Natural Hazards Observer

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The Military's Hazardous New Mission

Soldiers of Misfortune

An Invited Comment by Allan Boyce

Americans want things quick—from burgers to disaster relief. When politicians and civilian government agencies are slow to deliver, people look to the military—the most respected public institution for nearly two decades. Yet there are costs to this reliance, including the reluctance to look for alternatives. Here we examine present and past U.S. policies, perceptions, and expectations on the use of the military in disaster relief and humanitarian operations. This article hopes to inform, educate, and set the stage for meaningful future discussions.

On Tuesday evening, January 12, 2010, a magnitude 7.0 earthquake struck Haiti on the Caribbean island of Hispaniola. In less than a minute, nearly a quarter million people were dead and a like number injured. Over one million people were homeless.

Already one of the world's poorest and most politically

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INSIDE ...

Costs and Benefits of Ecosystems for Hazard Mitigation

Swampland for sale: A steal at $6,950 an acre

The BP oil spill disaster in the Gulf of Mexico is emphasizing the sometimes veiled link between ecosystems and natural hazards. The ProAct network (www.proactnetwork.org/proactwebsite/en/resources/ecosystem-based-drr) has released a briefing paper that argues "healthy ecosystems contribute positively to community and environmental resilience."

Though not specifically a reaction to the Gulf spill, the paper points out a couple of ecosystem services provided by the environment that are relevant to the cleanup and disaster response. "Wetlands and other ecosystems can be managed to reduce the impact of floods and regulate water flow," the paper says.

And, "Natural geological systems such as sedimentation and long-shore drift can be harnessed to facilitate the development of barrier islands, providing protection to vulnerable coastal communities."

While most hazards experts recognize a link between environmental protection and natural disasters, it is not always a direct connection. A degraded environment in Haiti, for instance, has increased the long-term vulnerability of the population, but was not directly responsible for the deaths and injuries from the quake there.

There has been considerable interest in recent years among economists and environmentalists about the monetary value of services that ecosystems provide outside of traditional economic valuation—or, as we sometimes say, "for free." According to these new variations, wetlands provide the most valuable of all the ecosystem services. This was made clear in the Hurricane Katrina disaster. Over the last century, 5,000 square miles of southern Louisiana wetlands have been lost to development. Research indicates that the loss of these wetlands is directly tied to increased

storm impacts.

There are about 105.5 million acres of wetlands in the United States working away "for free" on our behalf. An estimate by the Ecoinformatics Collaboratory at the Gund Institute for Ecological Economics at the University of Vermont (ecoinformatics.uvm.edu/the-collaboratory.html) values them at $6,960 an acre per year. This would make all U.S. wetlands worth about $734 billion every year.

Louisiana alone has three million acres of wetlands, making them worth $20.1 billion a year by the Gund estimates. There are an additional 1.2 million acres of wetlands in neighboring Mississippi ($8.1 billion per year). Alabama has an additional two million acres at risk ($13.9 billion annually).

BP has agreed to set aside $20 billion—one time—for spill claims. If you include the value of ecosystem services, BP's set-aside won't even cover a full year of likely damage to the coastline.

On May 27, President Obama ordered the construction of five barrier islands to protect the Louisiana coast, at an anticipated cost of $360 million (ecopolitology.org/2010/06/03/obama-orders-bp-to-build-360-million-barrier-islands/). Louisiana Gov. Bobby Jindal does not seem impressed. He said in a press conference later, "It's been almost a week and BP hasn't done anything on that first segment … I'd much rather fight this oil on the sand than in our wetlands."

Not everyone is thrilled with the idea of five new mountains of sand in the gulf. The *Christian Science Monitor* quoted Louisiana State University's Gregory Stone saying, "The governor has not been open about sharing details. This is a mammoth engineering project, and it can be done, but it's being done willy-nilly. It's foolish to embark on a project of this scale without establishing potential negative impacts on currents, on coastal erosion, on wildlife habitat, on a whole range of environmental issues" (www.csmonitor.com/USA/2010/0524/BP-oil-spill-pushes-Louisiana-to-desperate-massive-berm-plan).

Earth Economics has released its own report on the value of lost ecosystem services, saying the BP spill threatens a "net value of $330 billion to $1.3 trillion in natural system goods and services." The group's valuation included the "free services" of protecting against hurricanes, buffering climate instability, providing water, and several other environmental goods (www.prnewswire.com/news-releases/bp-oil-disaster-threatens-mississippi-delta-goods-and-services-worth-far-more-than-bps-value-96046614.html). The Earth Economics report gave total asset values for the ecosystem services, rather than annual ones.

They Said It ...

"We care about the small people."
—BP chairman **Carl-Henric Svanberg**

"A new survey by (the) Political Psychology Research Group show(s) … huge majorities of Americans still believe the earth has been gradually warming as the result of human activity and want the government to institute regulations to stop it."
—**Jon A. Krosnick** of Stanford University, writing in the *New York Times.*

"My church spends more than $150,000, and we don't have 300 million citizens, which is what the nation has."
—**U.S. Rep. Emanuel Cleaver**, D-Mo., on the Federal Emergency Management Agency's budget for rescuing the aged and disabled, quoted by McClatchy Newspapers.

"Several studies project that the Arctic Ocean may become seasonally ice-free by the year 2040 or even earlier … The current reduction in Arctic ice cover started in the late 19th century, consistent with the rapidly warming climate, and became very pronounced over the last three decades. This ice loss appears to be unmatched over at least the last few thousand years and unexplainable by any of the known natural variabilities."
—**History of sea ice in the Arctic** in *Quaternary Science Reviews,* July 2010.

Tajikistan Polio Outbreak Raises Concern

Polio and malaria on eradication 'hit list'

The World Health Organization and the United Nations Children's Fund launched an effort in April to vaccinate 77 million children in 16 West African countries against polio. And in May, WHO vaccinated 1.1 million children in Tajikistan in an effort to reduce polio there.

Tajikistan has seen a recent outbreak of the polio virus. There have been 129 confirmed cases over the last few months, 83 percent of which were in children younger than five years. Two deaths are confirmed. This has been the first outbreak of polio in WHO's European region since it was declared a "polio-free zone" in 2002, according to a report from IRIN (www.irinnews.org/Report.aspx?ReportId=89258). By the end of May, 6.3 million doses of vaccine had been distributed in the country.

This Tajik outbreak has potential repercussions well beyond its borders. An editorial in the June 23 *Canadian Medical Association Journal* (www.cmaj.ca) says, "There is now growing concern about the potential for spread of poliomyelitis elsewhere in the world. Too many regions and communities have ceased to worry about polio. As a consequence, rates of vaccine uptake are all too often well below effective prevention levels. As a second precondition, over half a million people from Tajikistan visited over 250 countries last year, according to the Centers for Disease Control Division of Global Migration and Quarantine. In fact, the epidemic has already spread to Russia as well as neighboring Uzbekistan."

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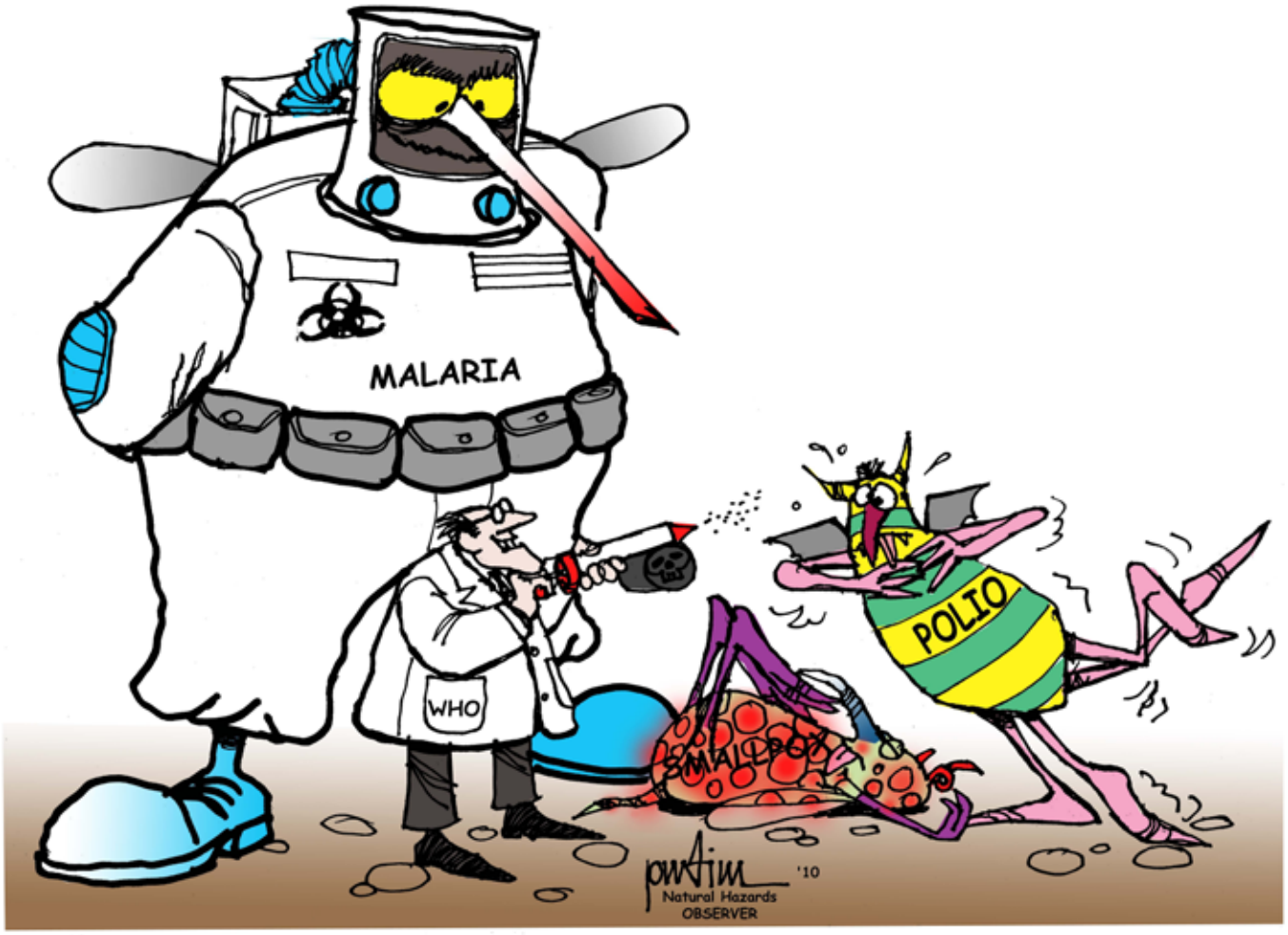

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Since the introduction and wide use of polio vaccine beginning the 1950s, the disease has been in retreat and is now close to eradication globally. It is endemic in only four countries—India, Pakistan, Afghanistan, and Nigeria. Tajikistan shares borders with two of the nations on this list—Afghanistan and Pakistan—and is quite close to India.

The current outbreak in Tajikistan appears to have been spread from India. *CMAJ* says genetic typing of the strains appear to point to Uttar Pradesh as the origin. Mass polio vaccinations have been undertaken in Tajikistan under the supervision of the World Health Organization.

But pockets of resistance to polio vaccination remain around the world. Anti-vaccine celebrity crusader Jenny McCarthy agreed in a *TIME Magazine* interview last year that parents shouldn't vaccinate their children against polio. "I do believe sadly it's going to take some diseases coming back to realize that we need to change and develop vaccines that are safe. If the vaccine companies are not listening to us, it's their f___ing fault that the diseases are coming back. They're making a product that's s___. If you give us a safe vaccine, we'll use it. It shouldn't be polio versus autism" (elisions in original; www.time.com/time/health/article/0,8599,1888718,00.html).

McCarthy blames vaccines for causing her child's autism, despite the fact that there isn't a shred of scientific evidence that there is a causal relationship between the two.

Claudia Emerson, program leader in ethics at the University of Toronto's McLaughlin-Rotman Centre for Global Health says that polio is very close to eradication worldwide. When the Global Polio Eradication Initiative was launched in 1988, there were 350,000 cases of polio. Sixteen hundred cases were reported in 2009.

The origin of the polio outbreak in Tajikistan has been been traced to India.

Only one disease has ever been eradicated—smallpox. "Polio is next in line," Emerson told the *Observer*. "It's really running a marathon. We're close to the finish line and it doesn't make much sense to stop short of the finish line. We have a moral duty to do that."

The elimination of another global disease scourge, malaria, was the subject of an article in the May 14 issue of the journal *Science*. Stefan Kappe of the Seattle Biomedical Research Institute and co-authors wrote, "The global research community must take up the challenge to work toward the eradication of malaria." They urge a strategy that would kill the parasite stages in the mosquitoes that carry it (www.sciencemag.org/cgi/content/abstract/328/5980/862).

There are almost 250 million cases of malaria annually, causing about 800,000 deaths. Eradicating this disease is a much more intractable problem than even polio. McGill University biologist Jonathan Davies told the *Observer*, "Basically, we haven't got a hope in hell of eradicating malaria. There are several strains going around. There are animal reservoir hosts. Even if we removed it from the human

population it might then reinfect us in the future, through an animal host."

Emerson says that it is often easier and cheaper to control diseases in affected populations. Reducing the prevalence of diseases in areas most affected by them is more effective and efficient, he writes in an article published online in the *Proceedings of the Royal Society B: Biological Sciences* (rspb.royalsocietypublishing.org).

He adds, "With polio, the difference is that we have it within our grasp. We could actually eliminate this disease. At the moment, it's really not feasible for malaria. Even within the United States, there have been huge efforts to remove the vector, there's still malaria present in the U.S., just at a very low level, a low prevalence."

Elsewhere on the disease front, researchers at the National Institutes of Health have developed an experimental vaccine for Ebola that shows promise. The vaccine, developed by a team led by Nancy Sullivan at the National Institute of Allergy and Infectious Diseases, protected monkeys against not only the two most lethal Ebola viruses isolated in 1976, but also against a newer species identified in 2007. The work was published in the open access journal *PLoS Pathogens* (www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000904).

Apocalypse When?

Survey says: 2050, maybe sooner

Fifty-eight percent of Americans think that another world war is likely by the year 2050, and 53 percent think there will be a terrorist attack with nuclear weapons against the United States before then, according to a June poll from the Pew Research Center for the People and the Press.

Only 31 percent think an asteroid will strike Earth by 2050, according to the survey, but 41 percent of those polled believe that Jesus Christ will return to Earth in the next 40 years. We can only hope he's back before the world war.

On a non-hazards-related note, 53 percent said that by 2050, "ordinary people will travel in space," which raises the question: Once you've traveled in space, are you still ordinary?

The Blimp is Back

China checks out airships for disaster aid

Airships are attracting attention in China for their potential use in natural disasters, according to an unclassified U.S. military report.

"Interest in the utility of airships was heightened after the 2008 Wenchuan earthquake and the problems faced by relief workers," says a report from the National Air and Space Intelligence Center based at Wright-Patterson Air Force Base in Ohio.

"There were serious bottlenecks in delivering the equipment and supplies needed by relief workers. The disaster area's terrain was precipitous. Highways were heavily damaged or blocked by landslides," the report *Current and Potential Applications of Chinese Aerostats (Airships)*, says. "Press reports indicated a need for a 'new' transportation vehicle, one that could fly over geographical barriers, carry large payloads, function safely and economically, and have an increased degree-of-freedom movement. The solution suggested was a new helium airship."

Airships can serve several functions better than traditional aircraft in disasters, according to the report. In cloudy weather, airships can cruise for long periods under the cloud layer and acquire clear remote sensing images. Properly equipped, they could provide 24-hour, all-weather monitoring of disaster areas.

There's no indication that the Chinese—or anyone else—have actually used airships in disaster relief, but China has used them on at least one construction project, demonstrating their feasibility in difficult conditions. "In May 2009 an airship was used to assist in the installation of electric power lines in the area around the mountain peak of Taishan, located near Yingxiu. Taishan is an unstable area covered in scree. It is unsuitable for the use of explosives and is an unsafe area for construction crews. By using an airship, power cables, ropes, and drop lines were installed the length of the national highway that spans the mountain," the report says.

The Long, Long Road from *Exxon Valdez* to Deepwater Horizon

An Invited Comment by Liesel Ashley Ritchie and Duane Gill

As the world watches the unprecedented environmental disaster in the northern Gulf of Mexico following the April 20, 2010, explosion of the Deepwater Horizon drilling rig, inevitable comparisons arise between this event and the 1989 *Exxon Valdez* oil spill (EVOS) in Alaska.

Where should we begin? Experts, local officials, activists, and laypersons on countless social networking sites are weighing in on the extent to which such comparisons are reasonable and meaningful. The most obvious—but often overlooked—difference between the two is that while no one died in the Alaska accident, 11 people were killed in the April 20 explosion. But this sad fact was soon overshadowed by the environmental damage and the economic, social, and cultural impacts associated with the Deepwater oil gusher.

The situation in the Gulf represents both an unfortunate segue and a unique opportunity to apply what we've learned about oil spill disasters. The overarching lesson we can share from our *Exxon Valdez* research is that the potential for negative, long-term community impacts must not be underestimated.

Shortly after the tanker ran aground on Bligh Reef in Prince William Sound, sociologists Steven Picou and Duane Gill began to document the immediate social impacts of the oil spill on the community of Cordova, Alaska. Subsequent research throughout the 1990s studied the continuing effects of the disaster on Cordova, with an emphasis on Alaska Natives and commercial fishermen.

Since 2001, the investigation has evolved to examine how the protracted litigation over punitive damages in *Exxon v. Baker*—resulting in the 2008 U.S. Supreme Court decision—has affected the lives of individuals and groups, and influenced social capital in that community.

Coincidentally, our EVOS-related research in Alaska is in its final stages as the Deepwater Horizon well continues to spew oil. As this piece goes to press, we have just returned from conducting the last of our formal data collection and fieldwork in Cordova, where reactions there to the BP oil disaster are a powerful reminder of what's in store for residents of Gulf Coast communities in the years to come.

Most folks in Cordova with whom we spoke describe flashbacks to their own experiences with the EVOS as they see television coverage of the situation in the Gulf. Said one third-generation Cordovan, "As bad as it was up here [after the EVOS], it's gonna be way worse down there. I can't watch it on TV. It brings back bad memories. [I'm reliving]

the pain all over again. It's all roaring back." Another fisherman adamantly pointed out as we sat eating our breakfast, "Here come the lies [from BP]." He proceeded to list the "three big lies" from Exxon. "The first lie: It's only 11 million gallons. The second lie: 'We will make you whole.' The third lie: Oil doesn't sink."

As disaster researchers turn our attention to the unfolding situation, Gulf Coast communities have an advantage over *Exxon Valdez* oiled communities in terms of access to a solid foundation of prior social science research in this arena. Research findings from the EVOS, other marine oil spills, and the broader body of knowledge on community impacts of natural and technological disasters offer insights about what can be expected in the immediate- and long-term. This valuable information is already being used to develop strategies to ameliorate the tragic situation for those who may be directly and indirectly touched by the Gulf Coast oil disaster.

What We Know About Social Impacts of the EVOS

As previously discussed by Duane Gill in the November 2008 issue of the *Natural Hazards Observer*, the EVOS and related litigation have had significant impacts on Cordova and other affected areas. As a community with intimate cultural, social, and economic ties to renewable natural resources, Cordova was particularly vulnerable to the effects of environmental degradation associated with the oil spill. Given the community's sociocultural relationship with the ecosystem of Prince William Sound, it is not surprising that residents initially experienced high levels of collective trauma, social disruption, economic uncertainty, community strain, and psychological stress. This was especially the case among Alaska Natives and commercial fishermen, who have particularly strong ties to renewable natural resources.

Over the years since 1989, community impacts of the EVOS have manifested as chronic collective stress, post-traumatic stress disorder (PTSD), and social disruption related to ecosystem resource losses, as well as the threat of resource loss. Research further suggests that being involved with EVOS-related litigation generated stress, anxiety, social disruption, and feelings of alienation beyond those related to the spill itself.

For individuals, groups, and communities on the Sound whose lives and culture are most closely tied to ecosystem resources, these impacts persist and have continued to negatively influence social capital.

The implications of these research findings for the Gulf Coast are already apparent.

Early Insights into Social Impacts of the Gulf Gusher

The amount of oil that's been released into the Gulf of Mexico has far exceeded that of the EVOS. In some respects, this confounds comparing the two events. The scope, scale, and potential longevity of the Gulf gusher, combined with a complex regional economy tied to an environment under siege from the oil, may best be described as "catastrophic." With that said, there are some meaningful comparisons between the two events when it comes to understanding and anticipating what Gulf Coast communities face from this catastrophe. An important similarity is that communities, groups, and individuals that are economically, socially, and culturally tied to damaged or threatened resources are most vulnerable.

The timing of the Deepwater Horizon rig blowout is reminiscent of the grounding of the *Exxon Valdez*. Both happened in the spring (April 20 and March 24, respectively)—the most biologically productive season of the year. This is not only disruptive to commercial and subsistence fishing prospects, but to long-held cultural traditions, as well. This upheaval of lifestyles is already emerging in significant, negative ways along the Gulf of Mexico—just as it did for years after the EVOS.

The environmental damage associated with the Gulf event has the potential to generate long-term resource loss for commercial and subsistence fishermen and shrimpers along the coast. This, too, resonates with the ongoing experiences of Alaskans, who since 1994 have yet to see the herring biomass return to a level where harvesting is viable. Perhaps a similar fate awaits shrimp, oysters, and certain species of fish upon which many Gulf Coast residents rely. In the BP gusher, the oil threatens many more industries and user groups along the northern Gulf including recreational fishing, tourism, and other enterprises tied to beaches, land, and other natural resources.

There are already observations of high levels of uncertainty and anxiety among area residents in Louisiana, Mississippi, Alabama, and Florida as a result of the BP disaster. This individual and collective stress is likely to lead to increases in intergroup conflict, domestic disturbance, depression, and alcohol and drug abuse. One suicide—that of charter boat captain Allen Kruse—has already been directly linked to the BP situation. The emerging toll on mental health among Gulf Coast residents suggests the potential for similar tragedies.

Early reports of such social disruption are plentiful. Over time, empirical research and formal statistics will undoubtedly bear out these narratives.

Both the EVOS and the BP oil disasters highlight issues of recreancy (blame) and loss of trust in corporations and government that is characteristic of human-caused or technological disasters. In the case of the Deepwater Horizon, this is evident as frustration and anger over accountability, lack of transparency, and finger-pointing continue to escalate along the coast and in Washington, D.C. BP's down-

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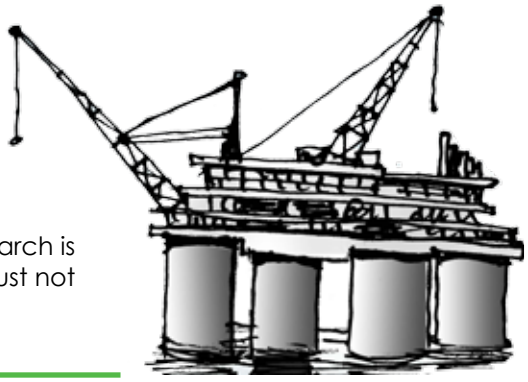

The overarching lesson we can share from our *Exxon Valdez* research is that the potential for negative, long-term community impacts must not be underestimated.

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playing of the amount of oil being released is also consistent with Exxon's approach beginning in 1989 and continuing through today. This corporate posturing sets the stage for BP to attempt to minimize responsibility for the resulting environmental, social, and economic damages.

With its pronouncements to pay "legitimate" claims and to make survivors "whole," BP has followed the Exxon playbook since immediately after the Deepwater Horizon rig blowout. President Obama's remarks that escrow funds in the amount of $20 billion represent "an important step towards making the people of the Gulf Coast whole again" does not instill a lot of confidence among those who lived through the EVOS. As one Cordovan recently put it: "That's lawyer speak for 'we're going to pay out as little as possible.'"

As with the EVOS, there is a strong likelihood of long-term, high-stakes litigation for Gulf Coast residents that could eventually be as stressful as the initial disaster itself. This goes hand-in-hand with long-term, chronic social impacts we can expect to occur, just as with the EVOS. The advice of one Alaskan fisherman to his counterparts on the Gulf Coast: "Make yourself whole … Don't rely on the oil company to do so." He added that for those who counted on Exxon, the legal system, and the government to make them whole, "the suffering [has been] unbearable."

The use of controversial clean-up techniques and strategies in the Gulf parallels EVOS. Among these issues are worker safety, dispersant use, lack of cleanup equipment, and a shortage of trained personnel to use that equipment.

According to accounts from Alaskans with training and experience in oil spill response, what they're seeing on the Gulf Coast is entirely inadequate and in many cases, inappropriate. As one woman explained, "I saw a photo of some boom being towed with water and oil [flowing] over and under it. That's useless. You can't tow it that fast." Other Cordovans we've spoken with express similar dismay, but hopefully this can be remedied as Alaskans and others are now headed to the Gulf to help train locals in effective skimming and booming techniques.

The influx of clean-up workers into affected communities is another point of comparison. "Boomtown effects," including substantial increases in local populations and the accompanying demands on the physical and social infrastructures of these communities, pose additional challenges that will last at least as long as the gusher continues.

The aforementioned similarities suggest that in many ways, what is happening to communities on the Gulf Coast is what many Alaskan communities experienced after the EVOS. As a commercial fisherman in Cordova put it, "It's exactly what happened to us—yet people seem surprised at the way things are unfolding."

There is another interesting dynamic emerging, as described by a Cordova community leader who recounted recent conversations with people on the Gulf Coast: "People in Louisiana were telling me that they see folks in Alabama and Florida experiencing what they [in Louisiana] experienced two weeks earlier. There's just a lag time. I told her, 'Honey, you're where we were 21 years ago.'"

Important Points of Departure

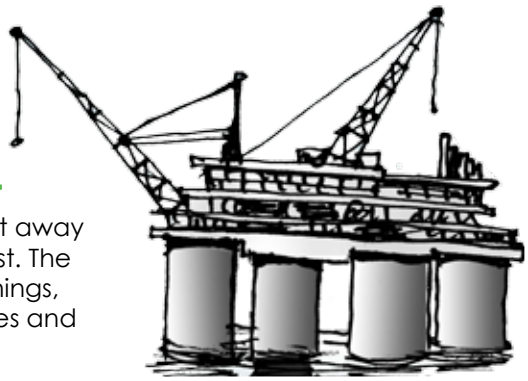
With all of that said, there are and will continue to be significant differences between the BP and the EVOS disasters.

Broadly speaking, most of the distinctions we can expect to see with respect to short- and long-term social impacts in the Gulf are a direct result of the size and geographic scope of the disaster. More oil equals the befouling of more ecosystems and developed coastline, as well as impacts on far more communities, more people, and more primary and secondary businesses than the EVOS.

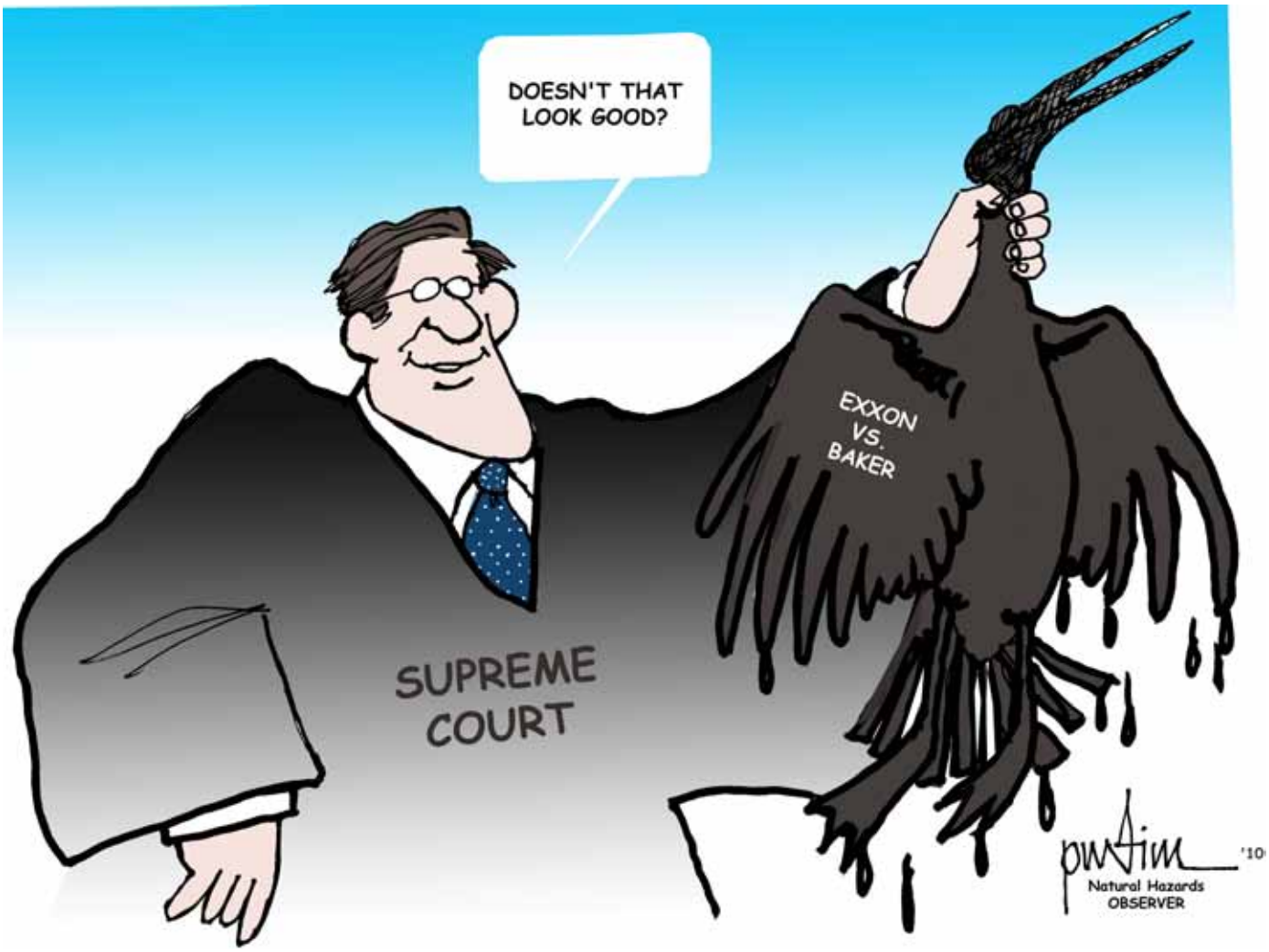
The fact that two months after the explosion, oil, methane, and other materials are still flowing from the Deepwater Horizon at rates estimated from between 56,000 barrels and 84,000 barrels per day add to the uncertainty about the extent of damages and when the disaster event can be declared over and recovery can truly begin. While the amount of oil on the *Exxon Valdez* tanker was known and finite (although figures about the amount actually spilled are still contested), the amount in the BP spill is unknowable. Although the size of oil reserves in the Gulf is not technically infinite, oil from the Deepwater Horizon could continue to leak for years, even decades. As if that weren't enough, there are additional concerns about even more geographically far-reaching impacts in the event of a hurricane or tropical storm in the Gulf of Mexico spreading the oil to Texas or further inland as a result of storm surges.

Early public responses to the rig explosion further suggest greater levels of perceived complicity and corruption between BP and the former Minerals Management Service—now the Bureau of Ocean Energy Management, Regulation, and Enforcement—than there was in the *Exxon Valdez* grounding. Based on more than 20 years of data regarding attitudes toward government, big business, and the U.S. legal system in the context of the EVOS, we know that beliefs about trust and blame are related to frustration, anger, alienation, and stress. In this milieu, we can expect these outcomes to escalate over time among Gulf Coast residents.

Another critical distinguishing feature for Gulf Coast residents as they deal with the current disaster is that many are still recovering from the 2005 hurricanes Katrina, Rita, and Wilma, as well as Ivan in 2004. In several re-



A former mayor of Cordova advises people on the Gulf Coast: "Get away from the TV set. Love your family. Take care of one another. Get rest. The disaster will wait. Children need to be hugged. Do some normal things, have friends over for iced tea. Do not become obsessed with the lies and ugliness. It isn't healthy."



spects, communities damaged by these storms are dealing with the cumulative impacts of a number of disasters, exacerbated by the current global economic crisis. The looming threat of hurricane season represents an additional, significant source of uncertainty. These stressors take a toll on various forms of community capital, including financial, human, social, built, political, natural, and cultural.

Combined, the aforementioned distinctions of the circumstances in the Gulf illuminate the immediate need for expanded mental health resources along the Gulf Coast. The suicide of Captain Kruse has served as an early wake-up call for local providers to establish mental health safety nets.

One of the positive distinctions between the EVOS and the BP situations is the fact that the location of the Deepwater Horizon rig in the Gulf of Mexico and the 24-hour video streaming of the gusher means that the disaster is more visible to the general public and that more people have direct access to the affected areas to witness the situation first-hand. The Internet, with its media outlets, blogs, and social networking sites, also affords opportunities for dissemination of information that were not readily available in 1989 when the EVOS occurred.

As they observe the events on the Gulf Coast, those who experienced the direct effects of the EVOS in the relatively remote area of Prince William Sound consider this a good thing. As they see it, because the Gulf of Mexico is in the proverbial front yard of millions of people, it will not be so easily dismissed as the EVOS has been.

Potential for Knowledge Transfer

Because more is known about social impacts of marine oil spills now than was the case in 1989, there is opportunity to bring this expertise to bear in support of Gulf Coast residents. Coastal communities from Louisiana to Florida have local knowledge and disaster-related experiences from recent hurricanes. Although policy makers and bureaucracies tend to have short memories, the importance of the latter should not be overlooked.

In Louisiana, especially, the grass-roots capacity to deal with postdisaster social issues has advanced in the aftermath of Katrina. This can be adapted and expanded to assist communities in neighboring states as the oil spreads along the coast. A recent visitor from Alaska to the Gulf Coast encouraged residents there to "Find their own voices, their own local champions" and to not rely on outsiders to do it for them.

Based on their experiences during the past 21 years following the EVOS, the people of Prince William Sound are providing insights to Gulf Coast residents about what to expect as the BP tragedy unfolds. For example, the community guidebook to coping with technological disasters developed for the Prince William Sound Regional Citizens' Advisory Council is being used in Gulf of Mexico communities. Several individuals from Prince William Sound have spent time in Gulf of Mexico communities and talked with local officials and informal leaders. Further, the shar-

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ing of information and support via social networking sites and blogs is also prevalent (e.g., see Facebook for the group Alaskan *Exxon Valdez* Oil Spill Survivors in Solidarity with the Gulf Coast).

At the very least, with effective information dissemination, residents of Gulf Coast communities should have a better idea of what to expect. They'll be in a position to seek assistance and to develop coping strategies appropriate for their local contexts.

What's Next?

The experience in the aftermath of the EVOS—and Hurricane Katrina—further highlights that dealing with this catastrophe will be a marathon. Twenty-one years post-EVOS, individuals, groups, and communities are still coping with the aftermath of that disaster. Some people have moved on from the event, but for others, closure on this disaster will only occur when they die.

The overwhelming nature of the unfolding catastrophe in the Gulf of Mexico leaves many wondering what, if anything, can be done. Out of every challenge rises opportunity and seeking these prospects is an important first step. First, there is an opportunity to use this event to re-examine our current energy policies and move toward a more rational policy based on renewable energy sources. This calls for self-examination of our individual lifestyles and roles in contributing to our society's addiction to petroleum. Research is needed to provide sound information to policy makers and decision makers, as well as to voters, on what policies are best to pursue. There is also an opportunity to re-examine our ideas of coastal resilience.

Although considerable effort as gone into understanding coastal resilience in the wake of recent hurricanes, less attention has been given to human-triggered threats like a deepwater oil gusher.

As for Gulf Coast residents, studies are needed that will enhance understanding of what is happening to them and their communities and help to diminish negative social impacts of this catastrophe. To date, findings of disaster-related research have demonstrated that many negative impacts reflect diminished social capital—loss of trust, perceptions of recreancy, lack of reciprocity, avoidance behaviors, internal strife and conflict, and decline in civility.

For coastal communities along the Gulf of Mexico, potential for loss of social capital is related to anxiety, uncertainty, and insecurity brought about by environmental degradation. What Gulf Coast residents are experiencing is very familiar to many people who have survived other technological disasters. It is crucial to help those being affected by the BP catastrophe to understand that they are not alone and to push decision makers to provide financial and human resources to address the growing need for social support. Moreover, it is important to study and document the successes and shortcomings of formal and informal responses to this event.

Perhaps most importantly, we must remember to support coastal communities in the Gulf over the long term. Although considerable attention is currently focused on the catastrophe, this nation—indeed, the world—tends to have a short attention span driven largely by whatever interests the media. Although obsessing over the situation is not recommended, keeping it in mind is necessary. Complacency, as we have seen, is dangerous. For residents of the Gulf Coast, the journey beyond this most recent disaster will be a long one. On that note, in preparing for this marathon, a former mayor of Cordova advises people on the Gulf Coast: "Get away from the TV set. Love your family. Take care of one another. Get rest. The disaster will wait. Children need to be hugged. Do some normal things, have friends over for iced tea. Do not become obsessed with the lies and ugliness. It isn't healthy."

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The authors wish to thank Steve Picou for his insights and suggestions on drafts of this article.

For more information and references related to the Deepwater Horizon oil disaster refer to **www.colorado.edu/hazards/oilspill_deepwater.html**.

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troubled nations, Haiti already was host to the United Nations Stabilization Mission and numerous non-governmental organizations providing support and coordinating aid with the government of Haiti. All of these organizations suffered losses and their ability to function was greatly impaired in the aftermath of the quake.

The underpinning of any disaster relief operation is logistics. The U.S. military is the only organization in the world that has moved the entire contents of a medium-sized city halfway around the world and back again—twice—in the last two decades. With its vast logistical resources, planning experience, and flexible mission structure, it became the de facto "first responder" to the Haiti quake disaster.

Most Americans were probably not surprised by this role. But in fact, it is only in the last decade or so that the military has become the "go to" organization for response to major disasters. The reliance on the U.S. military for humanitarian assistance makes sense, given that it can bring overwhelming capabilities to bear quickly. However, this assumption of military humanitarian assistance has important implications for the military's strategic national missions, as well as future humanitarian crises.

Many Americans may be surprised to learn that this humanitarian mission is controversial both within the military and outside it. There is fear the humanitarian focuswill detract from the military's primary mission—to prepare for national defense and war. Some aspects of humanitarian assistance may aid in the traditional mission, but others may harm it.

What is the basis for the U.S. military's lead in providing foreign disaster assistance—as in Haiti—as opposed to leadership by the United Nations and humanitarian NGOs? Why are U.S. military forces becoming increasingly involved in domestic disaster relief operations? What conflicts and concerns exist at the strategic level when decisions are made to prioritize the U.S. military in stability and civil support missions? What can be expected at the operational and tactical levels when U.S. forces deploy? What are the trends for future use of the U.S. military in humanitarian operations? These questions are being debated by policy makers, academicians, and average citizens alike.

The Disaster Milieu

Whether due to global climate change, shifting demographics, near instantaneous communications capability, or a combination, the beginning of the 21st century has ushered in an era of devastating natural disasters: the Indian Ocean tsunami in 2004; Pakistan's 2005 earthquake of 2005; hurricanes Katrina, Rita, Ike and Gustav; the Haitian earthquake; the Szechuan quake; Cyclone Nargis in Myanmar; and so on. The severity of these disasters has also introduced the term "catastrophic disaster," implying the necessity of global response and cooperation.

Disasters are usually seen as localized and of short duration, with victims having to make do for a few days until assistance is firmly in place, enduring months of rebuilding homes and lives, eventually returning to a "new normal"

over the course of a year or two.

Catastrophes are devastating events with a tremendous loss of life, property, or both. Help may not arrive for days, leaving victims to feel they "are on their own." There may be a complete loss of civil infrastructure. This can include overwhelmed public safety agencies with little police, fire, or EMS response; no electricity, municipal water, or communications; and the failure of fuel and food supplies. Recovery is very long term, measured in years.

The ink is barely dry on the reports of lessons learned from one disaster when the next strikes, with little time for reflection or the implementation of corrections. The civil resources of governments and private organizations have been overwhelmed in the initial stages of many recent disasters. The scope of these disasters is causing governments, NGOs, and commercial interests to reevaluate their roles and their operations. There is a sense of urgency within the emergency management and disaster relief community at all levels. Processes and structures are needed to combine and transform the resources that each individual organization brings to the table.

This is still an emerging process. In the interim, military forces are increasingly called upon as first responders, particularly the U.S. military.

A Busy Decade

The past decade has been a busy one for the U.S. military—fighting a war on two fronts while conducting the largest organizational transformation in 30 years.

Prior to September 11, 2001, the military neatly compartmentalized the missions of national security, domestic

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support, and foreign humanitarian assistance. Until the 1991 dissolution of the Soviet Union, the preponderance of active duty forces were oriented toward Cold War enemies. Defense of the continental United States was the job of the National Guard and the Strategic Air Command.

Overseas humanitarian missions were seen as detracting from war fighting skills. These efforts were generally avoided—though notable exceptions include support to Bangladesh after a devastating typhoon in 1992 (Operation Sea Angel) and assistance rendered to Caribbean and Central American nations after Hurricane Mitch in 1998 (Operation Fuerte Apoyo). The military was happy to have the Department of State and other civilian aid organizations coordinate with the United Nations to conduct international relief. As late as 2000, Department of Defense briefings on supporting foreign disaster relief operations focused on involvement only under specified conditions, only in a supporting role, and always with an eye on the exit conditions.

In the wake of the Indian Ocean tsunami and Hurricane Katrina, then-President Bush debated whether the Department of Defense should become the lead federal response agency for all natural disasters. A *Washington Times* article on September 26, 2005, noted the president favored increasing the Pentagon's powers in this arena. Bush said, "It is now clear that challenges on this scale requires (sic) greater federal authority and a broader role for the armed forces—the institution of our government most capable of massive logistical operations on a moment's notice."

By the end of 2005, the president and the DoD had both issued documents—National Security Presidential Directive 44 (Management of Interagency Efforts Concerning Reconstruction) and DoD Directive 3000.05 (Military Support for Stability, Security, Transition, and Reconstruction)—establishing stabilization and reconstruction as key elements of U.S. national security. These new policies amended the joint military doctrine that had previously maintained, "The Armed Forces of the United States exist to deter war and protect the security of the United States and its national interests." Stability operations in other nations, which include foreign humanitarian assistance and civil support, became core DoD missions on an equal priority with combat operations. Most of the military's emphasis, though, deferred to the ongoing conflicts in Iraq and Afghanistan rather than stability operations.

While the U.S. military's response to overseas natural disasters is primarily an ad hoc arrangement, almost never exercised or conducted the same way twice, the domestic response situation represents an entirely different picture. The Stafford Act, the National Response Framework, the National Incident Management System, and a host of other laws, directives, and regulations now prescribe how and when the U.S. military may react to a natural or man-made disaster on U.S. soil. This is an entirely new development in our nation's history.

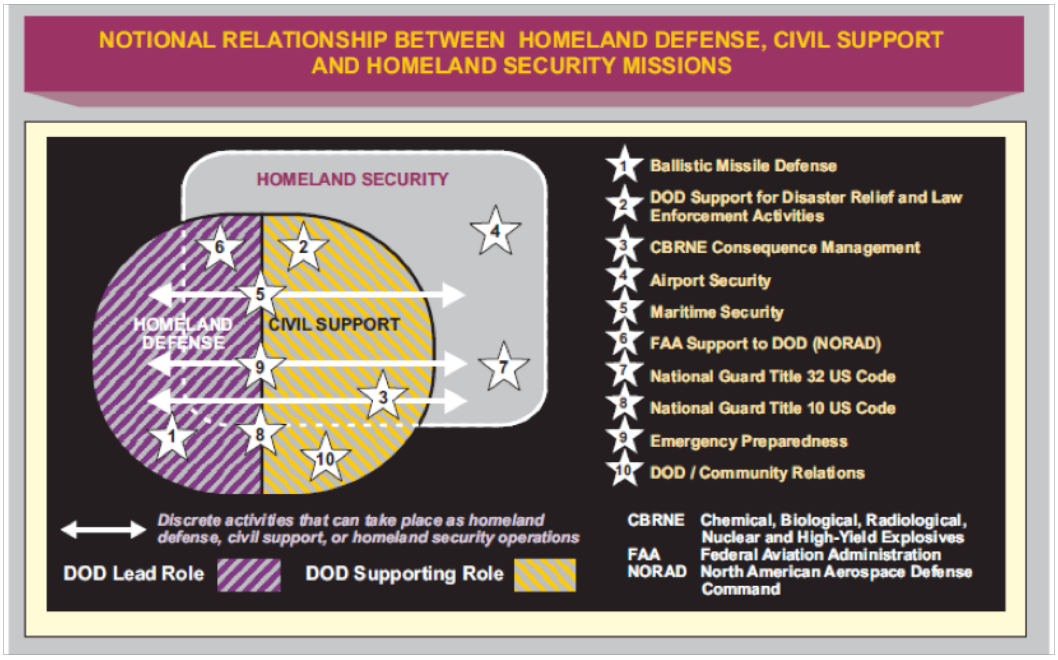
Changing Response

Until the early 1900s, disaster response in the United States was primarily a local and state responsibility. State governors used militias to provide disaster assistance. When the National Guard came into being in 1916, it took over the role. Though use of federal forces was rare, federal military commanders always had the option to respond to prevent the loss of life or property. During the 1906 San Francisco Earthquake, General Frederick Funston and a large share of the Army took charge of the relief and recovery mission. Nothing like this occurred again until 1992 and 2005, when the federal government response to hurricanes Andrew and Katrina saw the largest domestic deployments of U.S. troops since the Civil War.

The September 11, 2001, attacks caused much soul-searching by national leaders over the nature and meaning of homeland security, homeland defense, and defense support to civilian authorities (DSCA) (see figure, below). New organizations were created seemingly overnight.

In 2002, The Department of Homeland Security was assembled, placing a polyglot of federal agencies under one roof. Its cabinet-level secretary became the principal federal official responsible for national incident management. That same year, the U.S. military stood up a new geographic combatant command known as the Unites States Northern Command, or NORTHCOM (See figure, page 14), charged with conducting military homeland defense of the continental United States and providing civil support to federal agencies.

The less-than-stellar response by civilian officials at all levels to Hurricane Katrina prompted new legislation and many changes, including a new emphasis by the military on civil support. U.S. Army Lieutenant General William Caldwell, then the commander of the



Combined Arms Center, was quoted in a February 8, 2008, *New York Times*, "Army doctrine now equally weighs tasks dealing with the population—stability or civil support—with those related to offensive and defensive operations."

The Department of Defense released the *National Defense Strategy* in June 2008 which said in part, "While defending the homeland in depth, DoD must also maintain the capacity to support civil authorities in times of national emergency, such as in the wake of catastrophic natural and man-made disasters. DoD will continue to maintain consequence management capabilities and plan for their use to support government agencies. Effective execution of such assistance, especially amid simultaneous, multi-jurisdictional disasters, requires ever closer working relationships with other departments and agencies, and at all levels of the government. To help develop and cultivate these working relationships, DoD will continue to support the Department of Homeland Security (DHS), which is responsible for coordinating the federal response to disasters. DoD must also reach out to nongovernmental agencies and private sector entities that play a role in disaster response and recovery."

The Army likewise made changes. In the Army Strategy document dated August 2008, the number one objective out of five listed was to "Defend the homeland [by] continuously deterring, detecting, and defeating external threats to the U.S. homeland through an active defense in depth, *and to surge to contribute to the response and management of catastrophic events*" (emphasis added.)

The New Role of the Military

The increasing role of the U.S. military in domestic disasters worries many people in and out of uniform. Some fear the loss of local control even though the mantra of NORTHCOM is that the federal government does not replace state and local authority or responsibility. NORTHCOM commander, General Victor E. Renuart Jr., said in 2009 that the role of the command was, "bringing capability and capacity at the right time at the right place, not overwhelming the receiving state, but bringing in something that is sorely needed. The governor is the commander in his or her state. We work to find the right way to put together the capabilities of the federal government in support of the capabilities of the state and look for ways to continue to partner to make the job of the states easier when it comes time to respond within their own state."

For the first six years of its existence, NORTHCOM was solely a planning and command-and-control headquarters with no assigned forces. In October 2008, an active duty brigade combat team of 3,600 soldiers was placed under NORTHCOM command. As of April 2010, the command has over 15,000 active duty, National Guard, and Reserve forces assigned on a rotational basis.

Some fear the loss of personal liberties and freedom. The full Department of Defense definition of civil support from *Joint Publication 3-28* reads, "Support to U.S. civil authorities for domestic emergencies, and for designated law enforcement and other activities." It is the law enforcement and "other activities" portion that scares people. The attitude of the American public toward their military is an issue sociologists, politicians, and commentators have been tracking for the last three decades. On one hand, the public has a flag-waving, bumper-sticker, yellow-ribbon patriotism. Against this must be juxtaposed the fact that the guy with the "Support the Troops" magnet on his car knows more about his local sports franchises than he does about the military.

"When it comes to domestic policing, the military should be the last resort, not the first responder. Putting soldiers into peacekeeping roles will degrade their war-fighting skills."

—Gene Healy, Cato Institute

Prudent critics are raising serious concerns and questions about the military's role. In the same *Washington Times* article of September 26, 2005 where President Bush called for an expansion of the military role in civil support, Gene Healy, the senior editor of the libertarian Cato Institute, said, "When it comes to domestic policing, the military should be the last resort, not the first responder. Putting soldiers into peacekeeping roles will degrade their war-fighting skills." The reality is that a change in the Posse Comitatus Act of 1878 would be required for increasing active forces' employment in some domestic roles. The Congress does not currently seem inclined to debate the issue.

Some fear the U.S. military is straying from its primary mission. Protection of individual liberties and freedoms is essential, and though some may be tempted to debate precedence, they go hand-in-hand with national security like the two sides of the same coin.

At the strategic level, the simple phrase, "protecting the security of the United States." encompasses everything from the large concepts of power projection, forward deployment, and homeland defense to the smaller scale tasks of maneuvering a squad of eleven men or women in battle. Each service—Army, Navy, Marines, and Air Force—develops its own doctrine based on the specific roles and responsibilities of how it will defend the nation.

The Quadrennial Defense Review completed in March 2010 was conducted by defense civilian authorities with input from all military services. The goal of the QDR was to evaluate what the U.S. military looks like now and see if it will work for the future. A component of this discussion is the roles of the reserve forces, both the state-controlled National Guard (Title 32) and the federal Reserve from each service (Title 10).

For the past eight years, the National Guard and Reserves have fulfilled an operational role different from their pre-9/11 status as a strategic reserve. They are now an integral part of the war fighting forces in the American military. In a *Defense Review News* article from February 1, 2010, Chairman of the Joint Chiefs of Staff Admiral Michael Mullen said, "Access to the reserve components remains a critical lever for meeting global operational demands without substantially increasing the size of the active force."

The QDR says the "challenges facing the United States today and in the future will require us to employ National Guard and Reserve forces as an operational reserve to ful-

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fill requirements for which they are well-suited in the United States and overseas." The QDR calls for the designation of 10 homeland response force packages to correspond to each Federal Emergency Management Agency region. Composed of National Guard units, these homeland response forces would plan, train, and exercise with states in their regions to respond to natural or human-caused incidents.

Many Sides in the Debate

There are many sides in the debate over the proper role of the U.S. military in disaster relief. Some would agree that the National Guard should be structured solely as a homeland defense force with additional disaster response duties and only mobilized for federal service in times of total war or national survival. Others believe that in this era of persistent conflict, the use of the National Guard as a part of the operational force—deployable and interchangeable with active duty troops—is a necessity.

Changes have already taken place in the relationship among the president in his role as commander-in-chief, state governors, and the National Guard. Though usually just a formality, the president formerly required the approval of a governor to transfer a state's National Guard forces to federal control. However, under Executive Order 13528, signed by President Obama on January 11, 2010, a council of governors created by the executive branch now has that responsibility. The president no longer requires a state governor's approval to activate forces in that state.

In the federal active Army realm, doctrine from *Field Manual 3.0, Operations* dictates that forces equip and train for full spectrum operations—offense, defense, stability, and civil support. Yet some believe that given limited time and resources, it is in the best interests of the nation if the federal Army forces focus on only first three.

Another point of view says frequent nation-building—abroad or at home—reconstructing a war-torn nation in a stability operation, or providing civil support to states savaged by a natural disaster should not be a primary mission of the active U.S. military. One camp believes that the irregular warfare and counterinsurgency of Afghanistan and Iraq will be the *de rigueur* future of warfare, while the other camp worries that skills in combined arms operations—infantry, armor, artillery, aviation, and logistics working in concert—have atrophied from ten years of fighting insurgents. In a blog on the website of *Small Wars Journal* in April, Col. Gian Gentile asked the question, "But what if the American Army has to fight somebody in the future beyond insurgents laying IEDs [improvised explosive devices]…? Could we do it? Competent field armies, skilled in all-arms warfare, are not made overnight."

While this debate rages, the U.S. military continues to mobilize and deploy for humanitarian and civil support operations. At the operational and tactical levels of war, the military focuses on the management and control of the systems and procedures necessary to deploy, fight, and sustain forces. Transposing these assets into a disaster relief situation provides tremendous capabilities of which many relief organizations are unaware. Military capabilities intended for war perform the dual role of relieving suffering in peace. Ships, airlift, helicopters, logistics, and engineering vehicles—all have been used in disasters. Plucking someone from a rooftop in New Orleans' 9th Ward is not so different from recovering a downed pilot in combat.

The U.S. Military in Haiti

The U.S. military's capabilities are highlighted by its accomplishments in Haiti. World response to the catastrophe was immediate. Planeloads of relief supplies and search-and-rescue teams began arriving within 24 hours. The quake damaged Haiti's already weak transportation infrastructure. Civilian air traffic controllers at Toussaint L'Ouverture International Airport couldn't maintain any control over inbound relief aircraft. A team from the Air Force Special Operations Command arrived the evening of January 13. They restored order to air traffic operations. This was the first element of what would become a massive U.S. military humanitarian aid mission.

At the peak of military involvement in early March, more than 20,000 American soldiers, sailors, airmen, and Marines were located in Haiti or just offshore. Soldiers and Marines distributed relief supplies, both directly to the Haitian people and to NGOs running displaced persons camps and aid sites. They helped the Haitian National Police restore order. Army and Navy port operations specialists established logistics-over-the-shore sites to receive the large quantities of food and emergency supplies off-loaded from commercial ships.

Navy construction and dive experts restored operations to the crippled Port-au-Prince seaport. Doctors and nurses aboard the Navy hospital ship *USNS Comfort*

performed life-saving operations. Air Force air traffic controllers opened, organized, and expanded the air bridge that served as the lifeline in the early days of the disaster. Air Force crews flew countless missions delivering emergency supplies and personnel. Department of Defense civilians across all services prepared units for deployment and coordinated efforts with counterparts in other government agencies. Thus the DoD disaster relief mission was very aptly named—Operation Unified Response.

These operations were not without their problems. Initial criticism of the U.S. military efforts centered on a perceived bias in the prioritization of aircraft allowed to land in Haiti. As the military presence increased, it seemed to some organizations that the United States was taking over the country. Though untrue, this was a source of embarrassment to the U.S. and Haitian governments as the welcoming and enthusiastic entreaties of many Haitian citizens called for the U.S. to resume control over their country as it had done in the early twentieth century.

Commanders and public affairs officers were quick to point out that the military was only there to support the official democratic government. They would depart as soon as possible. UN organizations and NGOs chafed at control-oriented military procedures, but were themselves uncertain when they would be able to assume responsibility for the recovery mission. The United States and the United Nations signed an agreement on January 22, 2010 assigning specific responsibilities to each. The UN and the Haitian government would handle local security and law and order, while the United States worked on roads, airports, and the seaport.

By late April, U.S. forces were down to 10 percent of their initial deployment because of the expanding capabilities of civilian relief organizations. Some military training exercises focusing on medical and humanitarian relief are planned for the next several years.

The Future

The future holds many possibilities, all subject to the political tides and public opinion. Recent headlines and reports provide clues, several of which do not bode well in terms of commitment, exercise, and planning. While civil support will remain a primary DoD mission and a focus of NORTHCOM, the next rotation of U.S. military forces due for assignment to the command will be smaller and consist of more headquarters units versus "muddy boots on the ground" providing actual support.

Large-scale exercises may be on the wane, while planning activities may increase. In early April, the 2010 National Level Exercise designed to portray events following a terrorist nuclear detonation in Las Vegas was cancelled for political reasons. Because the proposed substitute tabletop exercise would not meet its training needs, NORTHCOM pulled out of the NLE. Already there are discussions to reduce the size of the 2011 NLE designed to test reactions following a Midwest earthquake along the New Madrid fault.

The Department of Homeland Security Office of the Inspector General released a heavily redacted report in February 2010 referencing the department's progress in federal incident planning. The report charged that two years after Congress had required DHS to produce federal incident management plans for all 15 National Planning Scenarios, "a full set of plans has not yet been completed for any of the scenarios." Perhaps an option would be for U.S. military planners to assist DHS and FEMA.

To borrow the lyric from a classic rock hit, "So where do we go from here?" In the December 31, 2008 issue of *TIME Magazine*, journalist-lawyer Siobhan Morrissey wrote a well-balanced article titled, "Should the Military Be Called in for Natural Disasters?" Her next to last line in the article read, "Reasonable minds can and do differ on this subject." But it was her noncommittal final sentence that reasonable minds should find unacceptable: "Only future disasters will reveal who's right."

While writers and news commentators may be afforded the luxury of a final dramatic line with no consequences, elected officials, public servants, and policy makers are not. People from Port-au-Prince to Yazoo City deserve better. The dialogue among all levels of government, private industry, and academia must continue concerning the roles, responsibilities, and mission in responding to domestic and international humanitarian crises—of the United States in general and the U.S. military in particular. There is also more than enough room for fair-minded, critically thinking individuals to enter this dialogue on a personal level. The informed, collaborative efforts of many diverse viewpoints and beliefs will eventually coalesce into the policies, law, and doctrine that will impact the U.S. military and the nation for a generation to come.

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References

For further information and assistance, here is a short list of military publications that everyone interested in disaster relief should have on hand to understand the missions, roles, responsibilities, and capabilities of the U.S. military. These are all unclassified and can be found using any Internet search:

(JP is a joint publication, applying to all services; FM is a field manual (Army); and AR refers to Army regulations.)

JP 3-08, *Interagency, Intergovernmental Organization, and Nongovernmental Organization Coordination during Joint Operations,* (Volumes I & II)
JP 3-27, *Homeland Defense*
JP 3-28, *Civil Support*
JP 3-29, *Foreign Humanitarian Assistance*
FM 3.0, *Operations*
FM 3-07, *Stability Operations*
FM 3-28, *Civil Support Operations*
AR 525-27, *Army Emergency Management Program*

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 HAZARDS

Ethics for Disaster. By Naomi Zack. 2009. ISBN: 978-0-7425-6494-7. 143 pp. $59.95 (hardcover). Rowman & Littlefield. www.rowmanlittlefield.com.

It's not often you can call a book about ethics a "wild ride"—the phrase doesn't pop to mind reading Aristotle, for instance—but Naomi Zack has managed to produce a book about disaster ethics that combines scholarly rigor with all the adventure and unexpectedness of real-world hazards.

To illuminate her points, Zack explicates the tried-and-true ethical dilemmas of "lifeboat ethics." But she doesn't stop there. She also draws examples from the movie *Snakes on a Plane,* from Cormac McCarthy's brilliant literary novel *The Road*, the graphic novels of Art Spiegelman, and the thrillers of Vince Flynn with stops along the way at Bob Dylan, Emmanuel Kant, and many other suspects, both the usual and the unusual.

Zack explores a real-life case of lifeboat ethics that occurred at Lifecare Hospitals in New Orleans. Patients at that hospital who couldn't be evacuated in face of Hurricane Katrina were left behind and then euthanized by a doctor. The presumption was that the doctor had killed the patients to prevent even worse suffering. A grand jury refused to indict. The charges against the doc were expunged, and the state of Louisiana agreed to pay the physician's legal fees.

The question of how to make ethical decisions in a disaster is a complex one. Zack turns it around on all its sides. In the end, she admits that nothing is "proved," but offers a "code of ethics for disaster" that includes a moral obligation to plan for, as well as respond to, disasters. She also calls for individual responsibility, fairness, and actions that are moral based on the principal of "fairly saving all who can be saved with best preparation."

Long-term Perspective in Coastal Zone Development: Multifunctional Coastal Protection Zones. By Frank Ahlhorn. 2009. ISBN: 978-3-642-01773-5. 220 pp. $129.00 (hardcover). Springer. springer.com.

The effort to protect the southern North Sea coastal zone is becoming more expensive and elaborate. Ahlhorn's effort focuses on the German portion of the region, especially Lower Saxony. The dissertation focuses on climate change as a future factor affecting the coast.

Hospital Emergency Response Teams. By Jan Glarum, Don Birou, and Edward Cetaruk. 2010. ISBN: 978-1-85617-701-6. 242 pp. $49.95 (softcover). Butterworth–Heinemann. elsevierdirect.com.

It's hard to say how much influence a book is going to have when it says on page two that "the person filling the command position should not necessarily be the chief executive officer" for a hospital facing an emergency response event. This is a harsh truth that the CEO may not be happy to hear. But the assertion is just the opening frame of this no-nonsense textbook for hospital emergency response planning. The three authors prescribe meticulous planning in an all-hazards framework for getting a hospital to be nimble enough to react appropriately.

The book is clear and direct in its prescriptions with plenty of checklists and questionnaires for planners. Of particular interest is the second chapter, "Assessment of Likely Mass Casualty Events," which lists the kinds of problems hospitals are likely to face in a wide-ranging disaster, and what preparations must be made to deal with them.

CLIMATE CHANGE

Climate Change and Sustainable Development: New Challenges for Poverty Reduction. M.A. Mohamed Salih, editor. 2009. ISBN: 978-1-84844-409-6. 311 pp. $121.50 (hardcover). Edward Elgar Publishing. www.e-elgar.co.uk.

It's a major issue in most of the world, seldom mentioned in the climate debates in the United States—poor countries will suffer the most from global climate change. Progress toward sustainable development in these countries has already been "agonizingly slow," says M.A. Mohamed Salih in this book's introduction. And then along comes a changing climate to change the rules even more. "Climate change challenges to sustainable development and poverty reduction are different from those prevalent during the 1980s and 1990s," he writes.

This collection of papers tackles a lot of tough issues on this front, primarily from the perspective of governance. It deals with many important issues that remain unresolved—the rights of children, environmental refugees, poverty reduction, ecosystem services, ecologically stable urban areas, and many others.

The book is densely packed with ideas (and a little dense in the prose department), but very ambitious and innovative in its approach to the problems and potential of sustainable development in the face of a changing climate.

Social Dimensions of Climate Change: Equity and Vulnerability in Warming World. Robin Mearns and Andrew Norton, editors. 2010. ISBN: 978-0-8213-7887-8. 320 pp. $30 (softcover). World Bank Publications. www.worldbank.org/publications.

Social Dimensions of Climate Change makes a nice companion volume to *Climate Change and Sustainable Development* (above). "The causes and consequences of climate change are intertwined deeply with global patterns of inequality," write the editors in the lead essay. The book casts a wide net in its exploration of these inequities, from gender issues to migration to the impacts on armed conflict.

The news on the climate-justice front isn't all bad. A

link between armed conflict and climate change, for instance, hasn't been demonstrated. It may in fact be negative—that is rising temperatures may be associated with reduced conflicts. "In statistical terms," the book says, "the post-Cold War correlation between conflict and temperature deviation is negative and statistically significant. Such a bivariate assessment should be interpreted with caution, but it serves to call for similar caution when claiming a causal connection between climate variability and armed conflict."

Another concern this book deals with is the issue of migration associated with climate change. But, "We roundly conclude that large-scale community relocation resulting from either chronic or sudden-onset environmental disasters related to climate change is unlikely to be a common response over the next 20 years," says one essay.

In the September 2009 *Observer*, United Nations University economist Koko Warner said data are not complete enough to know whether people are actually being motivated to migrate because of climate stress. "What we've seen from the field is anecdotal," she said.

Social Dimensions of Climate Change says, "The adaptation of people adversely affected by climate changes will be based on predisaster characteristics, economic opportunities, and political stability."

Heat Stroke: Nature in an Age of Global Warming. By Anthony Barnosky. 2009. ISBN: 978-1-59726-197-5. 269 pp. $26.95 (hardcover). Island Press. www.islandpress.org.

Most of the hand-wringing that goes on about global warming concerns the phenomenon's impact on human beings. This usually consists of dire warnings about the natural catastrophes that will befall humanity if we don't address the issue, counterpoised by the warnings of the economic catastrophes that will befall us if we do. Anthony Barnosky has written a compelling and interesting book about the impact of climate change on the natural world, especially the creatures that make life on Earth an interesting and sometimes perilous adventure.

To take one example combining the interest in climate and the peril, Barnosky talks about the whitebark pine in the greater Yellowstone ecosystem: "The prognosis for whitebark pines in Yellowstone is not good given the climate models," Barnosky writes. Well, so what? Whitebark pines are not high on most people's list of critical species.

But they are high on the list of important species for grizzly bears, which rely on whitebark pine nuts during times of the year when other food sources are in short supply. Some studies suggest that if whitebark pine declines below a certain level, the grizzlies can't survive in Yellowstone. "Indirectly, Yellowstone's whitebark pine anchors the entire subalpine forest ecosystem, as it builds habitat for a host of other species through rapidly establishing and promoting tree islands in the harsh conditions near tree line," he writes.

From here, Barnosky segues into a discussion about the mountain pine beetle, which is killing off forests all over the West, probably because winters no longer get cold enough to control the population. And those grizzlies are migrating northward, interbreeding with polar bears—their distant cousins—then producing fertile offspring.

And so on.

When I first started covering climate change way back at the beginning of this century, a mantra often repeated by climate skeptics was that the observations didn't fit the models, and the observations were the important thing. Barnosky provides a mountain of observational evidence that confirms the warming hypothesis across a broad and deep spectrum of life. And he offers some limited prescriptions about how to address the problems.

Usable Thoughts: Climate, Water and Weather in the Twenty-First Century. By Michael Glantz and Qian Ye. 2010. ISBN. 978-92-808-1186-5. 246 pp. $10 (softcover). United Nations University Press. www.unu.edu/unupress.

Michael Glantz is cornering the market in science books you can read on the subway. *Usable Thoughts* is another small format effort—his previous one was about hazard warning systems—presenting sophisticated information in an accessible way. "The book presents a collection of thought-provoking statements about various aspects of climate, water, weather, and society that are taken from the World Meteorological Organization publication *Climate: Into the 21st Century,*" explain the authors in the preface.

Each page of the book contains a few short paragraphs summarizing a critical point in climate-water issues: what is climate; climate from historical accounts; trends in cyclone numbers; drought in Africa; and so on. These are accompanied by colorful, informative graphics that illustrate the point being made.

The authors explain this intricate information clearly in bite-sized pieces, but without dumbing it down. This is the sort of book that might make you think science isn't so complicated after all.

Green CITYnomics: The Urban War Against Climate Change. Kenny Tang, editor. 2009. ISBN: 978-1-906093-21-1. 298 pp. $40.70 (hardcover). Greenleaf Publishing. www.greenleaf-publishing.com.

A lot of the things that make cities livable places are also things that will assist in the mitigation of climate change. In the June 2010 *Atlantic,* Christopher Leinberger writes that, in the United States at least, "Two-thirds of all households today consist of singles, childless couples, or empty-nesters, and that proportion will rise over the next 20 years. All of these groups tend to prefer walkable urban housing. Millenials—the rising generation of 20- and 30-somethings—are particularly drawn to urban living, seeing it not only as exciting but as healthy and environmentally friendly."

Green CITYnomics enlarges on the economic and social stakes involved around the world in the effort to make cities friendlier to the climate. Tang and company offer a guardedly hopeful message. While acknowledging that urban sustainability has so far been honored more in the breach, they offer the "odd glimmer of hope" that climate change my "trigger society's first ever real effort at a sustainable future."

The book looks at these issues concretely, with examples from Hong Kong, the Baltic, China and other problem urban areas around the globe. In a chapter on "unsustainable land uses," authors Charles Schartung and David Simpson consider the problem of repetitive losses, the issue of why people build in floodplains, and what to do about it. They provide a six-point plan of recommendations for action, with examples of typical "best practice." These are

Resources ...

(Continued from page seventeen)

primarily U.S. based, involving mostly buyouts and relocations. It's telling that none of their "best practice" examples highlight preplanning and zoning successes. "Only through an organic process of feedback and decision making can we begin to understand long-term impacts of natural disasters, especially as the impending crisis of climate change and global warming pushes these events to the forefront of society."

Climate Change and Gender Justice. Geraldine Terry, editor. 2009. ISBN: 978-1-85339-693-9. 203 pp. $19.50 (softcover). Practical Action Publishing. www.practicalactionpublishing.org.

Equity issues are some of the most important yet least discussed questions in the debate over climate change. Most people offer perfunctory acknowledgement that poor nations will suffer most, but the admission seems to lead nowhere.

Climate Change and Gender Justice takes on the subject of women and climate change, acknowledging that this is only part of the vast equity problem in the climate arena. Editor Geraldine Terry writes in the concluding chapter that gender and development analysts and "women's rights advocates need not shy away from working on climate change in the mistaken belief that it is a technical issue we are not equipped for … On the other hand, human-induced climate change is a symptom of the unsustainable development processes that the world has pursued to date."

The climate debate in the popular mind has focused on technical issues. Is it happening? How fast? Who's responsible? How hot? This volume—largely a collection of pieces that first appeared in the journal *Climate and Development*—makes a strong case for the value of going beyond the nuts and bolts to deal with the human problems that climate change will bring about.

VOLCANOES

Vesuvius: A Biography. By Alwin Scarth. 2009. ISBN: 978-0-691-14390-3. 342 pp. $29.95 (hardcover). Princeton. www.press.princeton.edu.

Vesuvius is probably the world's most famous volcano. It is certainly the longest studied. Pliny the Younger described the 79 CE eruption that famously buried Pompeii.

This readable book combines the history, geology, archaeology, and mythology of Vesuvius into an entertaining brew you'll want to have on the bookshelf the next time Vesuvius erupts. It's been quiet since 1944.

"The longer it remains dormant," Scarth writes, "the longer the molten rock beneath it can develop into an explosive cocktail, and the more destructive, dangerous, and lethal the re-awakening will be. No one can tell exactly when Vesuvius will spring back to life … Vesuvius is the most dangerous volcano in Europe."

WATER

Blue Covenant: The Global Water Crisis and the Coming Battle for the Right to Water. By Maude Barlow. 2007. ISBN: 978-1-59558-453-3. 196 pp. $16.95 (softcover). The New Press. www.thenewpress.com.

One paragraph on the back of this book calls Maude Barlow the "Al Gore of water," which may or may not be considered a compliment. Barlow is a Canadian who has been active in water issues around the world. She sees three scenarios converging to create a water crisis. First, she writes, the world is running out of fresh water. Numerous reports find that by 2025, two-thirds of the earth's population will live in water-stressed regions.

Second, even where there is water, it is less clean than it used to be. In China, for instance, 80 percent of the major rivers are so polluted they no longer support aquatic life, and 90 percent of groundwater resources under major cities are contaminated. She offers a distressing world tour of this contamination with stops in India, Indonesia, Russia, Israel, Belgium, Mexico, and, of course, the many nations of Africa.

Finally, she says, "The stage is being set for corporate control of water." The global South, in particular, is having its water sold off to private concerns under pressure from the World Bank.

One could argue—and someone certainly will argue it—that the problem is not too little water but too many people using it. Global population is in the background of Barlow's story, but it is not really addressed. There is a finite amount of fresh water available on the planet, she points out—about 400 billion liters of fresh water recycled each year via the water cycle.

Barlow wants to create a global "right to water" and an international covenant to enforce it. The covenant would have three components: water conservation; water justice; and water democracy. At bottom, she writes, "It must be commonly understood that water is not a commercial good, although of course it has an economic dimension, but rather a human right and a public trust. What is needed now is binding law to codify that states have the obligation to deliver sufficient, safe, accessible and affordable water to their citizens as a public service." So as with many global problems, competent governance would go a long way toward addressing the issue.

EARTHQUAKES

Connections: The EERI Oral History Series—Vitelmo V. Bertero. By Robert Reitherman. 2009. ISBN: 978-1-932884-42-5. 152 pp. $15 (softcover). www.eeri.org.

Vitelmo Bertero is a pioneer in the study of earthquake engineering. This sixteenth volume in the Earthquake Engineering Research Institute's valuable oral history series explores Bertero's career via an incisive Q&A inteview with Robert Reitherman. The book examines Bertero's early life in Argentina, his personal life, and his career, which spans nearly every important development in his specialty.

Predicting the Unpredictable: The Tumultuous Science of Earthquake Prediction. By Susan Hough. 2010. ISBN: 978-0-691-13816-9. 260 pp. $24.95 (hardcover). Princeton University Press. www.press.princeton.edu.

I quoted extensively from this book in the May 2010 issue of the *Natural Hazards Observer* because it is an exhaustive, entertaining, and informative exploration of the possibility of someday predicting the arrival of earthquakes. And also because I really want to know whether snakes and toads are smarter—earthquake-prediction-wise—than we are.

Alas, it does not appear that they are. Hough deals

with all aspects of earthquake prediction, not just the megafaunal. Accurate prediction of earthquakes has been called (endlessly) the "holy grail" of seismology. But most scientists are pessimistic that meaningful predictions can be made far enough in advance to provide useful warnings to at-risk residents. Seismologists still don't have a firm handle on what are called "earthquake precursors," those hoped-for, consistent signals from the earth that may (or may not) precede a quake. Hough says in one chapter, "Where earthquake patterns are concerned, reading the tea leaves is a tricky business."

This book provides an excellent overview of the science and is populated with dedicated researchers who aren't afraid of testing difficult ideas.

Some seismologists, Hough writes, "argue that earthquakes will never be predictable. It is also possible that some earthquakes might be more predictable than others. The prediction of some earthquakes would certainly be a good thing, but it would not be an entirely satisfying solution. We would still be left with the knowledge that a large earthquake could strike anywhere, anytime, with no warning whatsoever."

About those snakes and toads ... Hough examines reports of anomalous activity among frogs and snakes prior to the Mw 7.5 1975 Haicheng earthquake. "Whatever happened, if anything, in the Haicheng region to disturb frogs and snakes and water wells, one thing is clear: it does not happen commonly before large earthquakes … If Haicheng's snakes and frogs were reacting to something, that something was, if not entirely unique, then at least unusual."

FLOODS

A Watershed Year: Anatomy of the Iowa Floods of 2008. Cornelia F. Mutel, editor. 2010. ISBN: 978-1-58729-854-7. 252 pp. $19.00 (softcover). University of Iowa Press. www.uiowapress.org.

Iowa's been hit by two serious floods only 15 years apart—first in 1993, then again in 2008. Residents can be forgiven for thinking, "What gives?" This book fills them in. Although it focuses on Iowa's experience, the essays that make up this volume are enlightening to anyone who contemplates flood dangers. While they stick to the facts of the matter, carefully explicating the meteorology, geography, and hydrology that led to the problems, they manage to get the most out of those facts to offer important insights.

The book describes a clean arc from Noah and Nature and Gilgamesh through National Weather Service predictions to farmland contribution to flooding. *A Watershed Year* offers an engrossing lesson in the conjunction of modern agriculture and floods.

Conferences and Training

July 6-7, 2010
Geoinformatic Forum Salzburg
Centre for Geoinformatics and Institute for GIScience
Salzburg, Austria
Cost and Registration: $380

This conference will examine interdisciplinary hazard and climate change research and the methods used to assess, quantify, and represent vulnerability spatially. Session topics include spatial approaches to vulnerability assessment, mapping urban vulnerability from a multi-hazard perspective, and disaster resilience.

www.gi-forum.org

July 12-15, 2010
Rebuilding Sustainable Communities with the Elderly and Disabled People after Disasters
University of Massachusetts Boston
Boston, Massachusetts
Cost and Registration: $300, Open until filled

Long-term sustainable community recovery and rebuilding needs in postdisaster environments are the focus of this meeting. Specific issues to be addressed include the status of elderly and disabled people after disasters, the participation of the elderly and disabled in local, regional, and national postdisaster reconstruction policies, plans, and programs, and the role of women with disabilities in implementing reconstruction policies.

www.mccormack.umb.edu/centers/crscad/RSCEPD.php

July 22-23, 2010
Aid and International Development Forum 2010
World Bank, Institute for Advanced Studies on the United Nations, and others
Washington, D.C.
Cost and Registration: Not posted

This forum explores how technology and best practices can improve the coordination, response, and cross-sector understanding of humanitarian aid organizations. Conference topics include climate change, global disaster preparedness, and transitioning from disaster relief to long-term development.

www.aidforumonline.org

July 25-29, 2010
Conference on Earthquake Engineering
Earthquake Engineering Research Institute and the Canadian Association for Earthquake Engineering
Toronto, Canada
Cost and Registration: $1,050; $850 for EERI members

This conference applies the most recent knowledge and techniques to improve earthquake understanding and mitigation. Sessions include scenario spectra for ground motion and risk calculation, directions in geotechnical earthquake engineering, and societal dimensions of earthquakes and other disasters.

2010eqconf.org

Conferences...

(Continued from page nineteen)

July 28-30, 2010
Shanghai Disaster Risk Reduction Forum
Development Information Network, Local Governments for Sustainability, and others
Shanghai, China
Cost and Registration: Not posted

This forum will discuss disaster risk reduction, facilitating communication among Chinese officials, and fostering multi-stakeholder partnerships that reduce disaster risk at the sub-national level.

www.preventionweb.net/english/professional/trainings-events/events/v.php?id=13664

August 23-27, 2010
Watershed Management Conference 2010
Environmental and Water Resources Institute
Madison, Wisconsin
Cost and Registration: $650 before July 26, open until filled

Design, operation, and regulation of water resource facilities and resource management practices are the focus of this conference. Approaches for managing water resources in the face of climate change and land use challenges will also be discussed. Conference topics include hydrologic measurements and modeling, adaptive water management, risk-based designs, and the use of regional climate change predictions.

content.asce.org/conferences/watershedmanagement2010

September 1-4, 2010
Twelfth Plinius Conference on Mediterranean Storms
European Geosciences Union
Corfu Island, Greece
Cost and Registration: $382 before July 15, open until filled

This conference will discuss Mediterranean storms and their societal impacts. Conference topics include climate-related changes in storm behavior, advanced storm forecasting techniques, and the socioeconomic implications of hazardous storms.

meetings.copernicus.org/plinius12/home.html

September 13-17, 2010
30th International Conference on Lightning Protection
University of Cagliari
Cagliari, Italy
Cost and Registration: $611 before July 20, open until filled

Topics at this meeting will include lightning protection for buildings and power systems, and ways to improve the protection of people, animals, and property.

www.diee.unica.it/iclp2010/

September 13-17, 2010
Storm Surges Congress 2010
GKSS Research Centre and Land-Ocean Interactions in the Coastal Zone
Hamburg, Germany
Cost and Registration: $503, open until filled

This event will examine storm surge impacts and assess risk levels for and responses to changing conditions. Conference topics include what drives storm surges, storm surge scales, history and intercultural perception, dealing with uncertainty, and building with nature in mind.

www.loicz.org/calender/Congress/index.html.en

September 19-23, 2010
Dam Safety '10
Association of State Dam Safety Officials
Seattle, Washington
Cost and Registration: $700 before August 24, open until filled

This conference examines dam safety, engineering, and technology in the United States. Session topics include stress therapy, seismic issues, quick thinking in emergencies, private dams on federal property, and engineering solutions for levees.

www.damsafety.org

September 21-23, 2010
International Conference on Emergency Preparedness
Aston Centre for Research into Safety and Security
Birmingham, United Kingdom
Cost and Registration: $441, open until filled

This conference will examine current research in and best practices for mass evacuations and emergency preparedness. Conference topics include preparing the public for emergencies, shelter management, and emergency preparedness computer models.

www.astoncrisis.com/crisiscms/InterCEPt

October 1-3, 2010
ICCM 2010: Haiti and Beyond
International Network of Crisis Mappers
Boston, Massachusetts
Cost and Registration: $100 before August 1, open until filled

This conference will examine the 2010 Haiti Earthquake, including the role of crisis mapping and humanitarian technology in response, lessons learned, and technological best practices. Session topics include map sourcing (including natural language processing, mobile phones, and satellite imagery), crisis response and evaluation, and future research and technology.

crisismapping.ning.com

October 5-7, 2010
Wildland Fire Canada 2010
Ontario Ministry of Natural Resources and the Canadian Forest Service
Ontario, Canada
Cost and Registration: $200 before July 31, open until filled

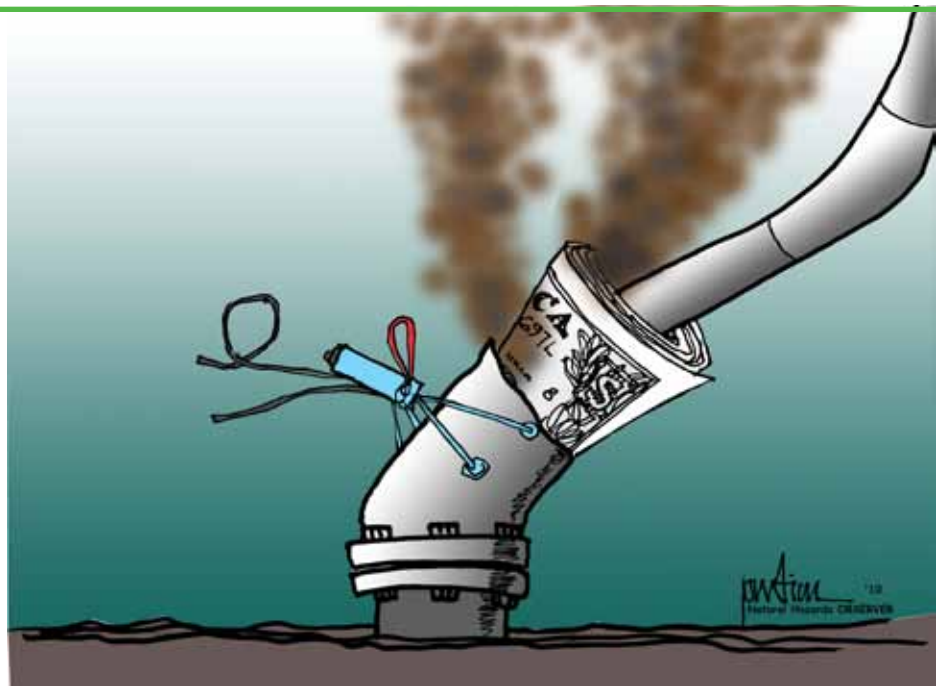
This conference will address best practices, emerging issues, and new research in wildland fire management. Session topics include fuel and fire behavior, fire weather forecasting, building community and public engagement, and understanding risk and uncertainty. Managers will exchange best practices with other fire managers and communicate emerging issues to scientists while providing an opportunity for scientists to present new research and models.

www.wildlandfirecanada.ca

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

Science to the Rescue

NSF makes a RAPID response



The federal government took a beating in the media for its slow response to the Deepwater Horizon oil well blowout in the Gulf of Mexico. But at least one agency—the National Science Foundation—responded quickly to the crisis.

The NSF has awarded a little more than $3 million in grants since April 10, 2010, explosion, which killed 11 people and created an oil slick the size of Minnesota, threatening the U.S. coastline and the waters of the Gulf.

The NSF grants were awarded under the agency's RAPID program, which is designed to help scientists respond quickly to fast-breaking events. Grant subjects cover a variety of fields, including the effect on blue crabs, hypoxic zones, three-dimensional forecasting of the slick's spread, and many others. A listing of some awarded grants available at the *Observer's* deadline is below.

BP meanwhile has pledged $500 million for academic research on the ecology of the Gulf of Mexico over the next 10 years. No sooner had this windfall been announced, however, than the excitement among researchers "turned to chagrin … after the White House ordered BP to consult with Gulf Coast governors before awarding research grants," according to the *Los Angeles Times.*

That decision may mean that the money is distributed only to researchers located on the Gulf Coast, the paper says. "Elected officials in the region responded by demanding that the financial bonanza not spread beyond their own state universities, potentially leaving out such distinguished oceanographic institutions as Woods Hole in Massachusetts and Scripps in San Diego," according to a June 26 story by writer Julie Cart.

RAPID: Social context and emotional response to disaster. National Science Foundation grant #1042786. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1042786. One year. $89,948. Principal investigator Christopher Kenny, Louisiana State University, pokenn@lsu.edu.

On April 22, 2010, two days after exploding and leaving 11 workers dead, the British Petroleum-leased Deepwater Horizon drilling rig sank in the Gulf of Mexico. Within a week, it became increasingly clear that oil leaks caused by the rig's collapse significantly threaten the regional and national economy and natural environment. This ongoing crisis has the potential to fundamentally change the way of life in coastal communities.

The purpose of this project is to understand the manner in which people use social networks to obtain information, making social and political decisions in the context of experiencing a major disaster, and to examine the extent to which emotional responses to disaster are structured by these networks of social communication.

This study will examine the social nature of disaster response—how social context influences how individuals learn about a crisis. The investigators examine how social networks shape emotional reactions and behavioral responses. Little research has been conducted regarding how people use social networks to respond to oil spills. However, a number of studies have examined the importance of social context in other disaster related behavior. Two theoretical approaches have emerged in these studies. According to the social cohesion model, intimacy, trust, respect, and mutual regard influence the social flow of relevant information. Alternatively, the structural equivalence model argues that it is the pattern of social ties that is most important, not the intimacy and respect present in the relationship. In general, the structural equivalence theory is compatible with an emphasis that ties between primary groups ("weak ties") are at least as important as ties within primary groups. Despite the devastating consequences of oil spills, they are unlike other types of disasters in that they do not force residents to leave their communities in the short-term. This crisis provides an opportunity to contrast the influence of close friends and family to the influence of similarly situated neighbors and co-workers in providing information about the disaster and influencing emotional and behavioral responses.

While substantial research has been done on the importance of social context in influencing attitudes and

behaviors, that research generally does not examine the role of emotion. Emotion is almost certainly a key factor in conditioning how social context influences attitudes and responses to disaster. The political and social implications of emotion are pervasive, having been empirically linked to numerous political and social behaviors. But little is known about the social antecedents of emotion. In catastrophic events emotions are rarely felt and displayed in isolation. Rather, they should be intimately linked to the reactions of others, especially as individuals seek the solace of others to cope with these aversive events. The investigators expect that emotional reactions will be conditioned by one's social network, as social connections are a primary way to cope with disaster. They are particularly interested in contrasting the relative power of structural equivalence and social cohesion in conditioning the emotional reaction to disaster.

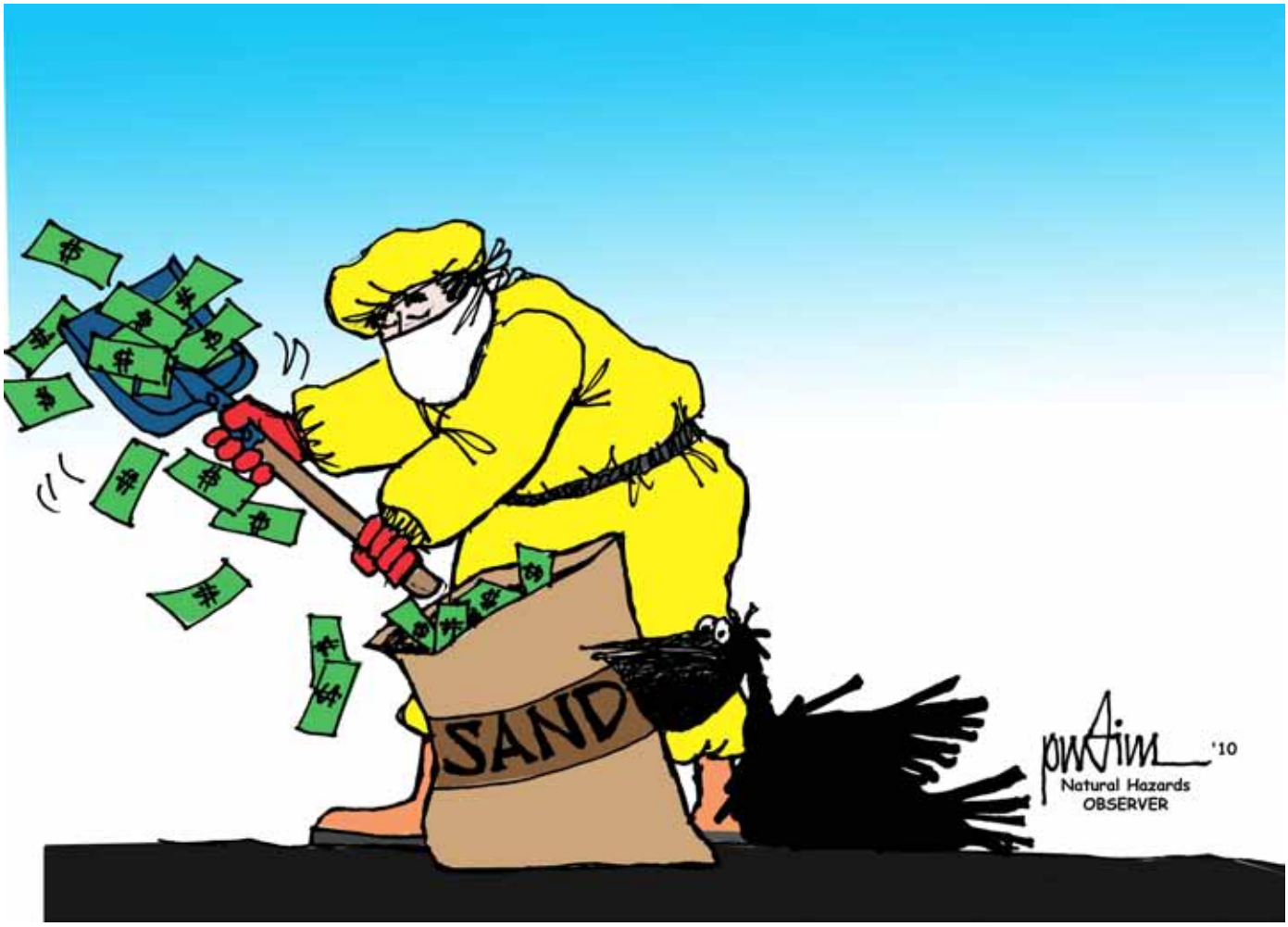
To examine the role of social ties in the context of a disaster, the investigators will administer a survey to a sample of respondents in two communities in coastal Louisiana. They will also interview discussants named in this survey, following a snowball procedure. This research is tailored to better understand the ways in which social context shapes human reaction to catastrophe.

RAPID: Assessing the impact of chemical dispersents on the microbial biodegradation of oil immediately following a massive spill. National Science Foundation grant #1042097. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1042097. One year. $119,964. Principal investigator David Valentine, University of California-Santa Barbara, valentine@geol.ucsb.edu.

The massive release of oil from the Deepwater Horizon incident in the Gulf of Mexico has led to an unprecedented use of oil dispersants, which include a mix of surfactant compounds designed to dissolve oil and prevent slick formation. Previous research has shown mixed effects of surfactants on biodegradation. Little is known about their effects on the ability of microbial communities to degrade the hydrocarbon compounds found in crude oil. Hydrocarbon degrading bacteria differ in their substrate preferences, as well as in their response to surfactants.

Researcher from the University of California at Santa Barbara will use a combination of chemical and biological tools to track changes in the composition of the oil, changes in the microbial community, and the amount of surfactant present, in order to determine the impact of these dispersants on biodegradation. Oil quantification and composition will be determined by gas chromatography, including the use of comprehensive two-dimensional gas chromatography. Microbial community changes will be determined by analysis of the 16S rRNA gene and functional genes for hydrocarbon oxidation. Surfactants will be identified and quantified. Initial sampling will be shore based, with deep water and sediment sampling planned as conditions allow. The study will provide important baseline information and enable long-term studies on the fate of oil and dispersants in the Gulf of Mexico.

RAPID: Resolving higher trophic level change within the northern Gulf of Mexico ecosystem as a consequence



of the Deepwater Horizon oil spill. National Science Foundation grant #0143413. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1043413. One year. $199,867. Principal investigator William Graham, Marine Environmental Sciences Consortium, mgraham@disl.org.

On April 22, 2010, the semi-submersible drill platform Deepwater Horizon sank in nearly 1,200 meters of water in the northern Gulf of Mexico. After several attempts to close a failed blowout preventer valve, it became clear that tremendous amount of oil was being released each day. Pre-approval of undisclosed chemical dispersants was made based on knowledge of the dispersant application over limited areas and for limited time at the sea surface. An unprecedented volume of dispersant has been applied both at the surface and through direct injection into the wellhead leak at 1,200 m depth. The result is the release of large, but unquantified concentrations of organic carbon available for microbial degradation. To date, there is no plan for understanding functional ecosystem baseline shifts as a consequence of this magnitude of application of dispersants or the resulting re-distribution of oil or released compounds within the water column.

Scientists posed the questions: Do these baseline shifts in resource (heterotrophic microbes versus autotrophic phytoplankton) permeate through the classical food web or remain largely within the microbial web? If material enters the classical food web, does it favor fish or gelatinous zooplankton? It is vital to understand in this in both the short- and long-term because secondary producers represent the major link between primary production and higher trophic levels (e.g., piscivorous fish) by which energy (and contaminants) are incorporated into grazer food webs.

This project will characterize ecosystem-level changes to the pelagic system of the northern Gulf of Mexico.. The group will employ a trophic assessment using both gut contents and Carbon/Nitrogen stable isotope ratios of pelagic filter-feeding invertebrates (jellyfish) and vertebrates (planktivorous fish). These will be compared to SI and gut content information collected over the previous two years in the spill-impacted area east and west of the Mississippi River.

RAPID: Deepwater Horizon oil spill: Trophic organization of sandy beach ecosystems across gradients of development and oiling. National Science Foundation grant #1043180. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1043180. One year. $127,693. Principal investigator Susan Bell, University of South Florida, sbell@cas.usf.edu.

Sandy beaches, one of the most abundant coastal ecosystems, contain unique biodiversity, represent ecotonal habitats, and are driven by distinctive ecological processes that provide critical ecosystem services. Food webs on sandy beaches may display a high level of trophic coupling at the beach-ocean interface where consumers take advantage of the high productivity generated in coastal waters, subsidizing the shore, providing seasonal or even perennial opportunities for alternative resource use. However, many beach ecosystems are trapped in a "coastal squeeze" between urbanization and rising sea levels. These systems are also under threat from oil extraction, as is the case for beaches in Florida and possibly the southeastern United States as a result of the ongoing and extensive Deepwater Horizon spill. Therefore, trophic organization of these important coastal areas may be disrupted by selected human activities.

The main objectives of this project are to: (1) document the abundance of critical beach consumers, and (2) describe the trophic structure across sandy beach habitats with an emphasis on the macrobenthic fauna and in the context of potential changes resulting from acute beach oiling and/or chronic anthropogenic disturbance (i.e. development).

The general sampling design calls for a series of beaches to be sampled both pre- and post oiling. The sandy beaches sampled will also span different levels of pre-spill anthropogenic disturbance (e.g., human population density, quantity of fixed structures, levels of habitat fragmentation). Characterization of the naturally occurring heavy stable isotopes of carbon (d13C) and nitrogen (d15N) will be conducted on the major benthic organisms and their food sources to 1) unravel food web structure; 2) detail the contribution of various food sources to consumer diets using 'mixing models'; and 3) evaluate variability of trophic position of major consumers, diet shifts, and subsidy integration across beaches with varying levels of development. The PIs also expect that ecosystem- level impacts of oiling as revealed via the food web may be detected with this approach.

RAPID: Deepwater Horizon oil spill: Impacts on Blue Crab population dynamics and connectivity. National Science Foundation grant #1042791. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1042792. One year. $199,863. Principal investigator Caroline Taylor, Tulane University, caz@tulane.edu.

Blue crabs (*Callinectes sapidus)* are an ecologically and economically important species in the Gulf of Mexico. In Chesapeake Bay and North Carolina, blue crabs have suffered from unexplained population crashes in recent years, purportedly due to increase fishing pressure and habitat degradation. Despite the importance of this species and the propensity for their stocks to crash, a realistic and predictive population model is still lacking for blue crabs.

This project will use a metapopulation approach to understand and predict the population dynamics of blue crabs. Blue crabs spend their initial, larval, life-stages in the ocean then recruit to estuaries for their juvenile and adult stages. In the metapopulation model to be used, local dynamics in a patch (estuary) will be described and parameterized using fisheries data, remotely-sensed habitat quality estimates, and results from field experiments estimating cannibalism rates. We will estimate connectivity (dispersal of larvae between estuaries) of the population with a particle tracking approach using a fine-scale, spatially-explicit ocean circulation model.

When the Deepwater Horizon oil rig exploded on April 20, 2010, and began oil into the Gulf, blue crabs were just beginning their spawning season. The project will investigate the impacts of the oil and chemical dispersants on the larval stages, and ultimately on population dynamics, of blue crabs by sampling planktonic larvae at three ocean locations that vary in distance from the oil source. Results will estimate both lethal and sub-lethal effects of oil and dispersants on larvae. They will incorporate the extent and concentration of oil and dispersants into the particle-tracking model and use it to predict the effects of the oil spill on

dispersal and recruitment for the entire Gulf of Mexico. To validate model results, the PIs will sample recruitment to estuaries over a wide stretch of the coastline, including areas unaffected, lightly affected and heavily affected by the spill. They will incorporate results into the metapopulation model to explore the long-term effects of the spill on the Gulf of Mexico blue crab population and its fishery.

RAPID: survey of structural and scour damage under 2010 Chilean earthquake and tsunami loads. National Science Foundation grant #1037861. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1037861. One year. $39,995. Principal investigator Solomon Yim, Oregon State University, solomon.yim@oregonstate.edu.

The February 27, 2010, magnitude 8.8, offshore Maule, Chile, earthquake and earthquake-induced tsunami caused extensive damage to structures in cities along the Chilean coast. Field observations from this event can provide valuable data for calibration of experimental and numerical models and tsunami design guidelines. This project will survey the structural damage and scour effects of the affected coastal areas

This survey for the Chilean tsunami intends to collect and preserve data to: (1) compare against numerical simulations; (2) update the database for risk models; (3) develop retrofit and design recommendations; and (4) improve the understanding of the dynamics of fluid, structure and sediment interactions, which is critical to the general design and retrofit of levees, dams, and a wide range of coastal structures. In addition, the team will perform a comparison of the data and analysis results obtained from the Chilean tsunami with those from the Samoan tsunami survey and document findings in conference and journal papers.

The effects of combined earthquake and tsunami have not been examined in detail by researchers due to the complex nature of sequential loading and response. The complexities involved include structural response due to earthquake, potential liquefaction of the supporting soil foundation, and fluid impact load due to tsunami run-up and drawdown, with each of the phenomenon being highly nonlinear. To date, there is little, if any, field data available for such combined events, which are likely scenarios of the anticipated Cascadia Subduction Zone earthquake and tsunami in the U.S. Pacific Northwest.

Data communications support for GPS observations of crustal deformation associated with the 2010 Chile earthquake. National Science Foundation grant #1036939. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1036939. One year. $198,830. Principal investigator Charles Meertens, UNAVCO, Inc., meertens@unavco.org.

This project will support installation and initial costs of the establishment of a mixed mode geostationary satellite low Earth orbiting satellite, and cellular data communications solution continuously operated GPS stations in Chile and Argentina in response to the February 27, 2010 M 8.8 Maule mega-earthquake in Chile. The communications solution will allow for daily downloads of 15-second position observations and short burst transmission of 1 hertz observations for up to 10 events from a planned 25 station continuous GPS network covering an aperture of nearly 100,000 km2 in Chile and Argentina, including stations on ocean islands on the Pacific Plate (Robinson Crusoe, Selkirk, and San Felix Islands).

Fully capturing the signature of the elastic and viscoelastic deformation response of the crust and the upper mantle to this earthquake promises to yield unprecedented insights into the rheological behavior of the crust and upper mantle. Never before has an earthquake of this magnitude been observed with the planned spatial and temporal resolution and fidelity planned for this post-response GPS network. Real-time high fidelity data from this GPS network will provide important contributions to mitigating future earthquake and related tsunami and landslide hazards.

RAPID: Geotechnical engineering reconnaissance of the Mw 8.8 Chile earthquake of February 27, 2010. National Science Foundation grant #1034831. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1034831. One year. $96,894. Principal investigator Jonathan Bray, University of California-Berkeley, bray@ce.berkeley.edu.

On February 27, 2010 a magnitude Mw 8.8 earthquake struck the central west coast of Chile. A event this powerful affecting natural ground and engineered facilities in coastal, plain, and mountainous areas is of great importance for the U.S. Pacific Northwest and for many similar earthquake scenarios throughout the world. Capturing details of lateral spreads and the impacts of liquefaction on well-built and marginal structures, characterizing the performance of earth, and understanding how soil/geologic conditions influenced the observed damage patterns are all important. Field reconnaissance will be focused on capturing perishable data, but the team will also perform geotechnical characterization of the soils through: (1) examination of ejecta; (2) hand-held cone penetration tests; and (3) hand-carried equipment to measure shear wave velocities.

RAPID: Tsunami deposits and coastal uplift near Concepcion, Chile before and after the major earthquake of February 27, 2010. National Science Foundation grant #1036057. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1036057. One year. $26,020.Principal investigator Lisa Ely, Central Washington University, ely@cwu.edu.

On February 27, 2010 a Mw 8.8 earthquake and accompanying tsunami struck the coast of central Chile. This project will precisely document the geomorphic and tectonic signatures of this earthquake and tsunami at several previously described study sites in the Concepción region. In 2009 and early 2010 the author and Chilean collaborators surveyed tsunami deposits and uplifted coastal marine platforms at 10 sites. The objectives of this project are twofold: 1) Investigate deposits and impacts of the 2010 tsunami at existing study sites containing geological and historical evidence of previous tsunamis in the Concepción area; and 2) Assess co-seismic and post-seismic land-level changes at existing study sites that underwent significant uplift in previous earthquakes.

Field investigations will include mapping and surveying the erosional and depositional effects of the 2010 tsunami at previously documented sites to compare the deposits from the 2010 tsunami with those from previous events; calibrate the sedimentary deposits with the observational data; assess the preservation potential of tsunami deposits in this environment; and use the 2010 deposits to guide the search

for additional repositories where stratigraphic records of multiple paleo-tsunami deposits are likely to be preserved. At the locations of land-level changes the field objectives will be to resurvey heights of marine platforms that were uplifted during previous earthquakes and surveyed by our team in January, 2010; determine the amount of additional uplift in the 2010 earthquake; establish a baseline elevation for subsequent monitoring of post-seismic land-level changes; and compare locations and amount of uplift in the 2010 earthquake with that measured after the 1835 earthquake.

RAPID: Collection of field data from Haiti for calibration of seismic vulnerability indices. National Science Foundation grant #1034834. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1034834. One year. $40,000. Principal investigator Santiago Pujol, Purdue University, spujol@purdue.edu.

The challenge of screening large inventories of structures is a major obstacle to the rapid recovery from earthquakes and to the efficient use of resources to mitigate the effects future earthquakes. This is especially difficult in urban areas built without strict regulation and enforcement of building codes. Screening of large inventories cannot rely on full structural analyses, if for no other reason than the structural plans for many existing structures are unavailable. Instead, screening tools that can be implemented quickly and reliably are needed.

Field data from Haiti will be used to test, calibrate, and improve seismic vulnerability indices. The collected field data will enable the researchers to answer challenging questions that cannot be answered by laboratory or analytical research alone. The research will answer questions about the versatility of existing vulnerability indices, the identification of additional key structural parameters, and the merits/drawbacks of adding to the complexity of the indices.

RAPID: Geotechnical-driven damage patterns and liquefaction in the January 2010 Haiti earthquake. National Science Foundation grant #1034828. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1034828. One year. $40,000. Principal investigator Scott Olson, University of Illinois at Urbana-Champaign, olsons@uiuc.edu.

The magnitude 7.0 earthquake that struck Haiti on January 12, 2010 caused tremendous damage to the built and natural environment, destroying buildings, crippling the Port-au-Prince seaport, and causing large coastal, roadway, and slope failures. The principal investigators participated in a reconnaissance trip to Haiti as part of a Geo-engineering Extreme Event Reconnaissance team. The team brought back an extensive set of data from this initial reconnaissance, including shear wave velocity (Vs) and dynamic cone penetration test data at several sites.

However, after an initial damage assessment and an evaluation of preliminary findings, a number of critical details that require further investigation have been identified. Given the tremendous damage that resulted from this earthquake, it is imperative that the profession maximize what is learned from this event in order to minimize damage during future earthquakes in Haiti, in other developing coastal nations, and elsewhere around the world.

The team will augment the previous investigations with additional and deeper investigations, as well as soil sampling and lab testing to understand liquefaction in carbonate sands, since these sands are poorly represented in the worldwide liquefaction case history. The work will chiefly involve sampling and testing along the southern coast of Port au Prince Bay, primarily between Leogane and Petit Goave, and along the major rivers north of Port au Prince. Subsequent lab testing will include ring shear and cyclic triaxial testing.

The team will expand initial observations of potential topographic effects on damage patterns on the hillsides and slopes in communities surrounding Port-au-Prince, such as Petion-Ville. This effort will involve collecting slope strike and dip angles, proximity to ridge tops, and obtaining shallow Vs measurements in areas identified with noticeable damage patterns apparently influenced by topography.

The team will also collect 15 to 20 near-surface Vs profiles in low-lying areas of Port-au-Prince where potential soft-soil amplification effects leading to noticeable damage patterns are observed. These measurements will be spatially-distributed in both areas that suffered heavy damage and areas that suffered minimal damage.

Documenting the engineering-relevant aspects of extreme thunderstorm winds. National Science Foundation grant #1000160. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1000160. Five years. $279,996. Principal investigator John Schroeder, Texas Tech University, john.schroeder@ttu.edu.

This research will measure and evaluate wind speeds and directions in extreme thunderstorm events to provide validation for numerical modeling, wind tunnel experimentation, and engineering design. Thunderstorm winds control the design winds across the world. While laboratory and numerical studies have suggested vast differences may exist in the near-surface characteristics of thunderstorm winds relative to those generated by other phenomena, there has been little field data to validate this hypothesis or evaluate its potential influence on wind loading.

This project will deploy an arsenal of state-of-the-art mobile radar instrumentation directly in the path of thunderstorms. The data will be analyzed to evaluate the differences between thunderstorm winds and those typically assumed for engineering design and wind tunnel testing. This will also provide much-needed data for future engineering studies, requiring more detailed information concerning near ground turbulence in wind.

The project research will improve the definition of wind design loads leading to safer designs of buildings and infrastructures such as transmission line towers, which have a known susceptibility to thunderstorm winds. The data will be compiled into a web-based archive and made available to the engineering community to facilitate further research and improve design.

REU Site: socials aspects of hurricanes: Preparation, response and recovery with vulnerable populations. National Science Foundation grant #1004980. http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1004980. Three years. $309,633. Principal investigator Naomi Yavneh, University of South Florida, yavneh@honors.usf.edu.

The University of South Florida will continue its summer research experience for undergraduates in the social aspects of hurricanes , i.e., how individuals, communities, and institutions prepare for, experience, and recover from

hurricanes. Particular attention will be given to vulnerable populations of children, older adults, and those of lower socioeconomic standing. Drawing faculty and mentors from anthropology, sociology, education, geography, psychology, public health, and social work, the program is designed to achieve these objectives: (1) to provide an intensive, mentored interdisciplinary research experience for undergraduate students; (2) to train students in qualitative and quantitative methods appropriate to social science research; (3) to provide experiential learning opportunities to increase student knowledge of systems and networks integral to research within the context of disaster preparedness and response; (4) to increase student knowledge of ethical issues in research, including cultural competency and certification in IRB human subject protection. Each component of the REU is designed to enhance critical thinking skills of the student with regard to the social aspects of hurricanes and other disasters, with a focus on decreasing loss of life and building resilience in recovery.

A multi-level, agent-based model for identifying the factors that enable or constrain international climate change negotiations. National Science Foundation grant #0962258. www.nsf.gov/awardsearch/showAward.do?AwardNumber=0962258. One year. $276,051. Principal investigator Mark Borsuk, Dartmouth College, mark.borsuk@dartmouth.edu.

Climate change policy represents a global, collective decision-making problem unprecedented in scale and complexity. Scientific methods for evaluating international policy, however, have tended to follow two separate lines of analysis, neither of which is fully instructive for real world settings. One approach, typically referred to as Integrated Assessment Modeling, is largely pursued by economists and decision theorists. It focuses on assessment of the long-term costs and benefits of various greenhouse gas reduction scenarios.

A second approach originates with game theorists, focusing on evaluating international structures and conditions likely to lead to effective cooperative climate agreements. Both types of analysis rely heavily on the simplifying assumption that national economies are orchestrated by perfectly rational central planners who have the information and ability to make optimal decisions despite the presence of pervasive uncertainty about mitigation costs, climate damages, and future states of the economy.

In reality, the outcome and implementation of any international climate agreement will be the net result of a complex interplay of stakeholders at multiple levels who have limited ability to make optimal decisions and have differing beliefs, power, and incentive structures. Therefore, it is likely that the existing assessment tools overlook some important factors that may enable or constrain effective climate policy formation.

This project will develop of new tool for international climate policy analysis based on agent-based modeling that facilitates a more realistic and simultaneous treatment of the diverse forces which influence multi-party decisions. The model will represent both the international climate negotiation process, as well as the key dynamics of domestic economies relevant to energy and climate change.

Gauging the mission creep potentials of Homeland Security "fusion centers." National Science Foundation grants #0957283 and 0957037. www.nsf.gov/awardsearch/showAward.do?AwardNumber=0957283. One year. $131,581 to principal investigator Torin Monahan, Vanderbilt University Medical Center, torin.monahan@vanderbilt.edu; and $23,432 to principal investigator Priscilla Regan, George Mason University, pregan@gmu.edu.

The Department of Homeland Security has supported the creation of "fusion centers" to share data across government agencies and with the public and private sectors. This project will begin to document and evaluate the information sharing practices of fusion centers. Specifically, the research will focus on variations in data sharing across fusion centers. The research questions are: (1) What types of data sharing are occurring with, or are enabled by, fusion centers? and (2) what factors contribute to the data-sharing practices of fusion centers? Using qualitative methods, research will be conducted through document analysis of government and media sources, observational studies at government-sponsored security conferences, and a minimum of 40 semi-structured interviews with representatives of government agencies, private companies, and civil society organizations.

This study will contribute to scholarship on surveillance and society, the privatization of security, and the politics of technological systems.

RAPID: Fault creep following the Mw 7.2 Sierra El Mayor earthquake of 4 April. National Science Foundation grant #1039474. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1039474. One year. $15,120. Principal investigator Roger Bilham, University of Colorado at Boulder, bilham@colorado.edu.

The investigation will deploy instruments sensitive to the movement of faults of southern California and northern Mexico. These faults all lie to the north of the epicenter of the Mw 7.2 Sierra Mayor earthquake of April 4, 2010, which abruptly increased tectonic stress in southern California, bringing three major U.S. fault systems closer to failure: the Elsinore, San Jacinto, and San Andreas systems. Seismologists believe that fault segments within each of these systems could slip in one or more earthquakes greater than Mw 7.0, resulting in huge U.S. economic losses. At least two of segments were already close to failure prior to the recent earthquake. The surface traces of segments of these three fault systems all slipped a minor amount (by a process of triggered creep) in response to the instantaneous stress released by the April earthquake. Some continue to creep in response both to aftershocks, and to the instantaneous stress during the main shock. Which of these three fault systems is most likely to experience failure in a future earthquake? Several remote sensing and local measurements are being undertaken to identify the most significant stress changes that have now occurred.

The instrumentation of the present project—starting less than a week after the earthquake—consists of six buried 20-foot-long to 60-foot-long graphite rods installed obliquely across each fault, attached firmly to the rock on one side, then drawn through a telescopic plastic pipe should the fault move. A displacement transducer monitors the displacement of the free end of the rod relative to a second anchor on the remote side of the fault. The displacement is measured every 15 minutes and recorded by a local data logger that operates autonomously for up to a year.

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RAPID: Collaborative research: Airborne Lidar ccan of the 4 April 2010 Sierra El Mayor, Baja California earthquake rupture. National Science Foundation grants #1039168 and #1039147. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1039168. One year. $30, 719 to principal investigator Michael Oskin, University of California-Davis, meoskin@ucdavis.edu and $112,381 to principal investigator J. Ramon Arrowsmith, Arizona State University, ramon.arrowsmith@asu.edu.

Surface ruptures provide a physically important accessible record of the distribution of slip in earthquakes and are the primary record of prehistoric seismic activity. Traditional field mapping and measurements may incompletely characterize surface ruptures due to their often complex, distributed nature. Prehistoric earthquake ruptures are also subject to surface processes that, over time, smooth out displaced features and mask critical components of the deformation field, such as warping of the land surface.

This grant supports the acquisition of very high-resolution airborne LiDAR topography over the surface rupture from the April 4, 2010 El Mayor-Cucapah earthquake in Baja California. The El Mayor-Cucapah earthquake ruptured the Pescadoros-Borrego fault system, which lies adjacent to the Laguna Salada fault that produced a similar-sized earthquake in 1892. Detailed comparison of the geometry of the 2010 and 1892 surface ruptures, engendered by the airborne LiDAR scan, will be especially important for assessing the relationship between these earthquakes.

RAPID: GPS observations in Argentina of co-seismic and post-seismic deformation associated with the 27 Feb, 2010 Mw 8.8 Maule, Chile earthquake. National Science Foundation grant #1036252. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1036252. One year. $75,129. Principal investigator Robert Smalley, University of Memphis, rsmalley@memphis.edu.

A research team is installing five new continuously operating GPS stations in Argentina in rapid response to the February 27, 2010 Mw 8.8 Maule earthquake in Chile. A rapid deployment is necessary because much of the important signal decays and changes rapidly in the weeks and months following the quake. The project objective is to capture the time- and space-dependent post-seismic signal in the far field associated with this event. These infrequent events provide a rare opportunity to fundamentally improve the understanding of the earthquake cycle of megathrust ruptures and the constitutive properties of the adjoining oceanic and continental crust and upper mantle.

The GPS data will be made available immediately to the international earth science community through UNAVCO so that important scientific questions can be addressed: (1) What is the rheological behavior of the fault interface? (2) If deep afterslip occurs, is it distributed along-strike of the rupture plane or does it occur uniformly? (3) What is the mechanical response of the bulk earth to large stress perturbations. (4) What is the reach and distribution of transient deformation and stress across the region, especially from deep-seated relaxation in the upper mantle? (5) How is stress transferred to the backarc?

RAPID: Geotechnical engineering reconnaissance of the Mw 8.8 Chile earthquake of February 27, 2010. National Science Foundation grant #1034831. www.nsf.gov/awardsearch/showAward.do?AwardNumber=1034831. One year. $96,894. Principal investigator Jonathan Bray, University of California-Berkeley, bray@ce.berkeley.edu.

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