



## Earthquake Early Warning Systems: An Investment that Pays off in Seconds

— an invited comment

In October 2007, Japan unveiled a national earthquake early warning system tasked with providing the general public with a few seconds of warning before the onset of strong earthquake ground shaking. This article defines earthquake early warning systems and describes how they can improve the way modern societies mitigate the effects of damaging earthquakes.

From the start, it should be made clear that earthquake early warning is not earthquake prediction. A useful earthquake prediction requires specific information about the timing, location, and size of a future

earthquake. It must be reliable enough that useful actions to protect life and property (evacuation, shutting down electric and gas lines, etc.) can be initiated based on the warning information. To date, earthquake prediction is a “holy grail” of seismology; it continues to be a hotly debated topic and active area of research. In general, the verdict is still out on whether earthquake science can be advanced to the stage where useful and reliable prediction statements can be made (e.g., “We expect a magnitude 6 earthquake to initiate within the Los Angeles metropolitan area on September 24, 2015”).

## If it's not prediction, then what is it?

While it may not be possible to predict when and where the next damaging earthquake might occur, it is possible to estimate the effects of strong ground shaking on surrounding areas while an earthquake is still rupturing. This is possible because earthquakes produce different types of waves that travel at different speeds. P (or primary) waves travel at approximately 6.5 kilometers (4 miles) per second and are the first waves to arrive at seismic monitoring instruments in a given region. They have relatively low amplitudes and are less likely to cause damage to buildings, but they carry important information about the size and location of an earthquake. S (or secondary) waves travel more slowly at approximately 3.5 kilometers (2.2 miles) per second and arrive after the P-waves, but they cause stronger levels of shaking and can bring down buildings during an earthquake.

Earthquake early warning systems (EEWS) estimate the expected maximum shaking, based on information extracted from the early arriving P-waves, and send this information to regions farther away from the earthquake source (or epicentral) region. Because information can travel at the speed of light (much faster than the damaging earthquake waves), there can be up to tens of seconds of warning time between the availability of the shaking estimates and the onset of damaging ground motions.

The difference between P- and S-wave arrival times (also known as the S-P time) is proportional to the distance of a given site from the earthquake epicenter. Regions in the immediate vicinity of the earthquake epicenter (the blind zone of an early warning system) will have very small S-P times and, therefore, little or no warning time. The farther a given location is from the epicentral region, the more warning time is available. Thus, early warning systems can be most effective for providing warning for large earthquakes that start at some distance from a site. For example, Los Angeles could have about a minute of warning before a repeat of the 1857 Fort Tejon earthquake, which initiated in the vicinity of Parkfield and ruptured about 185 miles southward. However, the city would have little or no warning from a large earthquake on the Puente Hills fault system, which runs under metropolitan Los Angeles.

## Different Flavors of Early Warning

A fundamental ingredient in the operation of an EEWS is a modern network of seismic instruments capable of measuring earthquake ground motions and processing and analyzing incoming waveform data in real-time.

While the technological ingredients have only become available in recent decades, the concept of earthquake early warning has been around for a while. Shortly after the 1868 Hayward Fault earthquake (magnitude 7.0), J.D. Cooper wrote an editorial in the San Francisco Daily Evening Bulletin proposing a system that would ring a bell over City Hall if ground motions exceeding a certain level were detected along earthquake faults. Cooper's article identified a number of requirements that continue

to define today's earthquake early warning systems: (1) systems with more dense instrumental networks perform better, (2) no warning will be available for regions too close to the earthquake source, (3) broadcasting of warnings and the actions in response to the warning information should be automated. (A 2005 article by Hiroo Kanamori gives a recent review and history of research efforts in this area. See References.)

“ Early warning systems can be most effective for providing warning for large earthquakes that start at some distance from a site. ”

There are numerous “flavors” of modern earthquake early warning systems. “Front-detection” systems are appropriate for areas where the damaging earthquakes consistently originate from a known region and the target warning area is at some distance away. For instance, many earthquakes that cause damage to Mexico City typically initiate along the Guerrero coastal subduction zone, about 185 miles from Mexico City. Thus, a relatively straightforward system consisting of a series of accelerometers installed along the coast works fairly well. These accelerometers send information via radio link to government offices in Mexico City when a certain level of ground motion has been exceeded at more than three stations. Because of the considerable distance between the source region and Mexico City, warning times on the order of 75 seconds are possible. Although Mexico City is situated a considerable distance from the source region, ground motions there can be abnormally large (and early warning information very useful) because the city is built on an ancient lake bed. The resonance of these lake sediments can produce amplified ground motions capable of collapsing high-rise buildings. Such a front-detection system is also possible for the city of Bucharest (Romania), which is located about 109 miles from the Vrancea region that is the source of damaging earthquakes.

Single-station approaches use P-wave information at a given site to predict the maximum ground motions (from the S-waves) at the same location. The uncertainty in the predicted ground motion amplitudes may be lower for the single-station approach, as it requires only a relationship between P-wave derived quantities and peak S-wave amplitudes. Such approaches have the potential to provide rapid warning information for regions in the blind zone of network-based approaches and have been proposed for nuclear plants and structural control applications.

Finally, network-based approaches provide early warning for widespread regions that have numerous potential earthquake sources (for example, Japan and California). The network-based approach uses stations that are part of a seismic monitoring network, which estimate the magnitude and location of an earthquake as quickly as possible. Such systems predict the maximum expected ground motions throughout the region of interest. The

recently activated national earthquake early warning system in Japan is the largest network-based early warning system currently in operation.

### How useful is a few seconds of warning time?

An equally fundamental component to an early warning system's success is an informed and well-prepared user community capable of efficiently using the information. A year before their national early warning system began broadcasting warning information, the Japan Meteorological Agency launched an extensive public outreach and education campaign to familiarize the public with the system and insure that the public was informed of how to react to information from the system. The campaign focused on simple personal safety measures that could be taken in response to a warning. However, if user systems are able to automate decisions and actions based on early warning information, more numerous applications are possible.

High speed trains in Japan have been automatically slowed down and stopped by early warning systems since the 1990s. Other automated responses include stopping elevators at the closest floor, opening fire station doors (so that fire trucks don't get stuck due to jammed doors), and saving data on computers. These applications are relatively easy to implement, as the cost of false alarms is negligible. More complicated applications include diverting airport traffic, inserting control rods in nuclear plants, stopping high precision manufacturing processes, and interfacing with active structural control systems to change the dynamic response characteristics of buildings. For these applications, the cost of false or missed alarms is significantly higher, putting more stringent requirements on the reliability of the warning information.

In general, the reliability of early warning estimates at any given time is dependent on the amount of available observations, and there is a trade-off between reliability and available warning time. Using the earliest estimates from an EEWs increases the available warning time, but at the cost of having to deal with uncertain estimates; later estimates are more reliable but provide less warning time. Increasing the number of real-time stations in an early warning network increases the reliability of warning information and the available warning times.

### Earthquake Early Warning in the United States

The California Integrated Seismic Network is currently implementing, testing, and evaluating the real-time performance of two network-based approaches and one single-station approach in northern and southern California. There are about 250 stations with real-time capabilities throughout the state. In contrast, approximately 1,000 stations distributed over an area roughly the same size as California contribute to the Japanese early warning system. A significant amount of investment is necessary to upgrade and expand the existing networks in California to an early warning-ready system. Such investments are likely to pay off in the long term, considering that

earthquakes rank among the most costly natural disasters of the twentieth century.

While an early warning system would not prevent all earthquake-related losses, it would allow people a few seconds to respond and take simple personal safety measures, which could significantly reduce the number of casualties. If an early warning system in California could prevent just 1% of the damage from a repeat of the magnitude 7.9 earthquake in San Francisco in 1906 (which was estimated by the California Office of Emergency Services to cost \$122 billion), it would pay for itself many times over. That sounds like a pretty good investment to me.

**Georgia Cua ([georgia.cua@sed.ethz.ch](mailto:georgia.cua@sed.ethz.ch))**

Swiss Seismological Service, Zurich, Switzerland

### References

1. Kanamori, H. 2005. Real-time seismology and earthquake damage mitigation. *Annual Review of Earth and Planetary Sciences* 33: 195-214.
2. Nakamura, Y. 1988. On the Urgent Earthquake Detection and Alarm System (UrEDAS). *Proceedings of the 9th World Conference of Earthquake Engineering, Japan Association for Earthquake Disaster Prevention, Tokyo, Kyoto: 673-678.*

*The early warning algorithms being implemented and tested in California are the ElarmS, Virtual Seismologist, and Amplitude/Period monitor algorithms. Details about these algorithms can be found in the following publications:*

1. Allen, R.M., and H. Kanamori. 2003. The potential for earthquake early warning in southern California. *Science* 300: 786-789.
2. Cua, G., and T. Heaton. 2007. The Virtual Seismologist (VS) method: A Bayesian approach to earthquake early warning. In *Earthquake Early Warning Systems*. P. Gasparini, G. Manfredi, and J. Zschau (eds). Springer Heidelberg.
3. Wu, Y.M., and H. Kanamori. 2005. Experiment on an onsite early warning method for the Taiwan early warning system. *Bulletin of the Seismological Society of America* 95: 347-353.

### Web Resources

**Japan Meteorological Agency, Earthquake Early Warnings**  
[www.jma.go.jp/jma/en/Activities/eew.html](http://www.jma.go.jp/jma/en/Activities/eew.html)

**Earthquake Early Warning in Japan (compiled by Masumi Yamada, Kyoto University)**  
[www.eqh.dpri.kyoto-u.ac.jp/~masumi/eq/ews.htm](http://www.eqh.dpri.kyoto-u.ac.jp/~masumi/eq/ews.htm)

**U.S. National Earthquake Hazards Reduction Program**  
[www.nehrp.gov](http://www.nehrp.gov)

**U.S. Geological Survey Earthquake Hazards Program**  
<http://earthquake.usgs.gov>

# Managing Lahars the New Zealand Way: A Case Study from Mount Ruapehu Volcano

**F**ew hazards have such well-defined attributes that specific preparations can be made in advance of an anticipated event. The break-out lahar (volcanic mudflow) threat from Mount Ruapehu's summit crater lake in New Zealand was one situation, however, where the likelihood, location, magnitude, and approximate timeframe of occurrence were all relatively well-constrained. As a result, a specific emergency response to the predicted lahar could be planned and mitigation measures employed.

When the lahar did occur in March 2007 there was no loss of life, reported injuries, or major damage to infrastructure. Here, we present the mitigation, warning, and planned response measures that were in place at the time of the lahar.

### Mount Ruapehu, New Zealand

Mount Ruapehu is an active volcano situated in the center of the North Island, New Zealand, near the southern limit of the Taupo Volcanic Zone. Historic activity has been dominated by relatively frequent but small eruptions through the acidic Crater Lake that occupies the active vent. Larger magmatic eruptions occurred in 1945 and 1995–1996. Volcanic hazards are dominated by base-surges and ballistic fall-out, which are confined to the summit area, primary eruption-triggered and secondary rain-triggered lahars in catchments draining the mountain (principally the Whangaehu River, the natural outlet to Crater Lake, and the route of more than 47 lahars since records began in 1861), and more widespread ash falls. Pyroclastic flows, surges, and debris avalanches also occur but are less frequent.

Because Ruapehu is located within the Tongariro National Park World Heritage Area, the mountain does not pose an immediate threat to established towns, which are located outside the park boundaries. The inception of this park in 1887 has provided rather fortuitous land use planning for one of New Zealand's most active volcanoes. Although two small ski areas (Whakapapa and Turoa) are located on the northern and western slopes of the volcano, residential ski lodges are located beyond the range of historic ballistics and away from known lahar paths. In addition skiers on the slopes are alerted to any eruption-caused lahars by an automated eruption detection and warning broadcast system.

During 1995–1996, volcanic activity at Mount Ruapehu emptied the summit crater lake and deposited about 25 feet (7.5 meters) of tephra (sand, gravel, and boulder-sized volcanic material) across the former hard rock outlet area. Over the following decade, the crater lake refilled to a level where it threatened to overtop and breach this fragile barrier. Based on rising lake levels, it was likely

that a breach would happen in late 2006 or 2007. Once the dam failed, it was predicted that up to 63.5 million cubic feet (1.8 million cubic meters) of hot, acidic water would be released into the steep gorge of the upper Whangaehu River, forming a lahar.

Although no human settlements were specifically at risk, some key infrastructure was threatened, including electricity transmission pylons; road, rail, and farm bridges and fiber optic cables carried across them; and state highway, district, and farm roads. Lives were also in danger if people were present in the lahar path as it came down the mountain (for example, along roads and bridges) on the walking track around Mount Ruapehu or at the Tangiwai memorial site.

The precedent of the 1953 Tangiwai disaster, New Zealand's worst volcanic tragedy, played a key role in informing emergency planning. This event was precipitated by a situation almost identical to the one that developed in 2007—eruptions in 1945 had emptied Crater Lake and constructed a fragile barrier of volcanic debris over the former outlet. This dam failed without warning on Christmas Eve 1953, generating a lahar that critically damaged a rail bridge minutes before the arrival of the Wellington-Auckland express train. Unable to stop in time, the engine and most of the carriages plunged into the lahar-swollen river, and 151 lives were lost. Given this historic event, authorities aimed to avert a similar tragedy by planning and taking action in advance of another dam-break lahar.

### Preparing for a Lahar from Mount Ruapehu's Crater Lake

In preparation for the anticipated lahar, the Department of Conservation (as manager of the park) produced an *Environmental and Risk Assessment for Mitigation of the Hazard from Ruapehu Crater Lake* in April 1999. The report presented 24 options in six categories, which included the following:

- Allow lahar to occur: develop alarm and response system, improve land use planning, but no engineering intervention at crater or in lahar flood zones
- Allow lahar to occur but intervene in lahar flood zones to reduce its size and/or confine it
- Prevent or reduce lahar by hardening or perforating the 1995–1996 tephra barrier at the crater
- Prevent or reduce lahar by excavating a trench through the 1995–1996 tephra barrier at the crater
- Prevent lahar and reduce lake volume by excavating trench into underlying rock at outlet
- Defer, prevent, or reduce lahar via other options (e.g., siphoning, barrier truss)



In late 2001, the Minister of Conservation decided to allow the lahar to occur without direct intervention at the crater rim, while also installing an alarm warning system and requiring that emergency management response and contingency plans were developed by relevant agencies.

State-of-the-art warning system hardware known as ERLAWS (Eastern Ruapehu Lahar Alarm and Warning System) was installed by the Department of Conservation and a consortium of local government bodies, emergency services, and infrastructure agencies. The warning hardware would detect failure of the tephra dam and confirm the creation of a lahar by sequential triggering of sensors in the upper Whangaehu Gorge and would then transmit a warning signal to agencies. Agencies would then put their response plans into action.

In addition, a series of preemptive engineering measures were implemented, including:

- raising and strengthening the State Highway 47 road bridge at Tangiwai to withstand the forces of a lahar
- constructing an embankment at the mouth of the Whangaehu Gorge to reduce the risk of the lahar spilling into channels to the north, from which it could then cross State Highway 1 (the main north-south highway) and enter the Tongariro River
- installing gates and warning lights and signs on roads crossing the Whangaehu River and other potential lahar channels

Two groups were organized to develop response plans to the lahar. The Southern Ruapehu Lahar Planning Group was responsible for developing a response plan for the southern side of the mountain, where the main

risk from the lahar was. The Northern Ruapehu Lahar Planning Group was responsible for planning a response for the northern side, which included the possibility of a large lahar overflowing to the north and entering the Tongariro River and Lake Taupo. The planning groups comprised a range of organizations, including local government bodies, the police, and other emergency services with input from other agencies involved in the response, such as the Department of Conservation, GNS Science, and transport and energy infrastructure companies. At a national level, the Ministry of Civil Defence & Emergency Management assisted with planning but was not directly involved in developing any plans.

The response plans defined agencies' roles and responsibilities during the event and outlined a timeline for expected response. The response involved deploying personnel, closing roads and railways in the affected area, setting up emergency operations centers, and monitoring the event. The northern and southern plans were integrated with each other and with individual agency plans. Written plans were tested in annual exercises.

### March 18, 2007: The Lahar Occurs

On March 18, 2007, more than 10 years after the initial eruptions that created the tephra dam, the lahar occurred when the dam holding back Ruapehu's summit Crater Lake gave way. The torrent rushed down the steep Whangaehu Gorge on the eastern flank of Ruapehu. Sensors and observation teams at multiple locations downstream were able to track the evolution of the lahar from its ini-

tiation at the crater rim to its arrival at the coast 95 miles (155 kilometers) away, 16 hours later.

Initially, small failures within the tephra dam triggered a primary lahar warning at 10:06 am, but because not all of the sensor thresholds had been triggered, responders were unsure whether the event was actually happening. This led to a period of uncertainty around the response. A few response staff were activated after the primary warning was received, then temporarily deactivated. When the dam failed and all the alarms were tripped at 11:22 am, these people were mobilized once again. The uncertainty caused by incremental failure of the tephra dam, along with the temporary deactivations, led to short-term delays in the response, but this did not affect overall response effectiveness.

As planned, relevant roads, railways, and bridges were closed and public access blocked. While the lahar could not be observed directly at the top of the mountain because of poor weather, it was observed by responders as it travelled down the lower Whangaehu Valley. Emergency operations centers and incident control points were updated as the event unfolded and undertook activities as outlined in the plans. A small road bridge and a toilet block at the Tangiwai memorial were damaged, but most infrastructure was left unharmed—the mitigation works proving successful. There were no injuries, and no lives were lost in the event.

Because it was known that a lahar was very likely to occur, it was possible to conduct social science research into the planned organizational emergency response to the lahar. Semi-structured interviews with individuals involved in the response were undertaken one year before the event to ask responders about their expectations for the planned response. One month following the lahar, the same individuals were again interviewed to find out how agencies performed during the actual response.

Overall, the emergency response to the lahar operated according to written plans. There were a few minor instances where actions bypassed what had been agreed to in the plans, primarily because people had developed strong informal relationships during the regular exercises, but these did not affect the outcome of the response.

The benefits of planning, training, and exercising before the event were reflected in the successful response to the lahar. The lahar response was continually improved by addressing issues that arose during exercises. Pre-lahar activities also helped foster good relationships between individuals and organizations, which proved to be invaluable during the response itself.

Now that the break-out lahar is over, the basic planning principles used for the event can be applied to planning for future risks in the Central North Island volcanic area, the most likely being a volcanic eruption. Existing plans can be updated and adapted to encapsulate a response to future volcanic events. The Northern and Southern Ruapehu Lahar Planning Groups are currently in the process of merging together as one group and are discussing future management of risk and response planning for the Central North Island volcanoes.

## Conclusion

Because the break-out lahar event was well defined in time and space, it provided a focus for which to put together a holistic program to manage a specific risk. This program included elements of structural mitigation, an effective warning system (including hardware and effective response to the messages generated from the hardware), and emergency management planning, exercising, and training. While future events may not be as well known or constrained, aspects of lahar planning can be applied to other future volcanic events within the region, as well as to other more general aspects of emergency management planning.

**Julia Becker (j.becker@gns.cri.nz)**

GNS Science, Avalon, Lower Hutt, New Zealand

**Vern Manville (v.manville@gns.cri.nz)**

GNS Science, Wairakei Research Centre, Taupo, New Zealand

**Graham Leonard (g.leonard@gns.cri.nz)**

GNS Science, Avalon, Lower Hutt, New Zealand

**Wendy Saunders (w.saunders@gns.cri.nz)**

GNS Science, Avalon, Lower Hutt, New Zealand

## References

1. Department of Conservation. 1999. Environmental and risk assessment for the mitigation of the hazards from Ruapehu Crater Lake. Assessment of Environmental Effects Report, Department of Conservation, Turangi, New Zealand.
2. Galley, I., G. Leonard, D. Johnston, R. Balm, and D. Paton. 2004. The Ruapehu lahar emergency response plan development process: An analysis. *The Australasian Journal of Disaster and Trauma Studies* 2004 (1). Available at [www.massey.ac.nz/~trauma](http://www.massey.ac.nz/~trauma).
3. Leonard, G.S., D.M. Johnston, D. Paton, A. Christianson, J. Becker, and H. Keys. Developing effective warning systems: Ongoing research at Ruapehu Volcano, New Zealand. *Journal of Volcanology and Geothermal Research*. In press.
4. Manville, V., and S.J. Cronin. 2007. Break-out lahar from New Zealand's Crater Lake. *EOS Transactions, American Geophysical Union* 88: 441-442.

## Web Resources

**GNS Science, Volcanoes in New Zealand**

[www.gns.cri.nz/what/earthact/volcanoes/index.html](http://www.gns.cri.nz/what/earthact/volcanoes/index.html)

**GeoNet**

[www.geonet.org.nz/about/](http://www.geonet.org.nz/about/)

**NZ Ministry of Civil Defence and Emergency Management**

[www.civildefence.govt.nz/memwebsite.nsf](http://www.civildefence.govt.nz/memwebsite.nsf)

## Bureau of Reclamation Records Indicate Lake Mead could be Dry by 2025

There is a 50% chance Lake Mead, a key source of water for millions of people in the southwestern United States, will be dry by 2021 if the climate changes as expected and future water usage is not curtailed, according to researchers at Scripps Institution of Oceanography, University of California, San Diego. Without Lake Mead and neighboring Lake Powell, the Colorado River system has no buffer to sustain the population of the southwestern United States through an unusually dry year, or worse, a sustained drought. In such an event, water deliveries would become highly unstable and variable, said research marine physicist Tim Barnett and climate scientist David Pierce.

Barnett and Pierce concluded that human demand, natural forces, and human-induced climate change are creating a net deficit of nearly 1 million acre-feet of water per year from the Colorado River system—an amount of water that can supply roughly 8 million people. Their analysis of Federal Bureau of Reclamation records of past water demand and calculations of scheduled water allocations and climate conditions indicate that the system could run dry even if mitigation measures now being proposed are implemented. The Lake Mead/Lake Powell system includes the stretch of the Colorado River that runs through northern Arizona. Aqueducts carry the water to Las Vegas, Los Angeles, San Diego, and other communities in the Southwest. Currently the system is only at half capacity because of a recent string of dry years, and the researchers estimate that the system has already entered an era of deficit. To read the full press release, visit <http://scrippsnews.ucsd.edu/Releases/?releaseID=876>.



## Katrina Levee Lawsuit Dismissed

In early January, a federal lawsuit against the Army Corps of Engineers over the breach of the levees from Hurricane Katrina was thrown out due to the Flood Control Act of 1992, which holds the federal government immune when flood control projects fail. U.S. District Judge Stanwood Duval acknowledged in later statements that even though the agency failed to protect the citizens of New Orleans and that they knew of the inadequacies of the levee system prior to its breaking, his hands were tied in the final ruling. Plaintiffs argued against the immunity by claiming that the Corps used the canals for other drainage projects and that failures were due to canal dredging. More than 490,000 claims against the agency have been filed so far, totaling trillions of dollars in damages. More suits from government entities, businesses, and individuals are expected to move forward, but many were connected to this lawsuit and a similar one concerning a navigation channel that caused much of the flooding in St. Bernard Parish. Judge Duval stated in his ruling that much of the failure was due to counterproductive laws, such as the Flood Control Act, and that legal and bureaucratic changes are necessary to overcome the incompetence of the system.

## USGS Earthquake Data Now Available Via Google Earth™

Users of U.S. Geological Survey (USGS) earthquake information can now access worldwide historic earthquake data using Google Earth™ mapping technology. Although the huge databases of earthquake occurrences have been available publicly for a long time, the interactive graphic display of Google Earth™ makes it easy to understand the context and significance of each quake. Pop-up windows in the application give the user more information about the earthquake's magnitude, date, location, and depth. USGS and Google™ signed an agreement to publish historic earthquake data from the Advanced National Seismic System (ANSS) catalog as a "built-in" layer, accessible directly from the Google Earth™ viewer. Now, it is simply a matter of toggling a check box to turn on the earthquake layer, similar to roads and other geographic features. The new layer includes historic earthquakes since 1900, and USGS real-time earthquake data are now accessible as a hyperlink from Google Earth™. If the layer is checked, users will see a sprinkling of dots across the globe, each marking an earthquake epicenter. The ease of finding USGS earthquake data directly within the Google Earth™ viewer makes complex scientific data much more accessible and understandable to more people worldwide. To read the full USGS press release, see [www.usgs.gov/newsroom/article.asp?ID=1860](http://www.usgs.gov/newsroom/article.asp?ID=1860).

## Red Cross Acknowledges Poor Monitoring of Volunteer Accommodations

In late February, the American Red Cross announced that hotel occupancy for volunteers, paid for by the charity organization, was not closely monitored during the southern California wildfires of 2006. The oversight led to tens of thousands of wasted dollars in unused hotel rooms. The exact total spent on empty hotel rooms was not released due to a contract with hotels that prevented overseers of Red Cross disaster services from disclosing the cost. According to a spokesperson for the Red Cross, dollar amounts will be disclosed after processing costs with the hotels and trying to negotiate refunds. A majority of the hotel rooms in question were originally booked to accommodate volunteers in San Diego County. The Red Cross has been previously criticized for its handling of donations following disasters and catastrophes, such as the 9/11 World Trade Center attacks and Hurricane Katrina. In the future, the organization pledges to follow more stringent procedures to review invoices and to provide volunteers with help from hotel vendors in coordinating reservations.



## NOAA Weather Satellites Help Rescue 353 People in 2007

Armed with personal locator beacons, 353 people were rescued in the United States and its surrounding waters in 2007 from potentially life-threatening emergencies. The distress signals were transmitted to rescue teams via a NOAA environmental satellite more commonly known for providing information to weather forecasters. NOAA's polar-orbiting and geostationary satellites, along with Russia's Cospas spacecraft, are part of the high-tech, international Search and Rescue Satellite-Aided Tracking System, called COSPAS-SARSAT. The system uses a network of satellites to quickly detect and locate distress signals from emergency beacons onboard aircraft and boats and from handheld personal locator beacons (PLBs).

When a satellite pinpoints a distress location within the United States or its surrounding waters, the information is relayed to SARSAT Mission Control at NOAA's Satellite Operations Center in Suitland, Maryland, and then sent to a Rescue Coordination Center, operated either by the U.S. Air Force for land rescues or the U.S. Coast Guard for water rescues. Alaska and Florida recorded the most rescues in 2007 (73 each), and North Carolina was third with 16 rescues. Of the 353 rescues, 235 people were saved at sea, 30 were rescued from downed aircraft, and 88 were saved with help from their PLBs. Following are some of the rescue highlights:

- Four people were rescued in Lake Michigan when a powerful storm knocked out communications to their boat, which was running low on fuel.
- Near Kanatak, Alaska, four people and a dog were pulled to safety from their sinking boat.
- In northeast Utah, three people were rescued after their raft capsized in the rough rapids of the Green River.
- A U.S. Coast Guard helicopter hoisted three people from 70-foot high seas after their boat sank 200 miles off the coast of North Carolina.
- A 71-year-old hiker, too exhausted to continue his outdoor trek along the Pacific Crest Trail, was rescued in Wrightwood, California.

Older emergency beacons, which operate on the 121.5 and 243 megahertz frequencies, will be phased out by early 2009 when 406 megahertz beacons will become the new standard. A key advantage of the 406 megahertz beacons is that they use Global Positioning System technology for instant detection, leading to faster rescues. According to NOAA, anyone who plans to hike or camp in a remote location where cell phone service is not reliable, or sail a boat far from shore, should not leave home without an emergency locator beacon that is registered with NOAA. To read the full NOAA press release, visit [www.noaa.gov/stories2008/20080117\\_sarsat.html](http://www.noaa.gov/stories2008/20080117_sarsat.html).





## CDC Takes Responsibility for Slow Response in Testing FEMA Trailers

The U.S. Centers for Disease Control and Prevention (CDC) recently reported to a Senate sub-committee on disaster recovery that they should have responded more aggressively to concerns about hazardous formaldehyde fumes in government-issued trailer housing. The trailers were provided to victims of Hurricanes Katrina and Rita by the Federal Emergency Management Agency (FEMA). FEMA enlisted the CDC's help in mid-2006 to test the air quality of the trailers; however, tests did not begin until late 2007. Formaldehyde levels in the trailers were found to be five times higher than the average level of exposure experienced by persons living in modern homes. The findings prompted FEMA to relocate approximately 34,000 families that still occupy these trailers to safer housing. During the Senate hearing held on March 4, 2008, FEMA Deputy Administrator Harvey Johnson emphasized FEMA's dedication to provide safe and secure temporary housing to victims. Alternative methods for temporary housing are being explored by the agency in an attempt to avoid future problems with formaldehyde levels in trailers and mobile homes. For more information on FEMA's future plan of action, see [www.fema.gov/news/newsrelease.fema?id=42611](http://www.fema.gov/news/newsrelease.fema?id=42611).

## NOAA Appoints New National Hurricane Center Director

In January, NOAA officials named Bill Read as the new director of its Tropical Prediction Center, which includes the National Hurricane Center and two other divisions. Read has served as the center's acting deputy director since August 2007. Tropical storms and hurricanes have frequently played a major role in Read's professional life. Read and his team were at the forefront in July 2003 as Hurricane Claudette made landfall on the Texas coast. He was also part of the Hurricane Liaison Team at the National Hurricane Center in Miami when Hurricane Isabel came ashore on the Outer Banks of North Carolina in September 2003.

Read was appointed as director of the Houston/Galveston weather forecast office of NOAA's National Weather Service in 1992 and led it through the challenges of the National Weather Service modernization and restructuring program in the mid-1990s. Prior to joining NOAA's National Weather Service, he served in the U.S. Navy, where his duties included an assignment as an on-board meteorologist with the Hurricane Hunters. Read began his career in 1977 at the National Weather Service test and evaluation division in Sterling, Virginia; developed his forecasting skills in Fort Worth and San Antonio, Texas; and served as severe thunderstorm and flash flood program leader at the National Weather Service headquarters in Silver Spring, Maryland. To read the full NOAA press release, visit [www.noaanews.noaa.gov/stories2008/20080125\\_read.html](http://www.noaanews.noaa.gov/stories2008/20080125_read.html).

## International Emergency Management Assistance Compact Signed Into Law

In December 2007, President Bush signed the International Emergency Management Assistance Compact (IEMAC) into law, a multi-state mutual aid agreement that allows participating states and provinces potential funding when managing disasters. The agreement was entered into by the states of Massachusetts, Connecticut, Rhode Island, Maine, New Hampshire, and Vermont as well as eastern provinces of Canada. This cooperative agreement was officially adopted by the participating jurisdictions in 2000 at the 25th Annual Conference of the New England Governors and Eastern Canadian Premiers in Halifax, Nova Scotia. Members of the IEMAC have established protocols that allow for equipment and personnel sharing during disasters or major emergencies. The IEMAC is known in Canada as the International Emergency Management Assistance Memorandum of Understanding (IEMAC MOU). To access the full text of the MOU, go to [www.scics.gc.ca/cinfo00/85007918\\_e.html](http://www.scics.gc.ca/cinfo00/85007918_e.html).

## New Instruments Installed on Hurricane Hunter Aircraft

Instruments that measure surface winds are now attached to the wings of aircraft that fly through hurricanes. These instruments, known as stepped frequency microwave radiometers, provide important information about storm intensity and are able to measure the wind speeds by detecting levels of radiation emitted from foam created by these high speed winds. The devices will provide forecasters at NOAA's National Hurricane Center with real-time data about intensity changes and rainfall rates of a particular storm system. The instruments were recently installed on aircraft of the Air Force Reserve 53rd Weather Reconnaissance Squadron and will be used to collect information about tropical storms during future flights. To read the full NOAA press release, visit [www.noaanews.noaa.gov/stories2008/20080229\\_hurricane.html](http://www.noaanews.noaa.gov/stories2008/20080229_hurricane.html).





## Enhancing the Resilience of Communities to Natural and Other Hazards: What We Know and What We Can Do

**H**urricane Katrina was a dramatic reminder of the importance of resilience for communities and regions exposed to hazards. One consequence was a Congressional earmark through the Department of Homeland Security to establish a Southeast Regional Research Initiative (SERRI), in large part to strengthen capacities in Mississippi and elsewhere in the southeastern United States to understand and cope with such catastrophic events. An aim of SERRI, in turn, has been the development of a Community and Regional Resilience Initiative (CARRI).

CARRI is intended to clarify an understanding of what resilience is and how to get there, based on research evidence; to help three communities become more resilient to possible natural disasters and other threats to resilience; to work toward a Web-based decision support tool to help other interested communities become more resilient; and to mainstream the use of this tool by relating it to economic benefits for participating communities.

For this project, led by the Oak Ridge National Laboratory (ORNL) in collaboration with the Meridian Institute, a resilient community is defined as one that anticipates problems, opportunities, and potentials for surprises; reduces vulnerabilities related to development paths, socioeconomic conditions, and sensitivities to possible threats; responds effectively, fairly, and legitimately in the event of an emergency; and recovers rapidly, better, safer, and fairer.

The project's viewpoint is that such qualities depend on more than just "traditional pillars" of emergency

response, such as local authorities and first responders. Community resilience is more than emergency preparedness. Resilient communities also depend on contributions from grassroots resources (from non-governmental organizations to neighborhoods), the business community, the media, and regional partners. Knitting together these various contributions is a central challenge to a community's structure and dynamics. This CARRI perspective is being tested in three communities in the southeastern United States: Memphis, Tennessee (earthquakes and tornadoes); Gulfport, Mississippi (hurricanes and sea-level rise); and Charleston, South Carolina (hurricanes and earthquakes), all of which consider natural hazards in a larger context of other threats to resilience, from possible economic downturns to possible exposures to epidemics and terrorist events.

The starting point is to bring new clarity to resilience as a concept and an operational objective. CARRI includes a research component, led by myself and senior scientist Bob Kates, that is commissioning a number of summaries of the current knowledge about resilience by leading experts in this field. To add to the existing knowledge, CARRI is also supporting resilience assessments in the three communities led by local expert teams who will not only inform local resilience-enhancement efforts but will also remain in place as resources for local decision making in the longer run. The leaders of these local teams are Arleen Hill of the University of Memphis, Tom Lansford of the University of Southern Mississippi, and Andy Felts of the College of Charleston.

The knowledge gained from these three intense local experiences about resilience and how to achieve it will enrich the knowledge bases available to other communities as they set out on similar paths. One example may be potentials for innovative private-public sector partnerships. Another may be potentials for emerging information technologies to reshape information exchanges about risks and emergency situations. In this sense, the community engagements contribute knowledge to a wider user community and advance resilience within the participating community.

In the longer term, CARRI will be working toward a Web-based decision support tool to assist interested communities in becoming more resilient. This tool will require the knowledge of a wide range of experts in the research community, from specific topics such as evacuation and health care, to threat-specific issues such as earthquakes and floods, to tool-specific issues such as decision support interfaces, to case-specific knowledge such as the experience of New Orleans with Hurricane Katrina. Connecting with the very best available research will get accurate advice in the hands of local communities.

CARRI will also be working toward some type of accreditation approach, whereby communities that achieve a high level of resilience can be recognized. That recognition—even in the absence of catastrophes—can spawn benefits through reductions in infrastructure insurance rates, bond ratings, attracting new business, or the advan-

tage of being less exposed to potential hazards than other communities in the same region.

Finally, CARRI will promote the development of a broader community interested in community-scale resilience, including communities far beyond CARRI's three local partners, such as New Orleans and Charlotte, North Carolina, which are involved in their own efforts to understand and enhance local resilience.

Participants in this project are motivated not only by opportunities to add to knowledge about community resilience but also by the prospect of making a difference. If, as expected, CARRI is sustained over a period of several years, it has the potential to measurably enhance the resilience of a number of communities in the southeastern United States and possibly in other regions of the country.

Experiences with extreme events over the coming decades will test this resilience in some communities. If the observed result is that impacts are reduced and recovery is facilitated, then not only will the project have reduced pain to those communities, but the evidence will also encourage other communities to make the same commitments. From such building blocks are revolutions built.

**Thomas J. Wilbanks** ([wilbanksjtj@ornl.gov](mailto:wilbanksjtj@ornl.gov))

Corporate Research Fellow; Oak Ridge National Laboratory

## Increased Hurricane Losses Due to Growing Population and Wealth in Coastal Areas

**A** team of scientists has found that the increase in economic damages from hurricanes in the United States is due to greater population, infrastructure, and wealth along U.S. coastlines—not due to a spike in the number or intensity of hurricanes. In a paper recently published in the *Natural Hazards Review*, the researchers found that economic hurricane damage in the United States has been doubling every 10 to 15 years. If more people continue to move to the hurricane-prone coastline, future economic hurricane losses may be far greater than previously thought.

The team used two different approaches, which gave similar results, to estimate the economic damages of historical hurricanes if they were to strike today. Both methods used changes in inflation and wealth at the national level. The first method used population increases at the county coastal level, while the second used changes in housing units at the county coastal level.

The results illustrate the effects of the tremendous pace of growth in vulnerable hurricane areas. For example, if the 1926 Great Miami Hurricane were to hit today, the study estimated it would cause the largest losses at \$140 billion to \$157 billion, with Hurricane Katrina second on the list at \$81 billion. The team concluded that potential damage from storms—currently about \$10 billion yearly—is growing at a rate that may place severe burdens on exposed communities and that avoiding huge losses will require a change in the rate of population growth in coastal areas, major improvements in construction standards, or other mitigation actions.

The *Natural Hazards Review* paper, titled “Normalized Hurricane Damage in the United States: 1900-2005,” was authored by Roger A. Pielke, Jr. (University of Colorado), Joel Gratz (ICAT Managers, Inc.), Chris Landsea (NOAA's National Hurricane Center), Douglas Collins (Tillinghast-Towers Perrin), Mark A. Saunders (University College London), and Rade Musulin (Aon Re Australia). To read the full NOAA press release, visit [www.noaanews.noaa.gov/stories2008/20080222\\_hurricane.html](http://www.noaanews.noaa.gov/stories2008/20080222_hurricane.html). The paper may be accessed at [http://sciencepolicy.colorado.edu/admin/publication\\_files/resource-2476-2008.02.pdf](http://sciencepolicy.colorado.edu/admin/publication_files/resource-2476-2008.02.pdf) or via the *Natural Hazards Review* web site at <http://scitation.aip.org/nho>.



# Hazards around the World

Below are brief descriptions of some of the most recent natural hazards and disasters that have occurred around the world. The list is not intended to be all-inclusive, but rather a representation of those hazards that have generated significant impacts, whether physical, social, or both.

## Cyclones and Hurricanes

### Tropical Cyclone Ivan—Madagascar

On February 17, 2008, Category 4 Tropical Cyclone Ivan struck the island nation of Madagascar at wind speeds of more than 120 miles per hour. The worst hit area was Sainte Marie Island, where 90% of the infrastructure was destroyed. On mainland Madagascar, over 400,000 acres of crops were destroyed, and flooding and winds left the large seaport city of Toamasina without electricity and drinking water. The storm caused 93 deaths and left more than 300,000 people homeless.

### Tropical Cyclone Jokwe—Mozambique

On March 8, 2008, Tropical Cyclone Jokwe hit Mozambique's northern coast in Nampula Province with sustained winds of about 90 miles per hour. Jokwe killed 7 people, left more than 30,000 families homeless, and tore through mangroves, destroying local shrimp production and devastating small agricultural holdings just a month short of harvest.

## Earthquakes

### Earthquakes—Democratic Republic of Congo and Rwanda

On February 3, 2008, a series of earthquakes struck Rwanda and the Democratic Republic of Congo. The most powerful earthquakes struck within hours of one another and had magnitudes of 6.1 and 5.0, respectively. The first one struck the province of South Kivu in the Democratic Republic of Congo, with an epicenter located about 12 miles north of the capital Bukavu. The second quake came just under three and a half hours later and hit slightly closer to Bukavu but within Rwanda territory. In Bukavu town, the quake resulted in the collapse of 99 buildings, and 815 buildings were left uninhabitable due to damage and fissures. Reports indicated that 5 people were killed, 200 people were injured, and 915 families were displaced.

## Floods and Landslides

### Flooding—South America

From December 2007 to March 2008, prolonged heavy rainfalls caused severe flooding across Bolivia. As of March 14, the flooding had claimed 71 lives and affected some 94,000 families. The province of Chuquisaca was especially hard hit, losing more than 60% of its agricultural production to the floods. More than 13,500 acres of corn crops were destroyed, devastating the lives and livelihoods of the majority of the people in the province.

In Ecuador, heavy rains beginning in mid-February caused the country's worst flooding in 25 years. The flooding has killed 37 people and affected an estimated 3.6 million others. More than half the country's 24 provinces have been affected, with the coastal provinces of Manabí, Guayas, Los Ríos, and El Oro suffering the most damage. Crop damage is estimated at \$110 million, which has left millions of people without a means to earn a living.

### Flooding—Midwest United States

Following an intense spring storm, flooding swept across much of the midwestern United States beginning in mid-March 2008. Many rivers swelled beyond their banks, leaving houses under water. In Missouri, a major interstate highway shrunk to one lane as workers sandbagged to hold back waters from the Meramec River. In Arkansas, the White River rose about seven feet in four days, causing historic flooding in eastern parts of the state. Some parts of the region saw nearly 12 inches of rain in 36 hours. As of March 25, sixteen deaths had been linked to the flooding.

## Tornadoes

### Tornadoes—Southern United States

On February 5, 2008, tornadoes ripped through the states of Arkansas, western Tennessee, northern Mississippi, northern Alabama, and western Kentucky in the southern United States. The tornadoes resulted from severe thunderstorms that had moved across the region. At least 55 people were killed and hundreds more were injured. The disaster was considered to be the most severe tornado outbreak in the United States in more than 20 years.

## Volcanoes

### Kilauea Volcano—Hawaii, United States

On March 19, 2008, a gas explosion occurred at Halema'uma'u Crater at the summit of Kilauea Volcano, shaking parts of the Big Island and spreading debris over about 75 acres of Hawai'i Volcanoes National Park. The U.S. Geological Survey's Hawaiian Volcano Observatory recorded a series of seismic events that may have been shallow, high-frequency earthquakes or minor explosions. The main explosion produced a small crater along the east wall of Halema'uma'u that is about 65-100 feet in diameter. Sulfur dioxide emissions were at 10 times the normal output and the area had been closed to visitors as of March 25. This is the first explosion in Halema'uma'u Crater since 1924 and the first eruption of any kind in Kilauea Caldera since September 1982.

# Contracts and Grants

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

**Spatial Patterns of Post-Wildfire Neighborhood Recovery.** Funding Organization: National Science Foundation, \$51,314. One year. Principal Investigator: Andrew Curtis, University of Southern California, (213) 740-0061, [ajcurtis@usc.edu](mailto:ajcurtis@usc.edu).

While much attention on large-scale disasters like massive hurricanes, tornadoes, earthquakes, and wildfire focuses on the dynamics of the catastrophe and the magnitude of its adverse impacts, scholarly attention has also been given to the processes through which people recover from the devastations associated with these traumatic events. A spatial variant of the "conservation of resources" (COR) stress model provides a suitable theoretical frame to investigate the geography of recovery in a post-disaster landscape. This theory holds that the loss of social (networks/neighborhood) and personal (possessions, emotions) aspects of life can result in psychopathology among affected residents unless the effects are modified by different coping strategies and eventually by the return to normalcy.

Building on two years of experience in studying the recovery of New Orleans from the ravages of Hurricane Katrina, the investigators of this research project will collect geographic data on neighborhood recovery over a series of time periods in San Diego County neighborhoods affected by the destructive wildfires of October 2007. The investigators will adapt a spatial video acquisition system (SVAS) first developed in collaboration with the National Center for Geocomputation (NCG) in Ireland for use in New Orleans to monitor the recovery of about 8,500 properties in five areas that were significantly impacted by the wildfires.

The system, which consists of two video cameras mounted to either side of a vehicle with the audio track recording a perpetual GPS signal, will be used at roughly three-month intervals for one year following the fires to gather critical data that can then be analyzed to determine the form and character of recovery in the different neighborhoods. These data will be analyzed with respect to the socioeconomic characteristics of the neighborhoods, as well as other variables, to analyze the spatial patterns of post-disaster recovery and to assess the impact of recovery efforts on the psychopathology of residents. The investigators will use the data to test hypotheses associated with post-disaster psychopathology, thereby advancing theoretical understandings regarding geographic factors that may affect the longer-term mental health of residents adversely affected by major disasters. The project will have direct practical benefits for public health officials seeking better understanding of where critical facilities might be placed, and the insights and data from this project will have utility in other settings,

thereby providing new information that might aid future post-disaster recovery efforts. The project will also aid in the refinement of new methods for gathering consistent data regarding post-disaster recovery over longer time periods.

**Atlantic Seasonal Hurricane Prediction and Understanding.** Funding Organization: National Science Foundation, \$159,945. Three years. Principal Investigator: William Gray, Colorado State University, (970) 491-8681, [gray@atmos.colostate.edu](mailto:gray@atmos.colostate.edu).

This project is related to extended range intra-seasonal and seasonal hurricane research and forecasting. The three areas of research are (1) improvement of extended range seasonal Atlantic basin hurricane prediction; (2) improvement of intra-seasonal (month-to-month) prediction of Atlantic hurricane activity; and (3) improvement in probability forecasts for U.S. hurricane landfall. The primary focus continues to be on predicting Atlantic basin seasonal tropical cyclone activity.

The development of statistical Atlantic basin seasonal hurricane forecasts has led to the discovery of physical relationships between hurricanes and global climate features that would likely not have been uncovered without the purpose of prediction. With the recent development of integrated observational/modelled reanalysis data sets, along with new satellite information, new research opportunities have become available. The principal investigator's seasonal and monthly hurricane forecasts are used by insurance agencies, the media, and the general public. His team's forecasts tend to bring the public's attention to the upcoming hurricane season and its potential for loss of both life and property. The continued improvement of both seasonal forecasts and landfall probability forecasts are beneficial to a variety of U.S. coastal interests.

**Board on Earth Sciences and Resources and Its Activities.** Funding Organization: National Science Foundation, \$185,000. One year. Principal Investigator: Anthony de Souza, National Academy of Sciences, (202) 334-2744, [adesouza@nas.edu](mailto:adesouza@nas.edu).

The Board on Earth Sciences and Resources (BESR) provides a focal point for National Research Council activities related to the earth sciences. Under the aegis of the Board, ad hoc committees provide independent advice to the federal government on a wide range of earth science issues, including research, the environment, natural hazards, resources, data, and education. It also provides guidance related to U.S. participation in international earth science programs. The Board and its six standing committees (Committee on Earth Resources;

Geographical Sciences Committee; Committee on Geological and Geotechnical Engineering; Committee on Geophysical and Environmental Data; Committee on Seismology and Geodynamics; and Mapping Science Committee) hold approximately two meetings each per year. At these meetings, potential studies are discussed and developed. Many of these activities are in response to requests from agencies of the federal government for advice on specific technical or policy issues. Other activities are federally mandated, or initiated by the Board in accordance with its efforts to support the continued health of the earth sciences. The Board responds by establishing an ad hoc committee or panel to address the specific issue. The Board continually seeks to provide accurate and timely input to support wise decision making in government, academia, and industry.

Presently, BESR is overseeing eight ad hoc studies with the several more expected to begin in 2008. Studies presently under way are: Challenges and Opportunities in Earth Surface Processes; Critical Mineral Impacts on the U.S. Economy; Deep-Time Geologic Records for Understanding Climate-Change Impact; FEMA Flood Maps: Accuracy Assessment and Cost Effective Improvements; Grand Research Questions in the Solid-Earth Sciences; The Earth System Context for Hominid Evolution; National Requirements for Precision Geodetic Infrastructure; and Strategic Directions for the Geographical Sciences in the Next Decade.

**Doppler on Wheels Mobile Radar Network.** Funding Organization: National Science Foundation, \$395,534. Five years. Principal Investigator: Joshua Wurman, The Center for Severe Weather Research, (720) 304-9100, [jwurman@cswr.org](mailto:jwurman@cswr.org).

Under this cooperative agreement, the principal investigator will provide as a national facility a three-system, ground-based mobile radar fleet: the Doppler on Wheels (DOWs). The three systems include two mobile X-band DOWs and the 6 to 12 beam "Rapid Scan DOW."

In the past, these radar systems have participated in research projects that have covered a broad range of topics including individual cumulus cloud studies, orographic precipitation and dynamics, hydrologic studies, fire weather investigations, severe convective storms, and tropical cyclones at landfall. By establishing these systems as a national facility, community access to mobile radar systems will be greatly enhanced with a concomitant increase in research activities.

The DOW mobile multiple-Doppler network has the potential to play a critical role in obtaining spatially and temporally fine-scale three-dimensional single-Doppler and multiple-Doppler vector wind fields and reflectivity fields in support of a variety of the NSF community's scientific studies. Due to the ease of use, transportability, and low deployment cost, the DOWs can be frequently used on site for educational activities, such as inclusion in university atmospheric instrumentation courses. The DOWs can be operated by students with minimal technical supervision, and they add significantly to the facility infrastructure of the atmospheric sciences community. It

is anticipated that many researchers from many different institutions and disciplines will use these systems on a variety of research projects.

**A Research Network for Sustaining Barrier Island Ecosystems in a Changing Global Environment.** Funding Organization: National Science Foundation, \$100,000. One year. Principal Investigator: William Smith, Wake Forest University, (336) 758-5779, [smithwk@wfu.edu](mailto:smithwk@wfu.edu).

Coastal barrier islands are found along many continental shorelines worldwide, including the heavily populated Eastern Seaboard and Gulf Coast regions of the United States. Coastal barrier islands are very popular areas for residential development, but they also provide critical protection for adjacent shorelines from high-energy oceanic waves. They also create shoreline and wetland habitats that support diverse plant and animal assemblages, including migratory birds and commercially important fish species.

Despite the large number of engineering, natural, and social science researchers who conduct research on these ecosystems, no organization currently exists for fostering communication among these researchers and evaluating the future sustainability of these important ecosystems. The focus of the current project is to develop an interdisciplinary network that will address the effective management of U.S. barrier island ecosystems under the pressures of global climate change (e.g., sea level rise and increased hurricane activity) and continued urbanization. Through the formation of the Coastal Barrier Island Network (CBIN), scientists and municipal planners will interact through workshops, summer courses for students, a newsletter, and an interactive web site that will emphasize public and educational outreach activities.

Climate change may have potentially devastating impacts on barrier island ecosystems and the associated socioeconomic and cultural infrastructures of these heavily populated areas. Predicted increases in sea level and the frequency of intense storms will particularly impact barrier island ecosystems due to their extreme vulnerability to both. By facilitating communication among barrier island researchers from multiple disciplines, as well as with managers, this project will lead to better understanding and more effective management strategies for protecting barrier islands.

## Coming in the July Observer

### Hurricane Evacuation: Traffic Contraflow

**Disaster Mitigation Series, Part 3:** From "Problem" to "Opportunity" in Water Management and Flood Mitigation: Past Experience and Future Perspectives from The Netherlands

## Firewise Leadership Awards: Call for Nominations

The national Firewise Communities program announces a call for entries for the 2008 Firewise Leadership Awards. This is an opportunity for Firewise Communities to acknowledge the leaders of the Firewise effort and to showcase best practices of our neighbors.

The Firewise Leadership Awards are designed to recognize individuals and organizations that demonstrate exemplary work in furthering the vision and mission of the Firewise Communities program at the local, state, and regional levels. Therefore, Firewise Communities/USA sites are eligible for Leadership Awards only if their work has broader impact on a city/municipal, county, or regional scale.

Information about the Firewise Leadership Awards program, including guidelines for entries, can be found at [www.firewise.org/awards](http://www.firewise.org/awards). **All entries must be submitted by June 30, 2008.** Submissions must be for efforts that are ongoing or were completed after January 1, 2007. Questions about the Firewise Leadership Awards should be directed to [firewiseawards@nfpa.org](mailto:firewiseawards@nfpa.org).

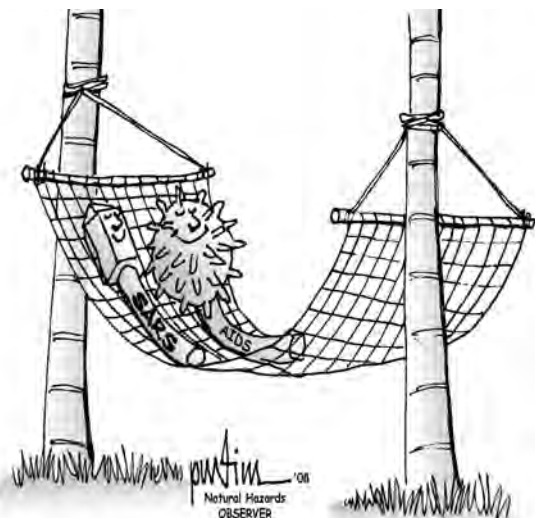
## Population and Environment: Call for Submissions

Lori M. Hunter of the University of Colorado at Boulder has assumed the role of editor-in-chief of the academic journal *Population and Environment*, published by Springer. The journal is keen to expand its representation of quality research by the hazards community and Hunter welcomes submissions from hazards researchers, particularly those engaging the social-demographic dimensions of natural hazards. *Population and Environment* reaches a wide readership of researchers working in academic and policy institutions in the fields of demography, economics, sociology, geography, environmental studies, public health, ecology, and associated sub-disciplines.

The journal's mission is to publish articles, commentary, and reviews related to the bi-directional links between population, natural resources, and the natural environment, with the purpose of deepening scientific and policy dialogue in this often complex area. The coverage is multidisciplinary, spanning a range of social, policy, life, and natural sciences. For further information, please visit the journal's web site at [www.springer.com](http://www.springer.com) or contact Lori Hunter directly at [lori.hunter@colorado.edu](mailto:lori.hunter@colorado.edu).

## Tropics are Likely Hotspot for Next Pandemic

Scientists say the next major disease like HIV/AIDS or SARS could occur in any of a number of developing countries concentrated along the equator, and they encourage increased surveillance to prevent the spread of a potential outbreak. Using global databases and sophisticated computer models to analyze patterns of emerging diseases, the researchers are able for the first time to plot, map, and predict where the next pandemic might occur. Funded through a Human and Social Dynamics Exploratory Research award from the National Science Foundation (NSF), the research represents a major breakthrough in understanding where and why pandemic diseases emerge and provides a key tool for preventing them in the future. By analyzing global patterns in human population density, population changes, latitude, rainfall, and wildlife biodiversity in correlation with patterns of emerging diseases, the researchers were able to show definitive proof that the number of emerging diseases is increasing. They cite zoonoses—diseases that originate in animals—as the primary threat to humans. The scientists analyzed 335 incidents of previous disease emergence and were able to identify the regions where future diseases were most likely to occur, plotting the results on a global, “Emerging Disease Hotspots” map. During the last three decades, billions of research dollars have been spent to deal with the seemingly random emergence of dozens of pandemics, but this is the first time researchers are able to provide a scientific prediction of where the next major disease could emerge. Results of the study were published in the February 21 edition of the scientific journal *Nature*. To access the full article text, see [www.nature.com/nature/journal/v451/n7181/pdf/nature06536.pdf](http://www.nature.com/nature/journal/v451/n7181/pdf/nature06536.pdf).





# Resources

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

## Publications, Reports, and More

### All-Hazards

**Management of Dead Bodies after Disasters: A Field Manual for First Responders.** 2006. Free online. Pan American Health Organization; [www.paho.org/english/dd/ped/DeadBodiesFieldManual.htm](http://www.paho.org/english/dd/ped/DeadBodiesFieldManual.htm).

Realizing that care of the dead is often overlooked in disaster planning, this peer-reviewed manual presents simple recommendations for emergency management practitioners to manage the recovery, basic identification, and storage of dead bodies. The manual was prepared by the Pan American Health Organization, the World Health Organization, the International Committee of the Red Cross, and the International Federation of Red Cross and Red Crescent Societies.

**Communicating Disasters: An Asia Pacific Resource Book.** 2007. Nalaka Gunawardene and Frederick Noronha, Editors. Free online. United Nations Development Program and Television for Education; [www.tveap.org/disastercomm/0801dis.html](http://www.tveap.org/disastercomm/0801dis.html).

This book was published jointly by the United Nations Development Program and Television for Education (TVE). Based on a 2006 seminar of media experts, disaster managers, and communications professionals, it explores the role of the media before, during, and after disaster. The book uses experiences during the 2004 Indian Ocean tsunami as a case study.

**Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises.** The National Academy of Sciences. 2007. ISBN: 978-0-309-10354-1. 247 pp. \$49.00 (paperback). The National Academies Press; (888) 624-8373; [www.nap.edu](http://www.nap.edu).

Millions of people are displaced annually because of natural or industrial disasters or social upheaval. Reliable data on the numbers, characteristics, and locations of these populations can bolster humanitarian relief efforts and recovery programs. It is crucial to use sound methods to estimate population numbers and characteristics for both industrialized and developing nations and to ensure that the data are geographically referenced for projection onto maps. This book provides a review of the primary methods and tools for making estimates of sub-national populations and makes several recommendations to improve the collection and the use of population data for emergency response and development.

### Climate Change

**Climate Change 2007: Impacts, Adaptation and Vulnerability.** Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. 2008. ISBN: 978-0-521-70597-4. 976 pp. \$85.00 (paperback). Cambridge University Press; (845) 353-7500; [www.cambridge.org](http://www.cambridge.org).

The Climate Change 2007 volumes of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) provide the most comprehensive and balanced assessment of climate change available. This IPCC Working Group II volume provides a completely up-to-date scientific assessment of the impacts of climate change, the vulnerability of natural and human environments, and the potential for response through adaptation. Written by the world's leading climate change experts, the IPCC volumes will form the standard reference works for policy decisions for government and industry worldwide.

**Climate Change 2007: Mitigation of Climate Change.** Working Group II Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. 2008. ISBN: 978-0-521-70598-1. 851 pp. \$85.00 (paperback). Cambridge University Press; (845) 353-7500; [www.cambridge.org](http://www.cambridge.org).

The latest assessment of the Intergovernmental Panel on Climate Change (IPCC) provide a comprehensive overview of knowledge related to the mitigation of climate change. It includes a detailed assessment of technology costs and practices, implementation barriers, and policy options for many sectors, including energy supply, transportation, buildings, industry, agriculture, forestry, and waste management.

**Climate Change and Adaptation.** Neil Leary, James Adejuwon, Vicente Barros, Ian Burton, Jyoti Kulkarni, and Rodel Lasco, Editors. 2008. ISBN: 978-1-84407-470-9. 381 pp. \$146.00 (hardcover). Earthscan; (800) 232-0223; [www.earthscan.co.uk](http://www.earthscan.co.uk).

This volume, along with its companion on vulnerability (see below), resulted from the work of the Assessments of Impacts and Adaptations to Climate Change (AIACC) project launched with the IPCC in 2002 and is the first to provide an in-depth investigation of the stakes in developing countries. It covers current practices for managing climate risks, deficits between current practices and needs, the changing nature of the risks due to human-caused climate change, strategies for adapting to



changing risks, and the need to integrate these strategies into development planning and resource management. The book also identifies obstacles to effective adaptation and explores measures needed to create conditions that are favorable to climate change adaptation.

**Climate Change and Vulnerability.** Neil Leary, Cecilia Conde, Jyoti Kulkarni, Anthony Nyong, Juan Pulhin, Editors. 2008. ISBN: 978-1-84407-469-3. 428 pp. \$146.00 (hardcover). Earthscan; (800) 232-0223; [www.earthscan.co.uk](http://www.earthscan.co.uk).

The award of the Nobel Peace Prize for 2007 to the International Panel on Climate Change (IPCC) brought needed attention to the threats from climate change to highly vulnerable regions of the developing world. This volume, which resulted from the work of the Assessments of Impacts and Adaptations to Climate Change (AIACC) project launched with the IPCC in 2002, is the first to provide an in-depth investigation of the stakes in developing countries. It discusses who is vulnerable and the nature and causes of vulnerability in regions of the world that have been poorly researched until now. It also provides researchers with new examples of applications of vulnerability assessment methods, an approach that is of growing interest in the climate change arena but for which there are relatively few applications in the literature.

**Climate Change as a Security Risk.** German Advisory Council on Global Change (WBGU). 2007. ISBN: 978-1-84407-536-2. 256 pp. \$146.00 (hardcover). Earthscan; (800) 232-0223; [www.earthscan.co.uk](http://www.earthscan.co.uk).

This book focuses on the likelihood of increasing tensions and conflicts in a climatically constrained world and spotlights places where possible conflicts may flare up in the 21st century unless climate change is checked. Without resolute counteraction, climate change will overstretch many societies' adaptive capacities within the coming decades, which could result in destabilization and violence, jeopardizing national and international security to a new degree. However, climate change could also unite the international community, provided that it recognizes climate change as a threat to humankind and soon sets the course for the avoidance of dangerous anthropogenic climate change by adopting a dynamic and globally coordinated climate policy.

**Hell and High Water: The Global Warming Solution.** Joseph Romm. 2007. ISBN: 978-0-06-117213-7. 292 pp. \$13.95 (paperback). Harper Perennial; (212) 207-7000; [www.harperperennial.com](http://www.harperperennial.com).

This book offers a searing critique of American environmental and energy policy and a passionate call to action by a writer with a unique command of the science and politics of climate change. According to author Joseph Romm, we have ten years, at most, to start making sharp cuts to our greenhouse gas emissions, or we will face disastrous consequences. The good news, he writes, is that there is something we can do—but only if the leadership of the U.S. government acts immediately and asserts its influence on the rest of the world.

## Drought

**Methods and Tools for Drought Analysis and Management.** Giuseppe Rossi, Teodoro Vega, and Brunella Bonaccorso, Editors. 2007. ISBN: 978-1-4020-5923-0. 418 pp. \$199.00 (hardcover). Springer; (212) 460-1500; [www.springer.com](http://www.springer.com).

Implementation of effective drought management policies requires both advanced technologies and appropriate methods. Monitoring and forecasting systems, practical tools for risk assessment, and simple and objective criteria to select and implement appropriate drought mitigation measures are key elements for a successful drought management strategy. This book presents the outcomes of projects with a special focus on drought monitoring and forecasting techniques at different spatial scales; new or modified agrometeorological indices and remote sensing techniques for drought identification and characterization; tools to improve surface water resource management under drought conditions; methods and tools for groundwater resources monitoring and management; and general criteria to select and implement mitigation strategies to prevent or minimize drought impacts.

## Hurricanes, Floods, and Coastal Hazards

**Elevation Data for Floodplain Mapping.** The National Academy of Sciences. 2007. ISBN: 978-0-309-10409-2. 151 pp. \$37.00 (paperback). The National Academies Press; (888) 624-8373; [www.nap.edu](http://www.nap.edu).

Approximately \$650 billion in insured assets are now covered under the National Flood Insurance Program (NFIP), which is managed by the Federal Emergency Management Agency (FEMA). Floodplain maps serve as the basis for determining whether homes or buildings require flood insurance under the NFIP. Although FEMA is modernizing floodplain maps to better serve the program, concerns have been raised as to the adequacy of the base map information available to support floodplain map modernization. This book shows that existing two-dimensional base map imagery is sufficient to meet FEMA's flood map modernization goals, but the three-dimensional base elevation data that are needed to determine whether a building should have flood insurance are not adequate. The book makes recommendations for a new national digital elevation data collection program to redress this inadequacy.

**Science and the Storms: The USGS Response to the 2005 Hurricanes.** 2008. Free online. U.S. Geological Survey (USGS); <http://pubs.usgs.gov/circ/1306/>. Print copies available from the Government Printing Office (\$30.00); <http://bookstore.gpo.gov>.

Scientists from the U.S. Geological Survey (USGS) say that the lessons learned and technology deployed before, during, and after Hurricanes Dennis, Katrina, Rita, and Wilma in 2005 can be used to help the public, emergency responders, and policymakers prepare for and reduce losses from future hurricanes. This publication showcases everything from the discovery of new storm surge modeling techniques, to the use of satellite imagery and airborne LIDAR (light detection and ranging) to measure

land loss and landscape change, to how science helps determine water quality and flooding threats. It represents the work of about 100 USGS scientists and their cooperators nationwide.

## Tsunami

**Tsunami Preparedness Guidebook.** 2007. Free online. Geo-Hazards International; [www.geohaz.org/contents/projects/tsunamiguide.html](http://www.geohaz.org/contents/projects/tsunamiguide.html).

GeoHazards International recently issued this Tsunami Preparedness Guidebook for community tsunami preparedness planning. It provides a step-by-step approach that enables anyone to be an advocate for tsunami safety. It also describes what to do to prepare a community for tsunamis and how to do it so that people pay attention. Although intended for developing countries, the guidebook contains information useful to any coastal community that is at risk from a tsunami.

## Volcanoes

**Super Volcano: The Ticking Time Bomb beneath Yellowstone National Park.** Greg Breining. 2007. ISBN: 978-0-7603-2925-2. 256 pp. \$24.95 (hardcover). Voyageur Press; (800) 826-6600; [www.voyageurpress.com](http://www.voyageurpress.com).

The volcanic caldera that sits beneath Yellowstone National Park is 45 miles wide—encompassing all of Yellowstone. Historically, this volcano has erupted about once every 600,000 years. It has not done so for 630,000 years, meaning it is about 30,000 years overdue. In this book, author Greg Breining takes a scientific yet accessible look at the enormous natural disaster brewing beneath the surface of the United States. Beginning with a scenario of what will happen when Yellowstone erupts again, he describes how volcanoes function and includes a timeline of famous volcanic eruptions throughout history.

## Wildfire

**Community Bushfire Safety.** John Handmer and Katharine Haynes, Editors. 2008. ISBN: 978-0-643094-26-0. 205 pp. AU\$49.95 (paperback). CSIRO Publishing; +61 3 9662 7500; <http://publish.csiro.au>.

This book brings together in one accessible and comprehensive volume the results of the most important community safety research being undertaken within the Australian Bushfire Cooperative Research Centre (CRC). Using perspectives from social science, economics, and law, it complements the extensive literature that already exists on bushfires, which ranges from ecology and fire behavior to information about emergency management. The wide range of issues covered in the book includes research into gender and vulnerability, the law and its implications for public/fire agency interactions, the arsonist's rationale, the influence of the media, the role of economics in bushfire management and decision making, understanding declines in fire brigade volunteerism, bushfire safety policy and implementation, the effectiveness of community education and risk reduction schemes, and modes of building ignition.

**Essential Bushfire Safety Tips.** Joan Webster. 2008. ISBN: 978-0-643-09535-9. 110 pp. AU\$24.95 (paperback). CSIRO Publishing; +61 3 9662 7500; <http://publish.csiro.au>.

This book contains valuable information on developing a bushfire (wildfire) plan, including over 2,000 authenticated tips covering every known bushfire danger and safety factor. It demystifies bushfire behavior, details the protective action needed at each stage of danger, lists killer and survival factors, and discusses evacuation dangers and advantages and how to make a safe “stay or go” decision. It also explains how bushfire attacks houses, describes weather factors and safe burning-off procedures, and lists home bushfire equipment.

## Government Accountability Office Reports

The following Government Accountability Office (GAO) reports are available free online at [www.gao.gov](http://www.gao.gov). Printed copies are also available (first copy is free, additional copies are \$2.00 each). To order, contact the GAO: (202) 512-6000, TDD (202) 512-2537; [www.gao.gov/cgi-bin/ordtab.pl](http://www.gao.gov/cgi-bin/ordtab.pl).

**Natural Disasters: Public Policy Options for Changing the Federal Role in Natural Catastrophe Insurance.** November 26, 2007. GAO-08-7. 84 pp.

**Influenza Pandemic: Efforts Under Way to Address Constraints on Using Antivirals and Vaccines to Forestall a Pandemic.** December 21, 2007. GAO-08-92. 71 pp.

**National Flood Insurance Program: Greater Transparency and Oversight of Wind and Flood Damage Determinations are Needed.** December 28, 2007. GAO-08-28. 35 pp.

**Army Corps of Engineers: Known Performance Issues with New Orleans Drainage Canal Pumps Have Been Addressed, but Guidance on Future Contracts Is Needed.** December 31, 2007. GAO-08-288. 42 pp.

**Emergency Transit Assistance: Federal Funding for Recent Disasters, and Options for the Future.** February 15, 2008. GAO-08-243. 38 pp.

**Disaster Cost Estimates: FEMA Can Improve Its Learning from Past Experience and Management of Disaster-Related Resources.** February 22, 2008. GAO-08-301. 30 pp.

**National Disaster Response: FEMA Should Take Action to Improve Capacity and Coordination between Government and Voluntary Sectors.** February 27, 2008. GAO-08-369. 57 pp.

**Catastrophic Disasters: Federal Efforts Help States Prepare for and Respond to Psychological Consequences, but FEMA's Crisis Counseling Program Needs Improvements.** February 29, 2008. GAO-08-22. 56 pp.

## Web Sites of Interest

### **Disaster Zone: Emergency Management in the Blogosphere** [www.disaster-zone.com](http://www.disaster-zone.com)

"Disaster Zone: Emergency Management in the Blogosphere" is dedicated to sharing information about the world of emergency management and homeland security. This blog presents interesting information on all aspects of disaster prevention, mitigation, preparedness, recovery, and response.

### **Environmental Protection Agency (EPA) Multimedia Portal** [www.epa.gov/multimedia](http://www.epa.gov/multimedia)

This new multimedia portal is EPA's one-stop location for environmental video, audio/podcasts, and photography. It also includes interactive features such as "Ask EPA" and the Deputy Administrator's blog. Another feature called "EPA in Action" follows the diverse jobs performed by the EPA workforce and examines some of the most pressing environmental issues facing the United States today. Users may subscribe to several podcast series or select from a number of individual podcasts.

### **Fires, Floods, Earthquakes, and Tsunamis: A Human Rights Perspective for Major Natural Disasters**

[www.brookings.edu/events/2008/0114\\_disasters.aspx](http://www.brookings.edu/events/2008/0114_disasters.aspx)

This Web site presents a summary of activities from a January discussion titled "Fires, Floods, Earthquakes and Tsunamis: A Human Rights Perspective for Major Natural Disasters," which was sponsored by the Brookings Institution. Included in the summary are transcripts, speeches, and reports presented during the event.

### **Gender and Disaster Network** [www.gdnonline.org](http://www.gdnonline.org)

The Gender and Disaster Network (GDN) has launched an updated version of its Web site, which contains recent resources and information in the gender and disaster field. The site features a more updated look with simple navigation tabs; a resources area, which hosts the Gender and Disaster Sourcebook; and the Knowledgebase, containing key resources, reports, practical guides, and case studies on gender relations in disaster contexts.

### **Public Entity Risk Institute (PERI)** [www.riskinstitute.org/peri/](http://www.riskinstitute.org/peri/)

The Public Entity Risk Institute (PERI), a nonprofit research institute focused on risk management, has launched a new and improved Web site designed to ease access to an extensive collection of risk management publications, programs, and tools. The new site features an expanded Resource Library organized by topic, audience, and type of resource for more user-friendly research; an E-Training Center; a Symposium Center; and a Data Exchange program.

### **Ready America Instructional Videos** [www.ready.gov/america/about/instructional\\_index.html](http://www.ready.gov/america/about/instructional_index.html)

The Department of Homeland Security (DHS), in partnership with The Advertising Council, has created instructional videos to help educate and empower Americans to prepare for and respond to all kinds of emergencies. The first set of instructional videos, released in English and Spanish, are designed to detail how American families can get an emergency supply kit, make a family emergency plan, and be informed about the different types of emergencies in their community.

### **Select Department of Homeland Security 2007 Achievements**

[www.dhs.gov/xnews/releases/pr\\_1197477138027.shtm](http://www.dhs.gov/xnews/releases/pr_1197477138027.shtm)

This fact sheet from the Department of Homeland Security (DHS) presents select accomplishments of the department during 2007. Included are border protection successes, record-breaking law enforcement, new communications technologies, record FEMA staffing levels, and new operations capabilities.

### **Talk of Alaska** <http://aprn.org/category/toa/>

The Web site of the Alaska Public Radio Network's "Talk of Alaska" show features numerous downloadable podcasts about the ongoing effects of the 1989 Exxon Valdez oil spill. A \$2.5 billion settlement that was awarded to the affected residents, businesses, and communities has been appealed by Exxon Mobile. One podcast, titled "Social Impacts of Exxon Valdez Settlement," looks at potential impacts when and if settlement money arrives to the affected communities. Many useful Web resources on the Exxon Valdez settlement and social impacts are linked from the site.

### **USFA Continuity of Operations** [www.usfa.dhs.gov/coop/](http://www.usfa.dhs.gov/coop/)

The Federal Emergency Management Agency (FEMA) U.S. Fire Administration (USFA) is hosting this business continuity resources site that features the Continuity Connection video series, a dozen short videos created to aid businesses in the development of a continuity of operations (COOP) plan. Related materials and other training resources are also available from the site.

### **What's New in the National Response Framework** [www.fema.gov/pdf/emergency/nrf/whatsnew.pdf](http://www.fema.gov/pdf/emergency/nrf/whatsnew.pdf)

Earlier this year the Department of Homeland Security (DHS) unveiled the National Response Framework (NRF), the guidelines for domestic incident response roles, responsibilities, and relationships. The NRF replaces the National Response Plan, and this four-page fact sheet from DHS explains the differences between the two documents.



# Conferences and Training

Below are the most recent conference announcements received by the Natural Hazards Center. A comprehensive list of hazards and disasters meetings is available at [www.colorado.edu/hazards/resources/conferences.html](http://www.colorado.edu/hazards/resources/conferences.html).

**Association of State Floodplain Managers (ASFPM) Annual Conference—Reno-Sparks, Nevada: May 18-23, 2008.** This comprehensive conference will showcase state-of-the-art techniques, programs, resources, materials, equipment, accessories, and services to accomplish flood mitigation and other community goals. Non-profit, government, business, and academic sectors will share how they successfully integrate engineering, planning, open space, and environmental protection to prepare for a better, sustainable future.

memberhelp@floods.org  
[www.floods.org/Reno-Sparks](http://www.floods.org/Reno-Sparks)

**Effective Risk Communication: Theory, Tools, and Practical Skills for Communicating About Risk—Boston, Massachusetts: May 19-21, 2008.** This introductory program by the Harvard School of Public Health will introduce the scientific foundations for effective risk communication. The program features the latest scientific findings on risk perception, global case studies, a suite of practice tools, and hands-on training. It is designed to aid professionals in communicating risk to various audiences. Legislators, senior policymakers, managers, regulators, and communications staff are encouraged to attend.

contedu@hsph.harvard.edu  
[www.hsph.harvard.edu/ccpe/programs/RCC.shtml](http://www.hsph.harvard.edu/ccpe/programs/RCC.shtml)

**5th Asia Oceania Geosciences Society Conference (AOGS 2008)—Busan, Korea: June 16-20, 2008.** This conference assembles scientists to discuss recent research on atmospheric science, hydrological science, planetary science, solar terrestrial science, solid earth science, ocean science, or interdisciplinary studies. The conference exhibition provides an opportunity for organizations in both public and private sectors to present their objectives and programs to the worldwide geoscience community.

info@asiaoceania.org  
[www.asiaoceania.org/aogs2008](http://www.asiaoceania.org/aogs2008)

**2008 IEEE International Symposium on Technology and Society (ISTAS)—New Brunswick, Canada: June 26-28, 2008.** ISTAS 2008 will be a multi-disciplinary event for researchers in engineering, computer science, social sciences, arts, and humanities, as well as for community-based researchers, policy makers, and technology user communities. The scope of ISTAS 08 will include research on how citizens, groups, and communities are or could be linked with information and communication technologies (ICT), and on designing and developing ICT with and for citizens, groups, and communities.

mary.milliken@nrc-cnrc.gcca  
[www.istas08.ca/~istas08ca/MediaWiki/index.php](http://www.istas08.ca/~istas08ca/MediaWiki/index.php)

**The International Conference on Flood Recovery Innovation and Response (FRIAR) 2008—London, United Kingdom: July 2-3, 2008.** FRIAR 2008 aims to bring together researchers and practitioners who are actively involved in the repair, reinstatement, and resilience of flood-damaged property. The goal of the conference is to identify and disseminate good practice in flood repair, reinstatement, and flood management. The meeting will also cover research in appropriate flooding and property issues in order to develop critical perspectives on the impact of flooding. Key themes of this conference are risk management in relation to flood events and climate change, pre-event planning and business continuity, management of major events, post-damage restoration and recovery, victims of flooding, and international and national government policy.

jsolanki@wessex.ac.uk  
[www.wessex.ac.uk/conferences/2008/friar08/index.html](http://www.wessex.ac.uk/conferences/2008/friar08/index.html)

**2nd Australasian Natural Hazards Management Conference 2008: From Warnings to Effective response and Recovery—Wellington, New Zealand: July 28-31, 2008.** This conference is for emergency managers, planners, risk assessors, asset and utility managers, natural hazards researchers, and scientists. It will provide a forum for discussion of the integration of hazard information into effective risk management, including applying hazard information to best practice planning, developing effective warning systems, improving response and recovery, and creating resilient communities through integrating science into practice. A “Gendering Disasters” workshop will examine the ways that gender impacts individual planning and response to natural hazards events in New Zealand and overseas.

ahmc@hazards-education.org  
[www.hazards-education.org/ahmc/2008/2008index.php](http://www.hazards-education.org/ahmc/2008/2008index.php)

**RGS-IBS Annual International Conference 2008: Geographies that Matter—London, England: August 27-29, 2008.** Like all research and teaching subjects, geography evolves through the combined, relatively uncontrolled acts of its many practitioners. Geographies that matter to geographers and others raises the perennial question of the subject’s wider role in socio-environmental change, conservation, and transformation. The goal of this conference is to critically look at the “drift” of the field by addressing the following questions: What are the geographies that matter? To whom do they matter and why? What is the role of geographical research, teaching, and advocacy in respect of these geographies?

ac2008@rgs.org  
[www.rgs.org/WhatsOn/ConferencesAndSeminars](http://www.rgs.org/WhatsOn/ConferencesAndSeminars)

**Dam Safety '08—Indian Wells, California: September 7-11, 2008.** Dam Safety 2008 will attract approximately 850 attendees from 50 states, Puerto Rico, and several other nations. The American Society of Dam Safety Officials (ASDSO) annual conference offers a unique blend of training in both technical and practical dam safety applications, along with the opportunity to network with a variety of professionals representing all aspects of the dam safety community.

sasorrell@damsafety.org  
[www.damsafety.org](http://www.damsafety.org)

**Wetlands and Global Climate Change—Portland, Oregon: September 15-18, 2008.** Global climate change will be the primary topic at the Association of State Wetland Managers (ASWM) annual conference. Potential sessions will focus on carbon sequestration and wetlands, sea level change, and strategies for managing wetlands in response to long-term changes in temperature and precipitation. Other related topics will include wetland research priorities, monitoring trends in wetlands and related resources, management strategies, invasive species, biodiversity, and policy responses to a changing environment.

jeanne.christie@aswm.org  
[www.aswm.org](http://www.aswm.org)

**International Conference on Modeling, Monitoring and Management of Forest Fires—Toledo, Spain: September 17-19, 2008.** Forest fires are very complex phenomena that, under the right physical conditions, can rapidly devastate large areas. Forest fire analysis and mitigation requires the development of computer codes that can take into consideration a large number of different parameters. This conference will focus on the latest research and applications of computational tools that are available to analyze and predict the spread of forest fires in an attempt to prevent or reduce major loss of life and property, as well as damage to the environment. The conference aims to address all aspects of forest fires, from fire propagation in different scenarios to the optimum strategies for fire fighting. It will also cover issues related to economic, ecological, social, and health effects.

rcreasey@wessex.ac.uk  
[www.wessex.ac.uk/conferences/2008/fires08/index.html](http://www.wessex.ac.uk/conferences/2008/fires08/index.html)

**2008 ICMA Annual Conference—Richmond, Virginia: September 21-24, 2008.** With the theme "Celebrating Our Past, Preparing Our Future," this year's International City/County Management Association (ICMA) conference program will address the issues, trends, and challenges currently facing local government managers worldwide. Experts from the public, private, nonprofit, and academic sectors will share their knowledge and interact with participants in educational sessions organized around the following theme tracks: infrastructure planning and financing, organizational and professional sustainability, civic engagement, and environmental sustainability.

ICMAconference@icma.org  
[www.icma.org](http://www.icma.org)

**International Snow Science Workshop—Whistler, British Columbia, Canada: September 21-27, 2008.** Advocating awareness of avalanche terrain, improving avalanche forecasting techniques, and providing effective lines of communication to the general public are the focus of this year's conference, which encourages a true merger of theory and practice. In addition to the oral and poster presentations on research and finding projects, virtual field trips, storm reports, or slide shows of remarkable events will be presented. Attendees will be able to familiarize themselves with more than 700 industry professionals for recommendations and testing of avalanche related products, ski touring gear, and technical clothing.

issw2008@avalanche.ca  
[www.issw2008.com](http://www.issw2008.com)

**GIScience 2008: 5th International Conference of Geographic Information Science—Park City, Utah: September 23-26, 2008.** This conference will address emerging topics and basic research findings across all sectors of geographic information science. The conference attracts leading GIScience researchers from all fields to reflect the interdisciplinary breadth of GIScience, including cognitive science, computer science, engineering, geography, information science, mathematics, philosophy, psychology, social science, and statistics. In addition, workshops will form a complementary forum to the main conference, encouraging the presentation and discussion of work in progress and facilitating a dialogue on emerging topics in small groups.

laura.siebeneck@geog.utah.edu  
[www.giscience.org](http://www.giscience.org)

**The 34th Annual North American Victim Assistance Conference. Host: National Organization for Victim Assistance (NOVA)—Louisville, Kentucky: September 28- October 2, 2008.** This conference provides victim assistance training and provides attendees with practical insights on developing skills that help victims thrive. The nation's leading victim advocates will share their stories and experiences, and the exhibition program will offer a diverse mix of instructive material.

[www.trynova.org/conference/2008/](http://www.trynova.org/conference/2008/)

**Eighth EMS Annual Meeting and Seventh European Conference on Applied Climatology (ECAC) — Amsterdam, The Netherlands: September 29-October 3, 2008.** The European Metrological Society (EMS) and European Climate Support Network (ECSN) have established a tradition of holding the EMS Annual Meeting and the European Conference on Applied Climatology (ECAC) together. These meetings are meant to provide a forum for the dissemination of latest research and development results, and for the exchange of ideas on future strategies in climatology and meteorology. This forum is attractive to the entire atmospheric and related communities: scientists, service providers, manufacturers, and users. The EMS annual meeting aims to strengthen and widen scientific exchange within the European context to explain the specific characteristics of the science of meteorology, to address

the challenges of interpreting the results, and to communicate them to society at large. It includes the application of meteorology for the benefit of society, providing a platform for the meteorological community to discuss demands and aims for the present and the future. To address these issues, the 2008 conference will have three streams: the atmosphere and the water cycle; meteorology and society; and forecasting the weather at all time scales.

ems2008@copernicus.org

<http://meetings.copernicus.org/ems2008/>

**Geological Society of America Annual Meeting: Celebrating the International Year of Planet Earth—Houston, Texas: October 5-9, 2008.** The vision of this conference is to highlight and stimulate discussions in areas of common interest across the diversity of disciplines and organizations represented. Shared involvement in energy, water resources, education, and earth systems will foster a program comprised of thousands of scientific papers, hundreds of exhibits, and a myriad of distinguished lectures and special events in order to engage students and professionals across the earth sciences and in every employment sector.

wcox@geosociety.org

[www.acsmeetings.org/2008/](http://www.acsmeetings.org/2008/)

**4th National Conference on Coastal and Estuarine Habitat Restoration—Providence, Rhode Island: October 11-15, 2008.**

This conference will address all aspects of coastal and estuarine habitat restoration, in all habitats and at all scales. The five-day meeting will explore the state-of-the-art in all aspects and scales of restoration and will be comprised of field sessions, plenary sessions, expert presentations, special evening events, workshops, a poster hall, and a Restoration Exposition. The goal of this conference is to advance the science, scale, pace, practice, and success of habitat restoration at all scales.

conference@estuaries.org

[www.estuaries.org](http://www.estuaries.org)

**14th World Conference on Earthquake Engineering—Beijing, China: October 12-17, 2008.** The World Conference on Earthquake Engineering (WCEE) is the most influential and the largest professional event in the field of earthquake engineering. This year's meeting will serve as an international forum at which more than 3000 specialists, government officials, and NGO representatives in earthquake engineering and relevant fields will exchange their latest research results and technologies. It will also serve as an opportunity for related vendors to display their latest products and services. The conference strives to promote innovation, transformative practice, and durable safety in reducing the impact of earthquakes on society and the environment.

pco@14wcee.org

[www.14wcee.org](http://www.14wcee.org)

**IHDP 7th Open Meeting: Social Challenges of Global Change—New Delhi, India: October 16-19, 2008.** This meeting, organized by the International Human Dimensions Programme on Global Environmental Change (IHDP) and The Energy and Resources Institute (TERI), will be highly applicable to

the South Asian region generally, and India in particular. The conference will follow up on outcomes from the last Open Meeting in Bonn in 2005, which tried to outline the need for a more specific and selective scientific approach. The four core issues to be addressed are demographic challenges; limitations of resources and ecosystem services; maintenance of social cohesion while increasing (global) equity; and adaptation of institutions to address global change.

openmeeting@ihdp.unu.edu

[www.openmeeting2008.org](http://www.openmeeting2008.org)

**1868 Hayward Earthquake Alliance Third Conference on Earthquake Hazards in the Eastern San Francisco Bay Area—Hayward, California: October 22-24, 2008.** Meeting organizers include representatives from the California Geological Survey, the U.S. Geological Survey, California State University East Bay, University of California-Berkeley, and United Research Services (URS) Corporation. This event is designed to help commemorate the 140th anniversary of the 1868 Hayward fault earthquake. The conference represents the third of a series of workshops, the last of which was held in 1992. It will offer scientific presentations, a free public forum on earthquake hazards and earthquake preparedness, teacher workshops/tutorials on earthquake science, and geology and engineering field trips in the East Bay area.

kknudsen@consrv.ca.gov

<http://1868alliance.org/activities/?id=16>

**Interdisciplinary Climate Research Symposium—Saguaro Lake Ranch, Arizona: November 2-9, 2008.** The Dissertations Initiative for the Advancement of Climate Change Research connects natural and social scientists engaged in research related to climate change, impacts, and solutions. The goal is to broaden perspectives and establish a collegial peer network to address climate challenges at the interface of science and society. The annual symposium brings a select group of early career scientists interested in working across traditional disciplinary boundaries together. Conference participants will provide oral and poster presentations in plenary format, hone interdisciplinary communication and team skills, and discuss emerging issues with each other and with established researchers.

phd@whitman.edu

[www.disccrs.org](http://www.disccrs.org)

**National Wildland/Urban Interface Fire Education Conference: Backyards and Beyond—Tampa, Florida: November 6-8, 2008.**

This conference provides an opportunity to learn from those who work and live in the wildland/urban interface. More than 500 individuals from fire protection, mitigation, research, insurance, planning, and emergency management will gather to exchange ideas, share personal and professional experiences, and learn the latest developments in mitigation and organizing and conducting community activities to improve safety and survival from wildfires.

cblake@nfpa.org

[www.firewise.org/fw\\_youcanuse/conference/08/](http://www.firewise.org/fw_youcanuse/conference/08/)

**American Water Resources Association Annual Meeting—New Orleans, Louisiana: November 17-20, 2008.** This annual conference offers a forum for all participants of the water resources community to engage in conversations about the many multidisciplinary aspects of water resources and to make connections that will improve how the community understands the importance of complex water issues for the region, the nation, and the world. To encourage this exchange, the conference will include oral and poster sessions, plenary panels, field trips, and networking events.

victorpr@cdm.com  
[www.awra.org](http://www.awra.org)

**Fourth EGU Alexander von Humboldt International Conference: The Andes: Challenge for Geosciences—Santiago, Chile: November 24-28, 2008.** The aim of this interdisciplinary and international conference is to bring researchers from diverse specializations together and catalyze more comprehensive interdisciplinary research towards a better understanding of the complexity of the Andes system. Scientists from all geosciences fields carrying out research related to the Andes are invited to contribute to this interdisciplinary conference. The conference general topics and interdisciplinary themes include cryosphere and hydrology, climate variability and change, and tectonics and geodynamics.

rgarreau@dgf.uchile.cl  
[www.dgf.uchile.cl/~rgarreau/EGU-Andes/](http://www.dgf.uchile.cl/~rgarreau/EGU-Andes/)

**7th General Assembly of Asian Seismological Commission and Seismological Society of Japan, 2008 Fall Meeting—Tskuba, Japan: November 24-27, 2008.** The main theme for this year's conference is "Sharing of Up-to-date Science and Technology to Reduce Earthquakes Disaster in Asia." The goal is to bridge science and technology, research and application, domestic efforts and international collaboration, and the Asia Pacific region to the rest of the world.

asc2008@tokyo.email.ne.jp  
[www.soc.nii.ac.jp/ssj/asc-ssj2008/](http://www.soc.nii.ac.jp/ssj/asc-ssj2008/)

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

[www.colorado.edu/hazards/](http://www.colorado.edu/hazards/)

**Call for Papers**

**Disaster as a Sociological Event: Modern Destruction and Future Instruction**

The journal *Social Forces* seeks papers for a special section on the sociology of natural disasters. Original papers that address the way in which disasters disturb not only the natural environment but also tear at the social fabric are invited. For example, papers might focus on how communities recover based on the composition of their social structures, the conditions in which social groups best deal with disasters, and what sociology tells us about past behavior and its predictions for the future.

Sociology and sociological inquiry have been at the center of disaster research for years; however, contemporary disasters have taken on significantly different forms and future catastrophes may have predictable, yet different contours. Papers that make a theoretical contribution in this area will be particularly welcomed, as will empirical papers based on any sound methodological approach.

The special section will be edited by David L. Brunnsma, Department of Sociology, University of Missouri. **The deadline for submissions is June 13, 2008.** Manuscripts should be limited to 5,000-9,000 words, including references and endnotes, and should be e-mailed as a Microsoft Word attachment to [social\\_forces@unc.edu](mailto:social_forces@unc.edu). Questions about the review process or about a particular manuscript should be directed to David L. Brunnsma at [brunnsmd@missouri.edu](mailto:brunnsmd@missouri.edu).

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

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