*, involved in planning and practicing with it since they were small.” On January, 21, Mrs. Tricia Wright was away. Her 22-year-old daughter home on her own. Though twice ordered to leave and while others around her were evacuating, she said, “I’m not going. I know what to do.” She stuck to the family bushfire safety plan and single-handedly saved the family home, while around her 43 homes were destroyed, 45 damaged, and three people died. The Wright’s was the only house in the street left standing.

Caird Ramsay of the Division of Building Research, Commonwealth Scientific and Industrial Research Organisation (CSIRO), also set himself a task. In the severely impacted Otway Ranges in Victoria’s southwest, he and his investigators examined 1,163 houses—burnt, partly burnt, and unburnt. Every house in the fire zone. It was the biggest and most thorough post-bushfire scientific investigation in the world. His aim was to determine why some houses burnt to rubble while others were unscathed. And whether staying to defend one’s home could be safely achieved.

Most heartening was the discovery that 90 percent of homes defended by one or more persons over the age of 10

Closing the book on bushfires



In 2001, I created a ready reference, *Essential Bushfire Safety Tips*, for people who had neither time nor inclination to read the in-depth *Complete Bushfire Safety Book*. In May

2010 I received the Order of Australia Medal “for service to the community in raising awareness of bushfire safety.” In July 2010, the Royal Commission issued its Final Report. In August 2010 I began an enlarged and updated 3rd edition of *Essential Bushfire Safety Tips*.

My aim is to clear a path of understanding through the confusions of post-2009 pronouncements and policies. To help people understand how to react safely to any bushfire threat. To set out clearly the benefits and risks of their three options: defend, evacuate, or shelter. And to detail how each could be achieved safely.

The current claim that even “well prepared” homes can not be saved during the worst bushfire weather are readily disproved by the scientific research. By the sight of the many safely saved. And by grateful correspondence from my readers: “Your book was critical in helping to save our house on Black Saturday.”

“Your book was a valuable guide to my family living near bushland where the fire raced through on 7th February, 2009.”

And—despite the opposition to its post-2009 pro-evacuation policy I have expressed in my book—the Victorian CFA has lauded its potential: “*Essential Bushfire Safety Tips* is truly an outstanding achievement and a book that certainly could help save lives within the community.”

who knew what to do had been saved. Furthermore, every single home that had three or four knowledgeable defenders came through unscathed.

Ramsay’s investigation confirmed definitively that houses burn when embers enter and ignite their interior. That the reduction of a house to a few centimeters of ash is not caused by the reach of bushfire’s devouring, towering flames, but by the ember-caused incineration of its own contents. And that the “stay” part of the “stay-or-go” policy can be successfully implemented.

The legacy of their evidence-based discoveries held through every bushfire since.

Until 2009.

For the ten years leading up to the day called Black Saturday—February 7, 2009—Victoria had suffered its worst drought in 100 years of rainfall records. For the preceding two weeks, strong northerly winds pushing a patch of extremely hot air down from inland southeastern Australia into southern Victoria brought record breaking air temperatures (Australian Government Bureau of Meteorology 2009)

February 7 itself was the hottest on record—up to 23 degrees C (72 degrees F) above the February average, according to the Bureau of Meteorology. The highest official temperature

in the state was 48.8 degrees C (120 degrees F). Melbourne recorded 46.4 degrees C (115 degrees F), its highest maximum since temperature records began. By mid-morning, hot northwesterly winds gusted to 115 km/h (72 mph). Relative humidity dropped to as low as six percent.

In the fires that erupted, 172 people died and 2,000 homes were destroyed. Contrary to the experience of past bushfires, most had died in or around their homes. They had “stayed.”

Media

Media presenters reporting the fires reacted with knee-jerk hyperbole. Assumptions were made:

- People died defending, therefore defending means death.
- People died “staying,” therefore staying means death.
- No one should be allowed to stay.
- No one should be allowed to defend their home from a bushfire threat.

This set off public panic, community confusion, and political, litigation-fueled fears.

The 2009 Victorian Bushfires Royal Commission did not enquire into whether victims’ deaths were, in fact, purely the result of “staying,” nor whether any neglect of normal safety procedures had contributed. No data was collected on either the proportion of safely saved homes, nor of how defenders achieved this desirable outcome. This has contributed to community confusion, frustration, authority dependence, and apathy.

One recommendation that has been called counterproductive to safety is its call for the provision of Neighborhood Safer Places. These can be bush-surrounded, ember-exposed sports arenas, beaches, or in-town buildings—even open streets. These are all of dubious accessibility to outlying rural residents during severe fire conditions.

Neighbourhood Safer Places were defined by the 2009 Victorian Bushfires Royal Commission as:

- Places of last resort, for access at short notice, “during the passage of fire through the neighborhood”—a known dangerous procedure.
- And, incompatibly with their title, as places that “can in no way be considered safe.”

Notwithstanding its acknowledgement that the “stay-and-defend or go early” policy was “strongly grounded in extensive research,” the commission branded it as “discredited.” With only anecdotal support for this stance, the report emphasized the dangers of home defense, recommending a policy of mandatory emergency evacuation.

Successful home defenders felt sidelined. And rightly so. They were by far the majority of fire-threatened residents. Of the 6,000 homes in the Black Saturday fireground, two-thirds remained intact. Most of those destroyed had been evacuated. The 172 victims comprised less than 1.25 percent of the area’s 14,000 residents, and died in fewer than one percent of its houses.

Not until after the final report of the Royal Commission was published did the facts emerge. Research by groups of eminent bushfire scientists produced actual evidence (Hammer, O’Neil, and Killalea 2010).

People died on that dreadful day not because they stayed to defend their homes, not because of the severity of the bushfire, not because of the unprecedented weather, not through lack of official warning, nor by divine displeasure.



Research showed unequivocally that people died on that dreadful day not because they stayed to defend their homes, not because of the severity of the bushfire, not because of the unprecedented weather, not through lack of official warning, nor by divine displeasure (McLennan, Elliott, and Omodei 2012). They died because of a lack of knowledge, through misunderstanding of how to react safely, and through complacency and, in a few, infirmity. The data showed that most fatalities had reacted foolishly—at times suicidally so.

These scientists found:

- Very few of the fatalities had a comprehensive bushfire safety plan.
- Sixty-nine percent died while sheltering in unsafe places. Of these, 27 percent were in bathrooms.
- Of the 34 percent of fatalities who had decided to stay and defend, 20 percent (6.8 percent of total deaths) were deemed “well prepared.” However “well prepared” meant, for the purposes of the research criteria, only that “appropriate activity” had been undertaken before the fires started.
- Less than 1 percent of fatalities who had decided to evacuate were found to be well prepared, lacking even a trigger to go and a destination.
- Fourteen percent of these died while fleeing, without suitable clothing.
- Survival rate for actively defended homes was 80 percent.
- Survival rate for undefended houses was 44 percent (Whittaker et al. 2013).

Nevertheless, the Royal Commission’s proposal for emergency evacuation was trumpeted by a number of state fire authorities as an injunction that people cannot survive such conditions even in well-prepared houses. And lodged in the public mind as, “Go. Just go.”

Overturning the system

With nothing to show that anyone following safe home defense procedure had died, Victoria—the state that had led the way in successful practice of “stay-and-defend or leave early”—completely overturned its long-proven system.

Despite the research, despite the evidence of one’s eyes of so many homes safely defended, the edicts were out. NSPs were designated, brochure and website advice altered, public meetings addressed, frightening TV docu-infos shown. Sound bites proclaimed, “Stay and you may die.” The revised doctrine? “Everybody out.”

The Australasian Fire and Emergency Service Authorities Council (AFAC) position [paper](#) of September 2010 says:

“Large scale evacuation is not the default op-

tion. Last minute relocation or evacuation is dangerous. Fire agencies should consider the likelihood of entrapment or being overrun by bushfire during an evacuation. While well-executed evacuations are likely to save lives, increased property loss is almost inevitable.”

It stresses that:

“People should be allowed and encouraged to take responsibility for their own preparedness and safety in bushfires. Fire agencies should encourage people to gain knowledge and skills to enable them to prepare themselves and their property, and to help them identify the triggers for response (appropriate to their situation and abilities) when a bushfire threatens.”

Nevertheless, directives from the Victorian Country Fire Authority, New South Wales Rural Fire Service, Tasmania Fire Service and Queensland Rural Fire Service say:

- No matter how well you prepare, your home will not be defensible on a Code Red day.”
- “Leaving early is your only safe option on Code Red days.”
- “No house can withstand a fire on a Code Red day.”

The mandatory evacuation of whole hillsides, whole towns, whole regions, is now planned for days designated “Code Red” or “Catastrophic.”

Many bushfire scientists, firefighters, and knowledgeable householders are greatly concerned about these post-2009 developments.

The “stay-or-go” policy was not wrong. It was wise, balanced, and evidence-based. What went wrong was that too many people misunderstood, or only partially understood, it.

Joan Webster is a freelance writer and researcher in Australia. She was awarded the Order of Australia Medal (OAM) for her work on wildfire safety in May of 2010. Her *Essential Bushfire Safety Tips* (2012) is available in the U.S from Stylus Publishing (<http://www.styluspub.com/Books/Features.aspx>) and <http://www.publish.csiro.au/pid/6969.htm>. *The Complete Bushfire Safety Book* (Random House, 2000) is available from <http://www.randomhouse.com.au/books/joan-webster/the-complete-bushfire-safety-book-9781740510349.aspx>.

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Resources

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

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

ALL HAZARD

Governing Disasters: The Challenges of Emergency Risk Regulation. Alberto Alemanno, editor. 2011. ISBN: 978-0-85793-572-4. 273 pp., \$103 (hardcover). Edward Elgar. <http://bit.ly/11SvImV>.

Way back in April 2010, the Icelandic volcano with the unpronounceable name Eyjafjallajökull erupted, grounding many of the airplanes in Europe. Volcanic ash, when sucked into the engines of jets, is a known hazard. But how much ash is dangerous? How much risk is acceptable? And who decides?

This book takes the Eyjafjallajökull eruption as a case study in the management of risks in emergencies. While Europe long ago dissolved its land borders, says editor Alberto Alemanno in the the first paper here, the airspace above the nations is still managed by the individual countries. Who knew? This created a “prisoner’s dilemma”-like scenario, no member state could act independently by departing from the ... guidelines and taking the first step to introduce change.”

In chapter two of the volume, Donald Macrae looks at the questions of which risks become important, and who decides the response. “The most striking aspect,” he writes, “is how few actors had a strong incentive to take a risk on flying. Most of the key players had no pressing interest in giving any assurance about safety. If ever there was a case of ‘not betting the company on a single throw,’ this was it. Getting this one wrong would be disastrous, both for the company and for the unfortunate people who would tragically prove the point.”

But people in Europe wanted things back to normal. And the airlines wanted to stop losing money. They were prepared to deal with the eruption as temporary inconvenience like, say, a serious snowstorm, but they weren’t willing to deal with it as a permanent part of the landscape. The book explores the various pressures, result, governance, communication, and regulation that emerged from the crisis.

Emotional Labor and Crisis Response: Working on the Razor’s Edge. By Sharon H. Mastracci, Mary E. Guy, and Meredith A. Newman. 2012. ISBN: 978-0-7656-2519-9. 173 pp., \$34.95 (softcover). M.E. Sharpe. <http://bit.ly/18foI7r>.

Not every decision and action lends itself to thoughtful, rational analysis for a best solution. It’s probably safe to say, in fact, that most don’t. People often have to incorporate their emotional intelligence along with their intellect to reach a good course of action to address a problem. This book deals with people who do emotional labor, especially those—fire, police, emergency responders—who must deal with problems in crisis situations.

“Emotional labor ... includes analysis and decision

making in terms of the expression of emotion, whether actually felt or not, as well as its opposite: the suppression of emotions that are felt but not expressed. More specifically, emotional labor comes into play during communication between worker and citizen.”

Emotional labor in a crisis involves sensing what the victim is feeling, analyzing one’s own emotional state, and responding appropriately in the context. This is a challenging issue in a fire, an earthquake, a traffic accident. The book—which is very well-written and engaging—includes examples that illustrate the emotional labor required in many of these crises.

The traditional conclusion is that “emotional laborers” in this sense are prone to burnout. But the authors found that this kind of work can also be rewarding and invigorating for people, provided their situations are handled properly.

CLIMATE

Climate Change and the Oceans: Gauging the Legal and Policy Currents in the Asia Pacific and Beyond. Robin Warner and Clive Schofield, eds. 2012. ISBN: 978-1-84844-818-6. 274 pp., \$103 (hardcover). Edward Elgar. <http://bit.ly/15b5T0b>.

Let’s suppose that you’re a nation claiming sovereignty over some islands in the ocean and the associated offshore claims arising from that sovereignty—fishing, oil exploration and development, and so on. Then, with rising sea levels from a changing climate, the islands disappear under water. What happens to your sovereignty claim?

The example is not hypothetical. As Warner and Schofield note in their opening paper in this volume, “With the onset of sea-level rise many of the Spratly Islands group may be permanently submerged, potentially undermining the basis for territorial sovereignty claims based on these insular features.” The Spratly Islands are the focus of sovereignty disputes involving no fewer than six contestants—Brunei, Taiwan, China, Malaysia, Philippines, and Vietnam. “States rarely concede sovereignty over territory easily, and such disputes may persist should the claimant and occupying states undertake concerted reclamation or protection works in order to preserve the threatened, yet disputed, features.”

This is only one of the many Asian legal and policy issues involving the oceans under the current regime of climate change. This book focuses strongly on the political issues faced by the oceanic nations of Asia in the face of the warming world. If the book can be said to have a theme for such a diverse undertaking, it is that these nations must cooperate on everything from ecosystem protection, fisheries, and maritime security.

The last chapter is very forward-looking essay on the legal, political, and ethical impacts of geo-engineering to address climate change. The eventual impact of these

technology proposals—inevitably governed by the law of unintended consequences—are highly speculative. Rosemary Rayfuse and Robin Warner write in this final essay, “Arbitrary human intrusion into previously undisturbed marine domains have the potential to harm the intricate links between complex marine ecosystems and to erode components of marine biodiversity ... Enhanced environmental protection for the oceans will require concerted action by the international community to put in place best practice guidelines and measure to assess and minimize the adverse impact of emerging climate change mitigation activities on all areas of the ocean.”

The Atlas of Climate Change: Mapping the World’s Greatest Challenge. By Kristin Dow and Thomas E. Downing. 2011. ISBN:978-0-520-26823-4. 128 pp., \$24.95 (softcover).

University of California Press. <http://bit.ly/18tLLOL>.

The onset of climate change is a visually powerful topic, it’s a wonder that there aren’t dozens of “atlases of climate change” like this one. But the Dow and Downing book is the best we’ve come across, a feast for the eye and mind at once.

The book is organized in a logical and readable way, beginning with the easiest to understand concepts—record temperatures, floods, heat waves—and progressing to the more complex—meeting Kyoto targets, financing the response. It concludes with a brief nod to possible solutions, personal and public.

The book is lavishly illustrated with charts, graphs, and photos. All are clear and easy to understand. The *Atlas of Climate Change* offers a brief but thorough lesson in the science and policy of global warming.

Contracts and Grants

Below are descriptions of some recently awarded contracts and grants related to hazards and disasters.

Quantitative Uncertainty Modeling for Performance Based Earthquake Engineering. National Science Foundation grant #1333630. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1333630. Three years. \$307,532 to principal investigators Shiling Pei, John van de Lindt, and Hongyan Liu, South Dakota State University, Pei@sdstate.edu.

The ultimate goal of earthquake engineering is to mitigate the adverse effects of earthquakes on society. This requires accurate prediction of structural responses to earthquakes. Because of numerous unknown factors, like earthquake intensity, material properties, and construction quality, there is a certain level of uncertainty in the response of structures. In earthquake engineering, this uncertainty must be quantified and considered in design of buildings to ensure safety.

Uncertainties are accounted for using empirical equations in the design of buildings. In this project, a systematic method to accurately calculate the level of uncertainty in building responses during future earthquakes will be developed and demonstrated. Once the model is developed and implemented, it will provide a mechanism to increase the accuracy of earthquake response prediction, ultimately enabling engineers to build safer buildings.

Currently, consideration of uncertainty in Performance Based Earthquake Engineering is simplified, empirical, and without experimental verification. The goal of this study is to develop a quantitative framework for uncertainty propagation in PBEE and verify it experimentally, using a new approach, probabilistic shake table tests. Initially, an uncertainty propagation model will be developed based on principles of probability theory and structural dynamics. Then a specially designed shake table testing procedure, which will isolate the uncertainty contributions from different sources, will be conducted to collect the necessary data to calibrate and verify this model. Finally, the calibrated model will be applied to improve uncertainty modeling in performance based earthquake design and shake table test planning.

Reconstructing Droughts in the Tropical Americas Using Tree-Ring Analysis. National Science Foundation grants #1263609 and #1263517. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1263609. Three years. \$98,193 to principal investigator Kevin Anchukaitis, Woods Hole Oceanographic Institution, and \$19,618 to Matthew Taylor, University of Denver, kanchukaitis@whoi.edu and m.j.taylor@du.edu.

This project uses the annual rings of tropical trees to reconstruct past rainfall in a drought- and famine-prone region, then applies this knowledge to understanding the role of natural and human-altered variability in the climate system in influencing regional patterns of drought in the past, present, and future. Prior research determined that high elevation tree species in Guatemala and Honduras form annual growth rings that can be dated to their exact year of formation. This is unusual for tropical tree species. Variations in ring width in these trees reflect the amount of winter and spring rainfall.

The investigators will develop estimates of past precipitation along Guatemala’s “Dry Corridor,” a region that currently suffers from severe water and food security challenges. Tree-ring data will be collected from mountain sites across this region. These will be used to develop estimates of past rainfall over the last five centuries or more. They can be used to understand whether current climate variability is exceptional compared to the last several centuries and the extent to which natural variability is entwined with a human-influenced changes. Specifically this research will evaluate the hypothesis that there are important modes of natural variability in Central American rainfall at time scales of decades and longer. This knowledge will help test and improve models that predict future rainfall trends both regionally and globally and can be applied to understanding their cause and consequences.

Knowledge gained from this project will be relevant in a region with populations that are particularly vulnerable to climate change, as it is likely that increased drought and flooding will be the most direct and immediate consequences

of global warming. Changes in rainfall exacerbate existing and emerging threats to sustainable water supplies from growing populations, pollution, declining infrastructure, and boundary conflicts.

Technological versus Natural Disasters: Consequences for Early Recovery Planning and Decision-Making at the Community and Household Level. National Science Foundation grant #1348070. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1348070. One year. \$43,893 to principal investigator Michelle Meyer and four others, Texas A&M University, mmeyer@arch.tamu.edu.

This grant explores community and resident post-disaster recovery in two small American towns. Both experienced disasters in the spring of 2013, but one town experienced a natural disaster while the other town had a technological disaster. To understand how disaster recovery differs based on the type of disaster, we are comparing the immediate recovery periods in each town. Often researchers compare disaster effects across very different communities or across different time periods. Our research takes advantage of a rare opportunity to compare disaster recovery in communities that are similar in size, location, and cultural traits but faced different disasters at about the same time. We are gathering data from community leaders and residents in both towns to address topics important to disaster recovery, including post-disaster community planning, community-based recovery activities, and residents' rebuilding or relocating decisions and efforts.

Reconstructing the History of Hurricane Landfalls in Southwest Florida over the Past Five Thousand Years. National Science Foundation grants #1335375 and #1335207. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1335375. Two years. \$84,959 to principal investigator Joanne Muller, Florida Gulf Coast University, jmuller@fgcu.edu, and \$74,545 to principal investigator Jennifer Collins, University of South Florida, collinsjm@usf.edu.

Funds are provided to reconstruct the history of hurricane landfalls in southwest Florida over the past five thousand years. The proxy record will be developed from hurricane overwash deposits preserved in back barrier lagoons and marshes, and correlated with a compilation of climatological, meteorological, and oceanographic data for the region. The chronology of the overwash deposits will be constrained by radiometric dating, and SLOSH model results will facilitate the correlation of overwash deposits with the tropical cyclones that created them. A site-specific hurricane database will be developed for southwest Florida to better understand the characteristics of storms that produce overwash deposits. Results of this research may have implications for coastal planning and management in the region.

Integrating Fault Slip Observations of Earthquake Swarms, Tectonic Tremor, and Slow Slip in Alaska and the Aleutians and Their Potential Relation to Large Earthquakes. National Science Foundation grant #1249780. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1249780. Two years. \$170,000 to principal investigator Stephen Holtkamp, University of Alaska, Fairbanks, stephen.holtkamp@gmail.com.

Stephen Holtkamp has been awarded an NSF Earth

Sciences Postdoctoral Fellowship to implement a research and education program at the University of Alaska, Fairbanks. This project aims to improve our understanding of the seismic cycle along the Alaskan megathrust subduction zone. While the main hazard from subduction zones comes from large earthquakes (generating extreme ground shaking and tsunamis) and volcanoes, there are a variety of other geophysical phenomena that have a currently unresolved impact on these major geologic hazards. Holtkamp will be using a newly developed seismic method, multiple station waveform cross correlation, to study Low Frequency Earthquakes (LFE's) and earthquake swarms, both of which are hypothesized to be related to aseismic ("slow") slip.

The technique has been shown to detect earthquakes up to one order of magnitude smaller than would be possible using traditional seismic techniques, allowing us to build a more complete catalog of these seismic signals. This technique is insensitive to various forms of seismic background noise, making it the ideal technique to build complete time histories of triggered phenomena. The higher resolution characterization of these seismic signals will provide us the ability to determine their role in the seismic cycle and their relation to large earthquakes and volcanic eruptions.

This technique is well suited for addressing a variety of problems in the earth science community, from volcano seismology to induced seismicity from energy technologies (e.g., wastewater injection induced seismicity).

A Nested Multi-Scale Hydrological Modeling Framework: Assessing Resilience and Vulnerability to Climate Change. National Science Foundation grant #1316536. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1316536. Three years. \$225,000 to principal investigator Amir AghaKouchak, University of California-Irvine, amir.a@uci.edu.

A nested multi-scale terrestrial water budget model coupled with a reservoir operation scheme is proposed for climate change impact assessment. Most climate projections predict a warmer and drier climate for the future that could affect both water availability and hydropower energy production. On the other hand, reservoirs are among the main infrastructures that provide resilience against droughts, and play a key role in water resource management and energy production. However, current climate/hydrology projections do not provide information on reservoir conditions under different climate change scenarios. The proposed nested modeling concept includes a high resolution river network and reservoir operation model nested within a gridded global terrestrial water budget model. This project will use the Coupled Model Intercomparison Project Phase 5 daily bias adjusted climate projections as input into the proposed model to analyze the impacts of climate change and variability on reservoirs, dry spells, hydropower energy production, and system resilience. The project will assess whether current reservoirs (system resilience) are adequate to cope with climate change and variability. Furthermore, the project will evaluate vulnerability to climate change and variability under different Representative Concentration Pathways.

Numerous studies have stressed that water resources are sensitive to climate change and thus, water resources management and planning strategies should be adjusted accordingly. In particular, sensitivity of the United States to water resources has been highlighted in several publications.

The main motivation for this proposal stems from the demand for more extensive and reliable methods for analyzing large-scale changes to the water cycle under climate change. The outcomes of this project will lead to a better understanding of our resilience to climate change and variability. In addition to addressing the project objectives, the proposed modeling framework provides the basis for future studies on the impacts of land-use land cover and urban development on the terrestrial water cycle.

Natural Disasters and Risk, Time, and Trust Preferences. National Science Foundation grant #1347968. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1347968. One year. \$39,910 to principal investigators Robert Shupp, Scott Loveridge, and Mark Skidmore, Michigan State University, shupprob@anr.msu.edu.

The researchers will investigate whether life coping strategies change in the aftermath of a significant natural disaster such as the category five tornado in Moore, Oklahoma. On May 20, 2013 a category five tornado struck the Oklahoma City suburb of Moore. The tornado, more than a mile wide, resulted in massive damage and 24 fatalities. This research will investigate whether a natural disaster such as this alters a person's propensity to: (1) think and plan for the future; (2) accept more or less risk; or (3) trust government and neighbors more or less.

Knowledge about what happens to risk, time, and trust preferences after a disaster is important since these preferences can affect individual and government post-disaster decisions about investing in rebuilding, recovery, and future disaster preparation. We will use surveys that incorporate time and risk preference experiments as well as standardized trust questions to get data from individuals directly affected by this disaster as well as individuals outside the affected areas.

Specifically, we will survey three populations: (1) individuals impacted directly (i.e., loss of life, injury or property damage) by the 2013 tornado event; (2) individuals from the surrounding community who experienced the event, but were not directly impacted; and (3) individuals residing in a similar (demographically) community in the Oklahoma City metro area, but which has not experienced a significant tornado event recently.

Comparing the responses of these three different samples should allow us to identify any significant changes in individuals' views on risk, time or trust. In addition, there will be a second survey completed approximately nine months later to see if any impacts on risk, time or trust preferences are short-term only or if they seem persistent.

This information is important in guiding both individuals' and governments' willingness to invest in private and public rebuilding and recovery efforts. For example, if a disaster causes victims to put less importance on the future and focus on the here and now right after disasters, it may be prudent to counsel victims to hold off making major reinvestment decisions in order to protect their long-term welfare. The research may also help understand which types of individuals are most susceptible to post-disaster life-skill shifts, so that such counseling can be targeted towards those most at risk. Finally, the findings from this grant can be integrated into a broader disaster research program designed to identify government-level changes in emergency preparedness and infrastructure investments that can reduce

tornado fatalities.

Engineering Damage Assessment in the Aftermath of the 2013 Moore, Oklahoma Tornado. National Science Foundation grant #1345311. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1345311. One year. \$19,791 to principal investigator Andrew Graettinger and four others, University of Alabama Tuscaloosa, ndrewg@eng.ua.edu.

This grant provides funding to collect structural damage data that was caused by the EF 5 tornado in the city of Moore, Oklahoma on May 20, 2013. The damage path of this tornado overlaps the damage paths of two previous tornadoes of 1999 and 2003. It would be interesting to see how the houses rebuilt after the previous tornadoes perform in this tornado. Even though there are close to 1,000 tornadoes recorded each year, typically less than 10 tornadoes are rated EF 4 and EF 5. When an EF 5 tornado impacts a city there is a unique opportunity to document and learn from the building damage. This tornado damaged two schools, dozens of commercial buildings, and over one thousand residential structures. RAPID funding provides an opportunity to document the structural damage before cleanup efforts remove the debris.

The team of faculty members and students will travel to the damage site and document failure modes, materials of construction, location of structures with respect to the center of the path, and debris impacts for each documented structure. Social media (twitter) will be used to obtain photos and comments made by citizens. The mining of the social media will enhance damage documentation at specific locations. The team will develop contour maps of EF ratings and wind speeds based on observed Degrees of Damage. These maps will be compared with past tornado studies to evaluate the similarities and differences. This comparison will contribute to the understanding of the spatial characteristics of tornado wind forces on structures. Building failure progression will be determined in different wind speed zones. The benefits and challenges of using social media to improve disaster assessment will be determined.

Improving Economic Resilience of the U.S. Gulf Coast Communities to Coastal Hazards. National Science Foundation grant #1335187. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1335187. Two years. \$306,793 to principal investigators Bandana Kar and David Cochran, University of Southern Mississippi, bandana.kar@usm.edu.

This research explores the relationship of economic vulnerability, resilience, and recovery in selected communities of three Mississippi coastal counties (Harrison, Hancock and Jackson). We will compare vulnerability and resilience of these communities at finer scales of analysis (i.e. parcel and household level) than has been accomplished in past research. This project will: (1) identify factors contributing to spatial and temporal variations in vulnerability and resilience; (2) estimate errors in vulnerability and resilience assessments by comparing their results at different scales of analysis; and (3) identify variables that contribute to the recovery of these communities after disasters.

We will learn why communities with similar socioeconomic compositions, facing identical disasters, have different vulnerabilities and recovery rates. Benefits of this project include: (1) increasing local participation in decision making regarding tropical cyclones; (2) aiding local policy makers in the design and deployment of effective mitigation

and economic development policies; (3) complementing local efforts to increase community resilience; (4) developing game-based educational tools to increase student participation in research; (5) constructing a web-based Spatial Decision Support System that will provide a venue for local participation in decision-making; and (6) disseminating research outcomes through community outreach, conferences, and scientific publications.

Interdependency in Decision Making, A Holistic Approach to Understanding Community Recovery from Catastrophes. National Science Foundation grants #1335109, #1333132, and #1333155. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1335109. Three years. \$110,611 to principal investigator Donovan Finn, SUNY at Stony Brook, Donovan.Finn@stonybrook.edu; \$101,879 to principal investigator Divya Chandrasekhar, Texas Southern University, chandrasekhard@tsu.edu; and \$177,603 to principal investigator Yu Xiao, Texas A&M University, yuxiao@tamu.edu.

This study analyzes the recovery process from Hurricane Sandy in New York City to develop a better theoretical understanding of how the interrelated decisions and actions of residents, businesses and government policymakers intersect in creating successful or failed recovery outcomes. Long-term recovery from major disasters has been one of the least studied phases of the disaster cycle, and because of its complexity it has largely been studied only in a piecemeal fashion. Yet, as numerous recent disasters have shown, recovery planners face enormous challenges and require better understanding of the specific dynamics of this process.

The research analyzes New York City's recovery over a three-year period to better understand how and why effective community recovery happens. Data collected through large-scale surveys, in-depth case studies and analysis of government policies will be used to test a conceptual framework of integrated disaster recovery decision-making based on questions such as: What factors contribute to household recovery decisions and how are they related to businesses recovery success? What factors contribute to business recovery decisions and to what extent are they related to household recovery success? How do these relationships change or evolve over time? Do government and institutions' policies and programs capture the recovery needs and priorities of households and businesses initially and over time?

Better understanding the ways in which household, business and government decisions interrelate is critical to helping planners, politicians and recovery managers develop more robust and resilient communities. The study will contribute to a mostly under-studied aspect of the disaster recovery process and help improve policy and assistance response to disaster-affected communities. These findings will add to the still evolving knowledge base on the complexities of urban and mega-urban responses to catastrophic disasters that continue to impact American cities such as New York, a premier global city that was seemingly diligent in long-term planning and pre-storm preparation but was still severely affected by Sandy.

Complex Dynamics of the Earthquake Recovery of an Ethnic Minority. National Science Foundation grant #1323698. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1323698. Two years. \$14,087 to principal investigators Nicholas Spitzer

and Qiaoyun Zhang, Tulane University, nspitzer@tulane.edu.

This research will explore the political, economic and cultural resources, processes and consequences of state-sponsored, culturally-oriented post-disaster reconstruction of an ethnic minority. After a devastating earthquake claimed about 10 percent of the ethnic population in 2008, many villages not only swiftly recovered materially, but were made into heritage tourist destinations with state planning to "restore and develop" their culture. The proposed research will examine both the state's conception of the ethnic minority through its policies and projects, and the range of villagers' response to the reconstruction and negotiation of lives and relationships revealing complexities and problems of this culturally sensitive recovery project.

The researchers will conduct 10 months of fieldwork. Two more months will be spent interviewing officials and planners in the capital as well as archival research into official reconstruction policies and tourism plans. Physical changes of the villages and statistical data of the reconstruction will be collected and mapped. Participant observation, interviews, and focus group discussions will be conducted to understand how villagers differently perceive and interact with the newly-established living environment and changed lifestyle. Beliefs, rituals, traditional festivals and official events will be documented to show the negotiation and representation of emergent and differential identities. This research is important because it will contribute to the anthropological study of disaster recovery by examining the interplay of state-led planning and the core values of an affected ethnic minority.

Performance and Survivability of Residential Safe Rooms in a Violent Oklahoma Tornado. National Science Foundation grant #1349084. http://www.nsf.gov/awardsearch/showAward?AWD_ID=1349084. One year. \$9,987 to principal investigator Seamus Freyne, Mississippi State University, freyne@cee.msstate.edu.

This project will collect data on structural damage caused by the EF5 tornado in the city of Moore, Oklahoma on May 20, 2013. The damage path of this tornado overlaps the damage paths of two previous tornadoes of 1999 and 2003. After the 1999 tornado several above-ground safe rooms were constructed in residences. We will assess performance of safe rooms subjected to an extreme tornado. Even though there are close to 1,000 tornadoes recorded each year, fewer than 10 are rated EF 4 or EF 5. When an EF5 tornado impacts a city there is a unique opportunity to document building damage. This tornado damaged two schools, several commercial buildings, few safe rooms and hundreds of residential structures.

We will develop contour maps of EF ratings and wind speeds based on observed degrees of damage. These maps will be compared with past tornado studies to evaluate the similarities and differences. This comparison will contribute to the understanding of the spatial characteristics of tornado wind forces on structures. Building failure progression will be determined in different wind speed zones. The benefits and challenges of using social media (twitter) to improve disaster assessment will be determined.

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<http://ibs.colorado.edu/hazards/subscribe>



Conferences and Training

September 4-6, 2013

Water and Society 2013

Wessex Institute of Technology

New Forest, United Kingdom

Cost: \$1,300

This conference will discuss the many issues facing water resource management on local and global scales. Using a multidisciplinary approach, conference sessions will address the financial, social, and industrial impacts of water scarcity. Topics include water as a human right, climate change and water management, contamination, transnational water rights, irrigation and desertification, and adaptation strategies for future demand shortages.

<http://bit.ly/14dQ3ha>

September 5-7, 2013

International Conference on Flood Resilience

University of Exeter

Exeter, United Kingdom

Cost: \$421

This conference will discuss new research in flood management planning and resilience. Topics include flood impacts on health, flood risk management plans, flood risk perception, the social impacts of urban floods, lessons learned in flood recovery, data collection and model calibration, weather radar technology in flood forecasting and analysis, urban development and flood risk, climate change, and economic growth in future risk analysis.

<http://icfr2013.ex.ac.uk/>

September 8-12, 2013

Dam Safety 2013

Association of State Dam Safety Officials

Providence, Rhode Island

Cost: \$800

This conference will explore dam safety engineering and technology. Topics include response to dam failures, new policies and guidelines for levee safety, the flood protection structure accreditation task force, blast damage experiments and simulations, tools for estimating flood impacts, and modernizing emergency action plans for dams.

<http://www.damsafety.org/conferences/>

September 16-20, 2013

36th Conference on Radar Meteorology

American Meteorological Society

Breckenridge, Colorado

Cost: \$595

This conference will introduce attendees to National Science Foundation observational research platforms and how they can be used to promote field campaigns and education. Conference topics include emerging technology, precipitation and hydrology, airborne and spaceborne radar, radar for numerical weather prediction models, and advances in microphysics estimation.

<http://www.ametsoc.org/MEET/fainst/201336radar.html>

October 21-24, 2013

International Smoke Symposium

International Association of Wildland Fire

Adelphi, Maryland

Cost: \$470

This conference will examine issues related to smoke from wildland fires and the threat smoke poses to human health, ecosystems, and the environment. Management strategies, knowledge gaps, and smoke science research will also be discussed. Topics include public health challenges, wildfire personnel exposure, climate change, transportation safety, agricultural fire smoke, and mitigation strategies for fire behavior and management

<http://www.iawfonline.org/2013SmokeSymposium/>

November 20-22, 2013

FLASH Annual Conference

Federal Alliance for Safe Homes

Buena Vista, Florida

Cost: \$265

This conference will explore best practices and lessons learned in building mitigation techniques. A \$20,000 academic competition to find ways to address catastrophic wind events will also be held. Topics include design and construction innovation, stopping the cycle of cascading disasters, mitigation-friendly building codes, and building better homes.

<http://flash.org/2013meeting/>



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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.

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