

## Forecasts and Decisions: The Missing Link

by Bob Ryan\*

Given the dire NWS statement that “those in one- or two-story buildings face imminent death,” why did about 40% of the residents of Galveston, Texas, choose not to evacuate as Hurricane Ike approached? The NWS issued the hurricane forecast, the statement was “released,” and then what? Do we—as members of a community we call the “weather enterprise”—know what decisions were made and why? Will we ever know why so many decided to stay rather than evacuate in the face of this warning? Probably not.

In situations like this, we must examine whether we have sufficiently involved social science expertise in every sector of the physical, computer, and engineering sciences that dominate our weather and climate disciplines in order to better communicate what we know and don't know; to better understand why decisions were made; and to help facilitate the best decisions by our users. Unfortunately, as evacuation decisions in the face of Ike prove, we continue to have a “missing link” in our science. No one is responsible for “completing the forecast.” And what, after all, is the purpose of weather or climate forecast if it doesn't result in the best decision by its users?

### The Purpose of a Forecast

Is a forecast merely a statement about the future state of the atmosphere, as in “sunny tomorrow” or “global temperatures are likely to rise 2° over the next 50 years”? Many have said that when we make a forecast—whether intended for the

public, for governments, or for private clients—the underlying purpose is to help others make weather-related decisions (Pielke 1998; Ryan 2003; Morss 2005). Be it every day or every few years, we offer predictions about the weather for the next few days or the climate for the coming 50 to 100 years. In doing so, we disseminate information that a variety of users can assimilate and use to make decisions.

But many of us also say that a “perfect” forecast (Ike was close to perfect) that results in a poor decision (“I'm not going to evacuate”) is a bad forecast. National Research Council (NRC; 2003, 2006) reports contain a number of additional examples of poor decisions made in conjunction with major weather-related events.

### The Digital World: Helping or Harming?

Do the digital forecasting systems and resultant machine generated text forecast and the dissemination of digital forecast data, that are now the core of the many public and private sector (including “the media”) provider of weather forecasts, really help the enterprise's primary user, the general public, make better weather related decisions and participate in the critical climate related decisions ahead? Could we have used better communication tools to show the threat from Ike—perhaps easy-to-understand graphics or animations—to facilitate better decisions by the 40% who decided to stay in Galveston? I certainly don't know. And until we, under NOAA and NWS leadership, really involve expertise

beyond our meteorological community, I don't believe any of us will know.

Digital systems (the National Digital Forecast Database [NDFD] and the Interactive Forecast Preparation System [IFPS]) are the heart of the

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A tsunami warning sign on the beach in Riversdale, New Zealand  
(Photo by Ilan Kelman; See <http://www.ilankelman.org>)

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# Integrating Environmental Security and Societal Impacts Research

by John M. Lanicci\* and James D. Ramsay\*\*

You don't have to look far these days to find media headlines that illustrate the global nature and societal impacts of today's major crises: energy, food, climate change, natural disasters, etc. What is not obvious from a cursory look at these stories, however, is that both environmental and security themes inundate all of them, and understanding the interactions and connections among these global themes is of critical importance. Our intent in this short article is to describe the concept of environmental security (ES), its importance as a part of national security policymaking, and how current weather/societal impacts research may be relevant to ES.

## History of ES

Although there are many definitions of ES many of which are associated with environmental restoration, compliance, and conservation considerations, we are interested in a more security-focused definition, as proposed by Chris King (2000):

*Environmental security is a process for effectively responding to changing environmental conditions that have the potential to reduce peace and stability in the world and thus affect U.S. national security.*

We also use King's definition of the natural environment as encompassing the earth's atmosphere, land, soil, vegetation, and ocean areas.

The field of ES has been around since the mid 1970's (Myers, 2004), but it was the end of the Cold War that first brought attention to ES in the U.S. national policy arena, as part of an ongoing debate within the U.S. policy community over whether we should broaden our view of security to include non-traditional considerations such as the environment. The

pro-ES argument was that an increasingly complex, multi-polar world could only be understood by incorporating environmental problems and other non-traditional areas (e.g., social, economic) into a redefined concept of security. The anti-ES argument acknowledged that while environmental, health, and socio-economic concerns have important connections to security, these issues should not be characterized as security concerns. The two sides to this debate have been summarized nicely by both Dabelko and Simmons (1997) and Mansfield (2004).

***The idea that environmental security could be linked to both international and domestic security issues became painfully apparent in the aftermath of Hurricanes Katrina and Ruth, where it was seen that vulnerability to the natural environment can have both significant national security as well as global economic impacts.***

In the 1990's, a growing body of research conducted by a combination of academic institutions, non-governmental organizations, and the Federal Government, began to unravel the complex multi-cause/effect mechanisms at work in many regions of the world (e.g., Homer-Dixon, 1999, and others). It was during this time that ES finally became a part of the U.S. State Department's priority list, when a tri-agency memorandum of understanding among the Departments of State, Energy, and Defense resulted in dedicated resources being spent on ES and emphasized the relationships among environmental, socio-economic, and security issues. Indeed, many humanitarian relief operations

undertaken by the U.S. military in the 1990's, both domestic and abroad, were linked to environmental events of one kind or another, and involved significant expenditures by a Department of Defense (DoD) that was going through steep personnel and budgetary drawdowns, driven by a perceived "peace dividend". Despite the DoD cuts, several of the regional combatant commands saw ES as a constructive means to engage many developing countries, and established ES programs to develop military-to-military contacts in these nations. It was believed that these military and diplomatic contacts could become very important should the U.S. military have to become involved in stabilization or other types of operations in those regions (Henk, 2006).

## Our Approach to ES

After 9-11, U.S. security policy shifted toward a military focus, primarily directed at the Global War On Terrorism (GWOT). As a result, ES has not been given nearly the same level of emphasis as it had seen prior to the terrorist attacks. We argue, however, that ES has new significance for two important, weather-relevant reasons: 1) long-term GWOT strategy; and 2) emerging security issues surrounding climate change.

### *Long-term GWOT strategy*

We contend that the stark reality of planning and executing national strategy in a post 9-11 world involves the twin challenges of conducting the kinetic phase of the GWOT, while simultaneously trying to anticipate and confront regional instabilities before they become crises requiring employment of an already overstretched military force. Since the GWOT is essentially a global

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# Bringing a Sociological Worldview to Weather and Society\*Integrated Studies (WAS\*IS) Work

by Thomas Behler\*

I'd like to begin by telling a story about the most important formative event in my life—the experience that sparked my passion for all things meteorological. To set the stage for my story, I must begin by pointing out that I have been legally blind since birth.

When I was 9 or 10, growing up in central Pennsylvania, one particularly warm and humid summer evening brought us a severe thunderstorm which became one of the most incredible and fascinating weather events I had witnessed as a boy. The kind of continuous lightning and thunder we experienced that night was somewhat rare in our area, more typically occurring in the Midwest or the South.

As I stood by a large picture window in our living room, I could see the lightning flashes traversing the sky, followed by tremendous, deafening crashes of thunder. I was totally awestruck by what my senses were experiencing. Why, you may ask, was this of such profound significance to me? Because, simply put, that storm was the last thing I remember seeing as a child, and for the entire rest of my life.

Born prematurely in 1954, I suffered from a condition caused by overexposure to oxygen in the hours after my birth, which destroyed the retinas of my eyes. The doctors explained that the condition, called “retinopathy of prematurity,” allowed just a very small piece of the retinas in each eye to survive the initial overexposure. But that survival was only temporary. Shortly after that stormy summer evening, atrophy destroyed those remaining retinal fragments, and took with it my potential to see anything ever again.

The memorable storm gave me what

could be described as my first lesson in sociology, although it wasn't until many years later that I understood the lesson and its significance. The lesson embodies two major sociological concepts—“norms” and “role strain.” Norms are a central component of the culture of any society. They represent the specific rules of social living that guide people's behavior in everyday life situations. With regard to norms, I had clearly violated basic social norms governing what one should and should not do during a severe thunderstorm. Standing in front of that picture window with the ferocious storm on the other side of the glass was dangerous and potentially life-threatening. But I simply could not pull myself away.

Furthermore, my parents encountered role strain as they tried to decide what to do about their inquisitive and temporarily irrational child. The social structure of any society contains roles, or expected behavioral patterns that are associated with each status that a person occupies. In simple terms, role strain occurs when conflicting demands or expectations are built into a single role. In this case it was the parental role that displayed the strain. Should my parents take the chance, let me stand by that window, and allow me to enjoy this once-in-a-lifetime experience? Or should they pull me away to protect me from actual or potential harm? Fortunately, my parents chose the first approach, for which I am eternally grateful.

My story is an excellent illustration of what I like to call “the sociological view of the world,” which basically argues that no person is an island. Instead, everything each of us experiences can be analyzed in broader sociological terms. Understanding these terms helps us to fully appreciate the overall effect of these life events. To state this worldview in another way, the sociologist asserts that



Cloud-to-ground lightning strikes near Snyder, Colo. during a rare October storm. (Photo by Gregory Thompson; See <http://www.inclouds.com>)

many of our most private or personal experiences aren't really all that private or personal. Instead, they are common to many others in the world, and are shaped by social forces that lie beyond the individual's control. This sociological view of the world was perhaps best described in the early days of the discipline by a sociologist named C. Wright Mills in his book *The Sociological Imagination* (1959). According to Mills, we must take a broader view of any situation we experience (“the sociological imagination”). Drawing on our sociological imagination allows us to better understand our life experiences and our problems, along with the larger social forces that may be shaping them.

More specifically, Mills argued that, in trying to understand why we find ourselves in certain situations, or why we may feel trapped and unable to control our environment, we tend to seek answers by explaining things in purely private or personal terms. We're often unaware of the larger historical,

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# From the Director

## Diverse Global Perspectives Enhance Our Work

by Jeff Lazo\*

A year ago in this space I wrote about a trip Rodney Weiher of NOAA and I made to work with the Russians on approaches for assessing the economic benefits of national meteorological and hydrological services (NMHS). That fascinating trip exposed me to some of the major challenges that the Russian weather service (Rhos-Hydromet) faces as an NMHS in a formerly communist country where the economy and the society are in transition to a market economy. Rhos-Hydromet's challenges in trying to use economics are more fundamental than those we face in the United States, where benefit-cost analysis has been entrenched in government decision making for decades.

I hadn't thought about this much since I returned from Russia. But recently, I had another opportunity to participate in efforts to bring economics to NMHS in countries with economies in transition. I was in Sofia, Bulgaria, last month for the World Meteorological Organization's (WMO) Workshop on Assessment of Socioeconomic Benefits of Weather, Climate and Water Services (see [http://www.wmo.int/pages/prog/amp/pwsp/Social\\_Economic\\_Benefits\\_Wkshops\\_en.htm](http://www.wmo.int/pages/prog/amp/pwsp/Social_Economic_Benefits_Wkshops_en.htm)).

A bit of background on the Sofia workshop. In March 2007 the WMO held the International Conference on Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate and Water Services in Madrid, Spain (see <http://www.wmo.int/pages/madrid07/>). The conference, intended to illustrate the value of weather, climate, and water information and services and to explore how these benefits can be greatly enhanced (Kootval and Wilhite 2008), resulted in the Madrid Conference Statement and Action Plan (better known as the Madrid Action Plan [MAP]; WMO

2007). MAP's overall objective is "to achieve, within five years, a major enhancement of the value to society of weather, climate, and water information and services. . . ." Action 11 of the 15 actions identified in the MAP is to "encourage the NMHS and the social science research community to develop knowledge and methodologies for quantifying the benefits of the services provided by NMHS within the various socioeconomic sectors, in particular" to . . . "train national staff on the use and practical application of economic assessment of the benefits of services provided by NMHS" (WMO 2007, p. 9). To fulfill this action, the WMO sponsored the Sofia workshop, and another workshop that will be held in Abu Dhabi, United Arab Emirates in 2009.

The Sofia workshop—a truly diverse gathering—included about 20 participants, mainly from the Balkan and eastern Europe countries including Bulgaria, Croatia, Hungary, Macedonia, Moldova, Montenegro, Poland, Romania, and Serbia, along with Israel and Spain. Several Sofia participants commented that this was a fundamentally different workshop than the typical WMO meeting. Rather than a series of formal presentations by each of the participants with little subsequent interaction, the meeting was truly a workshop.

In the first half day, Haleh Kootval of the WMO outlined the workshop's framework by discussing economics and NMHS, the MAP, and WMO's support for this action. This was followed by two and a half days of presentations on economics by an economist (yours truly). I based my remarks largely on the Primer on Economics for National Meteorological and Hydrological Services (Lazo et al. 2008; see <http://www.sip.ucar.edu/primer.jsp>)—a document designed to increase understanding of economic methods and their applicability in



*WMO president Alexander Bedritsky of Russia (on right) speaks with a delegate prior to the opening of a WMO congress meeting on May 7, 2007.*

*(Photo courtesy of Getty Images)*

evaluating both the impacts of NMHS and the associated benefits and costs of those services.

Instead of an endless series of talks on economics, we enjoyed significant discussion and interaction over the three days. We changed the agenda on the fly as we identified topics of greater or less interest. We even ignored the agenda altogether when that proved most useful—not standard operating procedure for WMO events. In addition, a number of the participants gave great informal presentations on their own on-the-ground work on economic analysis, impacts assessments, and projects to mitigate societal impacts of hydrometeorological events. I was amazed by the similarity between their work and the efforts often discussed at WAS\*IS workshops and American Meteorological Society socioeconomic sessions. Several of the participants in the Sofia workshop will be contributing to future issues of *Weather and*

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# Societal Impacts News & Announcements

## **AMS Announces New Journal**

Weather, Climate, and Society, a quarterly journal of the American Meteorological Society, will debut in 2009. The journal will publish scientific research and analysis on the interactions of weather and climate with society. Weather, Climate, and Society will encompass economic, policy, institutional, social, behavioral, and international research, including mitigation and adaptation to weather and climate change. Articles may focus on a broad range of topics at the interface of weather and/or climate and society, including the socioeconomic, policy, or technological influences on weather and climate, the socioeconomic or cultural impacts of weather and climate, ethics and equity issues associated with weather, climate, and society, and the historical and cultural contexts of weather, climate, and society. Because of the interdisciplinary subject matter, articles that involve both natural/physical scientists and social scientists are particularly encouraged.

The journal will print several types of pieces, including:

- Articles up to 7500 words of text
- Notes of up to 2500 words of text, focused on a single subject
- Policy fora of up to 1500 words, synthesizing or integrating policy debates with scientific research
- Comments from readers, not to exceed 500 words, in response to a published article, note, or forum

For more information, or to submit a manuscript, please visit <http://www.ametsoc.org/pubs/journals/wcs/index.html>.

## **New Journal Announces Call for Papers**

The new Journal of Natural Resources Policy Research will begin publication in January 2009. The goal of the journal is to foster productive dialog among the disparate sectors in the broad field of natural resources and among various social science perspectives, leading to an improved understanding of institutional and economic dynamics and informed policy making.

The journal will be largely social-sciences-focused including such fields as economics, sociology, geography, political science, anthropology, public administration, ethics and other disciplines relevant to the crafting of efficient, equitable and sustainable natural resources policies.

In addition, disciplines conventionally outside the social sciences field, such as planning, management and law, and natural and physical scientists writing for a social science audience are also welcome contributors to the cross-disciplinary journal.

Original papers in policy analysis, policy modeling, policy surveys and synthesis, institutional analysis, conceptual/ theoretical papers, case studies and case histories from academic and non-academic experts will be considered.

For more information or to submit a manuscript, please visit <http://www.tandf.co.uk/journals/cfp/rjnrcfp.pdf>.

## **Updated Extreme Weather Statistics**

SIP researchers have updated hurricane, flood, and tornado damage data on the Extreme Weather Sourcebook Web site, as well as composite statistics for all three extreme weather categories to \$2006. The Sourcebook is a collection of historical monetary loss data on severe weather events and presents a summary of damage suffered from hurricanes, floods, and tornadoes in the United States and its territories.

The goal of the Web site is to educate viewers on the economic impacts of severe weather events and stimulate interest in the societal impacts of weather. Loss totals by state are presented alphabetically and by monetary rank with data adjusted for both inflation and inflation and wealth. The Sourcebook also displays aggregate monetary loss information for hurricanes, floods and tornadoes, as well as information on fatalities, casualties, injuries and damages for severe weather events such as lightning, hail and wind.

For more information, please visit <http://www.sip.ucar.edu/sourcebook>.

To see original data sources or to download additional data, please visit the Sourcebook's data and methodology page directly at <http://www.sip.ucar.edu/sourcebook/data.jsp>.

# Conferences & Opportunities

## ***Coastal Cities Summit 2008: Values and Vulnerabilities***

**Workshop Date:** November 17-20, 2008

**Location:** St. Petersburg, Florida

**For More Information:** Please visit <http://www.coastalcities.org>

The International Ocean Institute's Coastal Cities Summit aims to bring together public officials, nongovernmental organizations, citizens, and natural and social scientists to consider the values and vulnerabilities of coastal regions around the globe. This summit will discuss environmental, social, economic, and public policy challenges faced by coastal communities and produce viable solutions. Topics to be discussed are climate change, sea level rise, maritime security needs associated with increase sea transportation, and extreme events such as tropical storms and tsunamis. For more information, please visit <http://www.coastalcities.org>.

## ***2009 International Disaster Management Conference***

**Meeting Date:** February 19-22, 2009

**Location:** Orlando, Florida

**To Register:** Please visit <http://www.emlrc.org/disaster2009.html>

This conference highlights the role first responders and response agencies play in disaster planning, response, and mitigation. Emergency management challenges and lessons from the past year will provide the basis for many of the conference sessions. The conference will take place at the Emergency Medicine Learning and Resource Center, and cost is \$390 when you register before January 23, 2009. For more information, please visit <http://www.emlrc.org/disaster2009.htm>

## ***2009 National Hurricane Conference***

**Conference Date:** April 6-10, 2009

**Location:** Austin, Texas

**To Register:** <http://www.hurricanemeeting.com/>

The goal of the National Hurricane Conference is to improve hurricane preparedness, response, recovery, and mitigation; saving lives and property in the United States and tropical islands of the Caribbean and Pacific. In addition, the conference serves as a national forum for federal, state and local officials to exchange ideas and recommend new policies to improve emergency management. To accomplish these goals, the annual conference emphasizes lessons learned from hurricane strikes; state-of-the-art programs worthy of emulation; new ideas being tested or considered; information about new and ongoing assistance programs; and the ABC's of hurricane preparedness, response, recovery, and mitigation. For more information, please visit <http://www.hurricanemeeting.com/>

## ***Journal of Flood Risk Management Call for Papers***

The Journal of Flood Engineering (JFE) is the peer reviewed technical publication of research and novel practical studies on flood and related topics. The journal accepts papers dealing with all aspects of flood engineering and applied sciences, streamflow quantity, quality and ecology modelling and statistics, river management and both social and health aspects of flooding. Examples of areas covered by the journal include, but are not limited to hydrology of extreme floods, coastal surge flooding, flood hazard management, flood forecasting, flood warning techniques, disaster recovery, GIS and flood zoning, flood risk analysis, flood uncertainty, flood damages, and health and social aspects of flooding. To submit a paper, email [Jflood@gmail.com](mailto:Jflood@gmail.com). For more information, please visit <http://www.serialspublications.com/journals1.asp?jid=324&jtype=1>.

current NWS operational forecasting system. Private sector companies widely use and disseminate information from these tools as “their” forecasts. The development and implementation of these systems has certainly brought about significant advances in the easy and rapid dissemination of forecast elements. But I believe that the determinism of this core NWS structure and the resultant reliance on machine generated text public forecasts has restricted really effective communication of what should be ever more accurate forecasts. And as a consequence of that restriction, end-user decision making has suffered. Many private sector weather companies meet the specific needs of individual clients not by relying on deterministic digital systems for preparing and disseminating a forecast, but by effectively communicating a forecast that meets the client’s needs and effectively communicating the uncertainty the client requests and knows is needed for making the best decision.

The public knows that uncertainty is an inherent element of the weather forecast (Morss, Demuth, and Lazo 2008) but individuals and households must rely on their own senses of the uncertainty in making a weather-related decision. When we don’t effectively communicate the uncertainty of critical weather elements—beyond the probability of precipitation—our science continues to fail to meet its full utility to the public and society. As an example, with the winter season approaching, we’ll soon see forecasts of approaching storms such as “increasing clouds tonight, chance of rain or snow tomorrow, probability of precipitation 40%, rain or snow likely tomorrow night, probability of precipitation 70%.” In 2008 (and years ago, for that matter) why isn’t the probability of precipitation type a forecast element we can easily and effectively communicate to the public? At times, it seems that the digital clothing we’re required to wear while we produce a public forecast has become a digital straitjacket. It

is encouraging to see that recent work (Peroutka, Zylstra, and Wagner 2005; Krzysztofowicz and Evans 2008) is finding tools and ways of incorporating uncertainty into NDFD. The recent draft by NOAA/NWS of a “Social Science Strategic Plan for Weather and Water,” for example, is to be commended and wholeheartedly supported by the entire enterprise. I wish that our weather/climate leadership had supported this work 10 years ago in parallel with the development of IFPS and NDFD.

***We must examine whether we have sufficiently involved social science expertise in every sector of the physical, computer, and engineering sciences***

### **The End-to-End Process We Need**

Ultimately, the user of weather and climate forecasts, whether it’s the person on the street or the politician on the Hill, will ask, “What does it mean to me?” More than ever before, with the terrific advances still being made in our sciences, the process of forecasting must become an “end-to-end” process. As described by Pielke (1998), the process must move from observation to forecast to effective communication to correct decision. Only by bringing in outside expertise in the social sciences, can we, as an enterprise, realize the goals and unfulfilled promise of our shared physical sciences.

Certainly, NDFD and IFPS have a place in the broad forecast and forecast dissemination universe. These digital systems, though, are becoming almost an insidious entity rather than just tools that are part of a larger, more important end-to-end process. As an example, consider the discussion of the NWS SOAP (Simple Object Access Protocol) product, which “take[s] *convenience* [emphasis mine] a step further by summarizing NDFD weather data over 12- or 24-h time periods, respectively. For example, if a weather forecast for a 12-h period includes fog, drizzle, and

rain showers at different hours, the 12-hourly product’s weather element would be summarized to contain the most significant weather type—rain showers” (Schattel and Bunge 2008, p. 450).

### **Convenience or Utility?**

This discussion brings up more questions: Are we trying to communicate a “convenient” forecast or one that will allow our most important users, the members of the public, to make the best weather-related decisions? Who determines that rain is a more important weather element than fog? And what would this product have generated for New Orleans before Katrina? What would the digital system choose as the “most significant weather type”? Rather than continuing to spend valuable public resources continuing down a ever more constrictive digital road, our most important core organization (NOAA/NWS) should make a major commitment now to bring in expertise in the social sciences that will benefit the entire enterprise and enable us to better communicate what we know, or think we know and help our users make the best decisions . . . not the most “convenient” forecasts?

### **Turning the Ship**

Outside the core body of our weather forecasting enterprise, expertise in the social sciences is increasingly being sought and considered. Programs such as WAS\*IS are helping to turn the forecasting ship (NRC 2006). In the words of one participant, “The social science training and exposure I gained through WAS\*IS taught me to think beyond NWS protocols on warnings and lead times and to more fully consider the public’s reaction to our products and services. This helped me to be more decisive and to send a clear warning of the potential life-threatening blizzard nearly 2 days in advance.” At these critical times as the forecast is being completed, a lack of leadership may cause NOAA/NWS to become just a skeleton that keeps the meteorological body functioning in the years ahead.

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operation, it is appropriate to evaluate the security situation in places which have not yet reached a crisis point, or where significantly degraded living environments provide ripe recruiting grounds for terrorist groups.

Consider the range of environmental phenomena that can devastate an already vulnerable region, from 'single-event' disasters such as floods and tropical cyclones, to prolonged climatic anomalies such as drought. Such phenomena, under the right set of circumstances and conditions, could easily impact the ability of a region to sustain itself. The resulting security implications could range anywhere from mass migrations and the possible radicalization of large segments of the population seen as having 'nothing left to lose', to violence, geopolitical instability, and the eventual involvement of military force to either restore order or provide humanitarian relief. Within this context, we argue that ES, operating as part of a proactive rather than reactive strategy, could provide a potential segue for entering a new, non-kinetic phase of GWOT sooner rather than later. Given the precarious state of the U.S. and other global economies, such an alternative strategy could be more attractive to the next U.S. administration.

#### *Climate Change and Security*

The second driver of ES's re-emerging relevance is happening on a much slower timescale, but eventually may become more important than long-term GWOT strategy. This driver is the growing acceptance among the world's nations that climate change is not only a real phenomenon, but that its national, regional, and international security implications will require an environmental component to be integrated into strategic planning across governmental departments at the national level. Newly released reports, such as the U.N. Foundation/Sigma Xi report (Scientific Expert Group on Climate Change (SEG), 2007) and CNA Corporation's

report on the security implications of climate change (CNA, 2007), point out potentially serious international security implications arising from global warming, such as dramatic increases in the number of "environmental refugees" fleeing environmental degradation from both global warming and non-global warming causes. It is imperative that we improve our understanding of the myriad ways in which aspects of the natural environment, from single-event disasters to climatic anomalies, can affect or exceed a nation's, a region's, or even the global community's capability to provide adequate resources for a growing human population.

We acknowledge that natural environment considerations should not be weighed independently from other geopolitical and socio-economic factors. Rather, environmental security requires an interdisciplinary approach, and that type of interdepartmental collaboration among various Federal agencies is sorely needed in national strategy planning and execution (see, for example, Flournoy and Brimley, 2006). Integrating ES into national security planning would provide benefits beyond simply improving our ability to anticipate and mitigate security risks due to climate change. An ES-type approach to homeland security strategic planning can be used to address policy imperatives such as infrastructure resiliency from both terrorist attacks as well as natural disasters (see Flynn, 2007).

#### **Potential ES and Weather/Societal Impacts Research**

Although there are many potential collaborative areas between ES and weather/societal impacts studies, one that deserves attention is natural disaster research, where linkages between environmental, high-impact weather events, societal impacts, and security can be studied within either an international or homeland security context. The idea that ES could somehow be linked to both international and domestic security issues became painfully apparent in the aftermath of Hurricanes Katrina and Ruth, where it was seen

that vulnerability to the natural environment can have both significant national security as well as global economic impacts (The White House, 2006).

Another potential area of collaboration could be the development of regional climate change scenarios and the societal/security implications of such changes. As a "teaser" to conclude this article, we present the following hypothetical problem that a robust ES/Weather-Societal Impacts collaborative research study could address:

With the aspects of global warming looming on the horizon, there is speculation that the northern oceanic areas of countries such as Russia and Canada could become ice-free for as long as 9 months of the year. What would the implications be for the opening of a true "Northwest Passage" between the Atlantic and Pacific Oceans? According to Byers (2006), such an opening would not provide just an economic benefit to the nations affected:

*"There is some potential economic benefit to Canada. But the overriding concern from the Canadian government's permission is actually one of environmental protection and then from a national security perspective. Anytime that you have increased activity of a commercial kind you're also going to have increased criminal activity. So there's a real concern about smuggling of drugs, of guns, of illegal immigrants. And also a concern about the potential for terrorists to use the Canadian Arctic as a backdoor to North America."*  
(See [http://marketplace.publicradio.org/features/frozenassets/frozenassets\\_ryssdal\\_byers.html](http://marketplace.publicradio.org/features/frozenassets/frozenassets_ryssdal_byers.html))

A collaborative ES/Societal Impacts research study could examine the regional climate, investigate how rapidly the changes are taking place, analyze the demographics of the regions by addressing questions such as "Are the populations shifting to these locations? Are businesses  
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investing there?”, and establishing some tentative relationships between the changes taking place in the natural environment and shifting demographics, regional economics, and U.S. and Canadian security concerns. We invite dialogue among our weather and societal impacts colleagues as a means of opening up fruitful interchanges of information between our respective areas of study.

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## *Sociology (continued from page 3)*

social, political, and economic forces that shape our individual lives on a fundamental level. When we deal with the problems and realities facing humankind, we must recognize and take these larger forces into account. Once we master this more broad-based sociological view, we become able to better understand our individual experiences in terms of the broader social picture.

To tie these concepts to WAS\*IS work, let's suppose that a tornado has just torn through a community. That tornado is much more than a hardship for any one individual. It affects the community as a whole, and the community and its residents will respond collectively. Their ability to respond will depend largely on how well they were initially prepared for such an event. Furthermore, that collective response will likely shape future preparedness and response efforts not only in that community, but in surrounding communities as well.

In addition, the sociological imagination gives us a broader understanding of the need for large-scale solutions to major problems. These solutions must go well beyond reforming or changing any one person. Basic structural patterns or arrangements may need to be altered. One of the challenges of sociology is helping to determine what those alterations should be, and how they might be most effectively implemented.

To carry our tornado example further, we can argue that, although the tornado and its effects will be experienced as intensely personal hardships, the hardships are unlikely to be confronted or reduced effectively through personal therapy or psychological intervention. To solve these issues, we'll need to change existing social structures and structural arrangements within the affected community. Possible strategies for change might be implementing a better community warning system, conducting severe

(continued on page 11)

**Society Watch.** Sharing these diverse yet closely aligned experiences will go a long way toward building a greater international understanding of the societal impacts of weather and NMHS.

Although SIP is focused mainly on integrating social sciences into the U.S. weather enterprise, workshops like the one in Sofia indicate that there is a huge role for integrating social sciences into NMHS around the globe—especially given the economic and social issues faced by many countries. A proper balance among natural sciences, social sciences, and basic capacity will be crucial to meeting the missions of NMHS around the world.

Workshop participants brought up a couple of issues that struck me in particular:

- Representatives of some of the countries represented at the meeting reported that weather radar is not in place anywhere within their borders. Given the importance of radar observations for now-casting – especially with severe weather – this is a critical issue not faced in the US.
- Some countries in Eastern Europe do not have the budget to maintain forecasters 24 hours a day, 365 days a year. In some areas, when the office closes in the evening, no forecasters are on duty until the doors open again in the morning.
- Some countries must overcome budget challenges—in terms of NMHS employee pay—at a much more fundamental level than we see here in the United States. One forecaster reported that their spouse made roughly five times as much in the private sector as they did working for the NMHS, even though the two have similar educational backgrounds.
- Budget constraints were perhaps the most common challenge

participants mentioned. Sometimes even funding for basic NMHS staffing, much less funding for observing equipment, computers, or research, cannot be secured. Many of the NMHS represented at the workshop are funded partially, if not largely, through user fees. They have a difficult time convincing the ministers of the appropriate agencies of the importance of the public goods aspect of their services.

- Finally, it struck me that many of these NMHS work closely with their user communities to meet their needs, provide for safety and support economic activities, in ways that do not seem to work in the United States because of the private–public divide.

At the Sofia workshop, I encouraged participants to contribute and subscribe to *Weather and Society Watch*, so as I regroup for the next workshop in Abu Dhabi, I hope I'm also welcoming some new readers!

And I wonder where I'll have been by the time next September rolls around!

\*Jeff (lazo@ucar.edu) is the director of NCAR's SIP.

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## Job Opportunity

### **University of Colorado Assistant Professor**

The University of Colorado at Boulder seeks to hire an assistant professor for the Center for Science and Technology Policy Research of the Cooperative Institute for Research in Environmental Sciences (CIRES). Applicants must have demonstrated expertise in science or technology policy research with an emphasis on the environment. Specializations of interest include the policy aspects of science, energy, technology, and the human dimensions of climate change, water, and solid earth processes.

The successful candidate must have an established interest in interdisciplinary research and teaching, is expected to develop a record of funded research, and must be willing to contribute to both undergraduate and graduate teaching. The position is tenure-track and will be located in any relevant academic department, to be mutually decided upon by the candidate and department. Possibilities include Geography, Political Science, Environmental Studies, Economics, and others. A Ph.D. in a relevant field is required.

To apply, applicants should send a letter of application, curriculum vitae, a statement on teaching, a statement on research, and three names to be used for letters of reference to <http://www.jobsatcu.com>, job posting number 805664. Questions can be directed to CIRES Human Resources (Dempsey@CIRES.Colorado.edu). Review of applications will begin November 15 and continue until the position is filled.



The seminal report entitled *Completing the Forecast* (NRC 2006) is now almost 3 years old. As called for in the report, it's time for the NWS to acknowledge and assume a leadership role in turning the ship. Resources should be devoted to increase NWS support for those trained in social sciences (currently 0 full-time equivalent) even if at the expense of a more convenient digital forecast. It's time to think less about the most convenient forecast and more about the best weather-related decisions . . . and how to more effectively communicate information to help the public make those decisions. In short, it's time to complete the forecast instead of just talking about it.

The American Meteorological Society (AMS) has stepped up to the plate by forming the Ad Hoc Committee on Uncertainty in Forecasts (ACUF). But the NWS needs to help build a new ballpark—the old one contains too many obstructions. Members of the public have to peer around these obstacles, which can prevent them from seeing the entire field and being involved in the effort.

Few of us, who began our careers in meteorology 40+ years ago, could foresee the great advances that have been made in our science. Only by emphatically reaching out to other sciences and disciplines can we realize the great promise of our science—full utility to the public, our most important client. Numerical weather forecasting and digital systems have been critical to the advances of our science until now, and the next chapter in the application can be equally exciting. With effective leadership, I'm certain it can happen. The forecast *can* be completed.

\*Bob (bob.ryan@nbcuni.com) has been the chief meteorologist for NBC's NBC4 in Washington, D.C., since 1980. He has served on numerous American Meteorological Society (AMS) boards and committees and was elected president of the AMS in 1992. Bob has also served on several NRC boards and report committees.

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weather awareness training for citizens, establishing viable shelter locations for displaced residents, and formulating a better overall community emergency operations plan.

Finally, the sociological imagination implies that if we want to understand why things have happened, and what we can do to improve the situation, we must examine the circumstances through a wide variety of viewpoints. Regardless of our own unique station in life, we must consider all viewpoints—from the less-advantaged segments of society, through an average, suburban middle-class citizen, to the rich and powerful. We also must consider the nature of the community or population of concern (e.g., a major inner-city area versus a rural farming community). The people in each economic situation or geographical area will have very different lifestyles, experiences, and outlooks on life.

In summary, the sociological view of the world gives us a broad and helpful mechanism for understanding many realities of life. Along with traditional concerns such as poverty, divorce, crime, prejudice, discrimination, and cultural conflicts, these realities can include the responses of people, organizations, and communities to weather forecasts, high-impact weather events, and even more mundane weather phenomena. These latter concerns, of course, are of central importance to the WAS\*IS initiative and to the basic goals of societal impacts research.

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# About Weather and Society Watch

Weather and Society Watch is published quarterly by the Societal Impacts Program (SIP) at the National Center for Atmospheric Research (NCAR). The University Corporation for Atmospheric Research (UCAR) operates NCAR with support from the National Science Foundation and other sponsors.

The purpose of Weather and Society Watch is to provide a forum for those interested in the societal impacts of weather and weather forecasting to discuss and debate relevant issues, ask questions, and stimulate perspective. The newsletter is intended to serve as a vehicle for building a stronger, more informed societal impacts community.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of NSF or other sponsors. Contributions to Weather and Society Watch are subject to technical editing at the discretion of SIP staff.

Weather and Society Watch is available on the World Wide Web at: <http://www.sip.ucar.edu/news/>. Archives of Weather-Zine, a previous weather impacts newsletter upon which Weather and Society Watch was modeled, are available on the Web at <http://sciencepolicy.colorado.edu/zine/archives/>.

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## About SIP

All aspects of the U.S. public sector, along with the nation's economy, are directly and indirectly affected by weather. Although the economic impacts of weather and weather information on U.S. economic agents have been loosely documented over the years, no definitive assessments have been performed, and information generated from the previous studies is difficult to locate and synthesize.

sSIP, initiated in 2004 and funded by NOAA's U.S. Weather Research Program (USWRP) and NCAR, aims to improve the societal gains from weather forecasting. SIP researchers work to infuse social science and economic research, methods and capabilities into the planning, execution and analysis of weather information, applications, and research directions. SIP serves as a focal point for developing and supporting a closer relationship between researchers, operational forecasters, relevant end users, and social scientists concerned with the impacts of weather and weather information on society. Program activities include primary research, outreach and education, and development and support for the weather impacts community.

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