



The International Symposium on Societal Resilience

Proceedings of the First International Symposium on Societal Resilience

November 30–December 2, 2010
Fairfax, Virginia

A Publication of
The Homeland Security Studies and Analysis Institute
in Collaboration with
The U.S. Army War College Center for Strategic Leadership and
Israel's Institute for National Security Studies

Front Cover (left to right): Assistant Secretary, Infrastructure Protection, **Mr. Todd Keil**; Deputy Administrator, Protection and National Preparedness, **Mr. Timothy Manning**; Israeli Deputy Defense Minister **Major General (Retired) Matan Vilnai**; President and Chief Executive Officer, Analytic Services Inc., **Dr. Ruth David**; Senior Director for Preparedness Policy, Resilience Directorate, National Security Staff, The White House, **Mr. Brian Kamoie**.

Note: Appointments are shown at the time of the symposium.

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Homeland Security Studies and Analysis Institute

The Homeland Security Act of 2002 (Section 305 of PL 107-296, as codified in 6 U.S.C. 185), herein referred to as the "Act," authorizes the Secretary of the Department of Homeland Security (DHS), acting through the Under Secretary for Science and Technology, to establish one or more federally funded research and development centers (FFRDCs) to provide independent analysis of homeland security issues. Analytic Services Inc. operates the Homeland Security Studies and Analysis Institute as an FFRDC for DHS under contract HSHQDC-09-D-00003.

The Institute provides the government with the necessary expertise to conduct: cross-cutting mission analysis, strategic studies and assessments, development of models that baseline current capabilities, development of simulations and technical evaluations to evaluate mission trade-offs, creation and evolution of high-level operational and system concepts, development of top-level system and operational requirements and performance metrics, operational analysis across the homeland security enterprise, and analytic support for operational testing evaluation in tandem with the government's acquisition process. The Institute also works with and supports other federal, state, local, tribal, public and private sector organizations that make up the homeland security enterprise.

The Institute's research is undertaken by mutual consent with DHS and is organized as a set of discrete tasks. This report presents the results of research and analysis conducted under

Task 11-01.02.05, International Symposium on Societal Resilience, 2011

The purpose of the task is to publish the proceedings from the International Symposium on Societal Resilience, conducted in Fairfax, Virginia over the period November 30 to December 2, 2010.

The results presented in this report do not necessarily reflect official DHS opinion or policy.

Proceedings of the First International Symposium on Societal Resilience

Edited by

Alex B. McLellan
and Meir Elran

Homeland Security Studies and Analysis Institute

The Institute was envisaged by the National Research Council of the National Academies in its report, *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism*, which proposed the creation of a dedicated, not-for-profit institute to provide the federal government with analytic capabilities to support effective counterterrorism-related decision making and program execution.

The Homeland Security Act of 2002 called for the establishment of the Department of Homeland Security (DHS) and directed the new Secretary to "establish a federally funded research and development center (FFRDC) to be known as the 'Homeland Security Institute.'" The Institute became operational in 2004 and by law was terminated in 2009. In 2009 Analytic Services Inc. was awarded a contract to operate a new FFRDC, the Homeland Security Studies and Analysis Institute.

Since its inception, the Institute has completed more than 650 studies and provided support to virtually every major staff function and component within DHS. The Institute also supports the homeland security needs of other organizations such as the Departments of Defense, Education, Interior, Health and Human Services, and Justice; the Office of the Director of National Intelligence; the National Archives; and the Smithsonian Institution.

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This effort was truly a collaborative one and could not have been accomplished without the help of Brigadier General (retired) Meir Elran from Tel Aviv University and Professor Bert Tussing from the Army War College. Meir Elran has been an integral partner since the beginning of this process. His knowledge of the subject and his encouragement have been unwavering, leading to the success of the proceedings. Bert Tussing provided invaluable guidance, and his work may have led to the genesis of this effort. We would also like to thank the distinguished researchers highlighted in this publication for their exceptional work in advancing the field of societal and community resilience.

I would also like to thank the following individuals who helped make the 2010 International Symposium on Societal Resilience a success and provided valuable reviews and comments to this publication: Sarah Maloney, Robbi Dickens, Audrey Mazurek, Kim Corthell, Curt Mann, Matthew Sinn, Justin George, and Eric Ambinder.

Robbi Dickens and Audrey Mazurek were truly unstoppable and the real movers behind the symposium operation, anticipating every possible need before it became a problem.

Katie Kingsman became the go to person when we began the long process of assembling the papers and putting this book together. This would not have been as successful an endeavor without her great and untiring work.

I especially want to thank Sarah Maloney, Bob Tuohy, and Phil Anderson for their leadership in allowing me the opportunity to establish all the national and international connections and support to create this first international symposium on societal resilience.

Finally, the planning committee for the 2010 International Symposium on Societal Resilience showed overwhelming diligence through the entire process. The committee comprised of Brigadier General (retired) Meir Elran, Alex McLellan, Bert Tussing, Robbi Dickens, Audrey Mazurek, and Katie Kingsman.

Alex B. McLellan

> Our greatest glory is not in never falling, but in rising every time we fall. – Confucius (551– 479 BC)

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Foreword

Alex B. McLellan

An old word, "resilience," has found new meaning. The term "resilience" likely has its origins in the physical sciences, where it was principally used to refer to the properties of an object that could return to its original shape and size after some form of deformation. More recently, the word has taken on new uses in ecological and biological domains, where it is associated with the tendency of an ecosystem to maintain or return to a steady state of existence.

Today, "resilience" has taken on even greater significance as individuals, organizations, communities, and whole societies begin attempts to simultaneously understand and achieve resilience as a desirable characteristic necessary to minimize the effects of disruptive events.

On September 11, 2001, terrorists successfully took control of four U.S. commercial aircraft and proceeded to fly them as airborne missiles at iconic targets in New York, Virginia, and Washington, D.C. After examining the incredible disruptions that resulted from that perilous day, the U.S. Congress began to consider how it might encourage higher levels of public and private sector preparedness to produce a more resilient nation.

Less than four years later Hurricane Katrina made landfall in New Orleans, resulting in several breaches in the system of levees that

guards a large portion of the city from flooding. Once again the nation refocused on how it could be more resilient.

As a result of these and other significant disruptions, more and more focus is being given to how to achieve and maintain resilience, at the individual, organizational, and community levels. With these and other imperatives in mind, the Homeland Security Studies and Analysis Institute, in partnership with the U.S. Department of Homeland Security, the U.S. Army War College's Center for Strategic Leadership, and Tel Aviv University's Institute for National Security Studies began planning for the first of a series of biennial international symposiums around the topic of societal resilience.

International Symposium on Societal Resilience

The inaugural International Symposium on Societal Resilience convened on November 30, 2010, in Fairfax, Virginia. During the welcome function, the participants where addressed by several distinguished speakers including Mr. Brian Kamoie, the Senior Director for Preparedness Policy, Resilience Directorate, National Security Staff, at the White House, and Ms. Christine Wormuth, Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs, U.S. Department of Defense. The evening concluded with remarks from Israeli Deputy Defense Minister Major General (retired) Matan Vilnai.

Plenary Sessions

The symposium plenary sessions began the following day with an international panel, moderated by Mr. Dan Kaniewski, the Assistant Vice President and Deputy Director of The George Washington University Homeland Security Policy Institute, discussing their various perspectives on resilience. The distinguished panel comprised Dr. Gamini Keerawella (University of Peradeniya, Sri Lanka); Lieutenant Colonel Rami Peltz (Home Front Command, Israel); Dr. Matt

Qvortrup (Cranfield University, United Kingdom); Mr. Christian Sommade (French High Committee for Civil Defense); Brigadier (retired) K. Srinivasan (Centre for Security Analysis, India); and Dr. Norman Vasu (Nanyang Technological University, Singapore).[1]

Later in the morning the participants were addressed by the Assistant Secretary of Homeland Security for Infrastructure Protection, Mr. Todd Keil. Mr. Alex McLellan, a Principal Analyst with the Homeland Security Studies and Analysis Institute, addressed the question of community and organizational resilience. The President and Chief Executive Officer of Analytic Services Inc., Dr. Ruth David, concluded the pre-lunch session by addressing the value of systems thinking in relation to resilience.[2]

During lunch, two distinguished speakers addressed the symposium audience: Mr. Timothy Manning, Deputy Administrator for Protection and National Preparedness at the Federal Emergency Management Agency, spoke on the importance of individual resilience as a key contributing element of community and societal resilience. Dr. Leonard Marcus, a lecturer on public health practice, from the Department of Health Policy and Management, at Harvard University, spoke on the importance of leadership, in particular, meta-leadership as a key element of resilience.

The first day of the symposium concluded with two of the three sets of concurrent sessions (described in detail below). Each concurrent session was introduced by a moderator and then participants were randomly assigned to a particular session. Assigning participants helped to ensure that there would be a variety of professional backgrounds in each session, making for a more lively and non-predictable discussion with the researchers.

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1 For a complete listing of speaker titles and biographies, please see the 2010 Symposium Program in appendix A.

2 The Homeland Security Studies and Analysis Institute is a federally funded research and development center operated by Analytic Services Inc. on behalf of the Department of Homeland Security.

The last day of the symposium opened with a welcome from Homeland Security Institute Director Dr. Philip Anderson. The first keynote speaker of the day was Mr. Arif Alikhan, Homeland Security Department Distinguished Visiting Professor and Scholar-in-Residence at the National Defense University College of International Security Affairs, and former Assistant Secretary of Homeland Security for Policy Development. The second keynote speaker was Mr. Charles Ng, Executive at the National Security Coordination Centre at the Prime Minister's Office in Singapore.

The day continued with the third set of concurrent sessions (described below), and concluded with a closing plenary focused on summarizing the lessons learned from the symposium. The closing plenary was moderated by Professor Bert Tussing, Director of Homeland Defense and Security Issues at the Center for Strategic Leadership, U.S. Army War College. The distinguished panel included the three moderators for each of the concurrent sessions as listed below.

Part I: The History and Philosophy of Resilience

The first set of concurrent sessions was moderated by Dr. Benjamin Nickels, a faculty researcher from the University of Maryland's National Consortium for the Study of Terrorism and Responses to Terrorism.

Is the Blame Game Making Us Less Resilient? A Re-examination of Blame Allocation in Systems with High Uncertainty

Dr. Patricia Longstaff presented her research on the role of "blame" in reducing resilience in systems with high uncertainty. In particular, she discussed the implications of what has been called "The New Normal": a time of higher uncertainty for many businesses and governments, with fast and strong disruptions in many systems. She argues that we cannot manage systems with high uncertainty unless we receive accurate feedback. If surprises are concealed because they are seen as "failures" of the system or the person in charge, the system cannot adapt. In some cases, the energy it takes to fix and apportion

blame is diverted from the adaptation process with little payback and often results in attempts to resist (i.e., stop from happening) similar surprises by creating new constraints on the system that will rob it of resilience.

Multiple Dimensions of Societal Resilience: Developing a Resilience Index

Dr. Alka Sapat presented her research on identifying and analyzing the multiple dimensions of community resilience, including their conflicting and complementary relationships and to help understand the factors that adversely impact the ability and capacity of a society to bounce back and rebound from an event. Dr. Sapat advocated the development of an index of resilience, policy indicators, and metrics based on these dimensions. She proposed that societal resilience can be strengthened through policy interventions and development of policy measures and argued that we must understand how resilience is tied to both the speed and quality of long-term recovery initiatives.

Measuring Societal Resilience in a Terrorist-Threat Context

Brigadier (retired) Meir Elran presented his research on measuring societal resilience in the context of a terrorist threat environment, such as Israel. In particular, his research focuses on how to (a) identify and analyze the multiple dimensions of community resilience, including their conflicting and complementary relationships and understand the factors that adversely impact the ability and capacity of a society to bounce back from an event; (b) develop an index of resilience and policy indicators and metrics based on these dimensions; (c) based on the Resilience Policy Index identify how societal resilience can be strengthened through policy interventions and development of policy measures; and (d) understand how resilience is tied to both the speed and quality of long-term recovery initiatives.

Part 2: Ecological and Biological Perspectives of Resilience

The second set of concurrent sessions was moderated by Mr. Bob Tuohy, Vice President for Operations for the Homeland Security Studies and Analysis Institute.

Developing Bio-Event Resilient Communities and Societies: A Holistic Approach

Dr. Paula Scalingi presented on actions to improve community and broader societal capabilities to withstand biological events that impact community health and safety and to rapidly recover to normal or new normal conditions. The approach she offered uses a multistep process that builds upon various regional interdependency initiatives to develop a comprehensive resilience action plan. The plan is the initial foundation for a sustainable, ongoing process centered on a public-private partnership to move a community or society incrementally toward resilience to address any adverse significant event. This process has been under development for nearly a decade by the Pacific Northwest Center for Regional Disaster Resilience, a component of the Pacific Northwest Economic Region.

Foundations of Ecological Resilience

Dr. Lance Gunderson examined two specific approaches to resilience: the engineering approach and the ecological approach. Ecologists have developed and refined the idea of resilience to explain abrupt, unpredictable, and deeply systemic ecological changes. His presentation suggested that ecological resilience is related to the amount of a disturbance that can create a new system configuration. This concept has important considerations for managers, as past approaches that seek to optimize natural resource production have led to a loss of ecological resilience and subsequent state change.

Indicators of Ecological Resilience: Building and Sustaining Resilient Communities

Dr. John Pine's presentation examined approaches to measuring the contribution of natural ecological systems and how these measures contribute to our understanding of resilience and sustainable communities. The presentation suggested that "resilient communities are the product of their natural, social and economic resources"; measuring these systems "is critical for the long-term sustainability of a community and especially in the recovery process from a disaster." Indicators of ecological resilience may be selected to complement social and economic indicators and form a basis for policy decisions. Communities should be engaged in selecting and using indicators to ensure their long-term sustainability.

Part 3: Social, Organizational, and Cultural Perspectives of Resilience

The last set of concurrent sessions was moderated by Dr. Warren Fishbein, Coordinator for the Global Futures Forum, Bureau of Intelligence and Research at the U.S. Department of State.

Bases for a Community Resilience System

Dr. John Plodinec and his colleagues at the Community and Regional Resilience Institute have developed the Community Resilience System (CRS) to help communities become more resilient. The CRS is a set of processes, guidelines, incentives, and other supporting resources that together compose a practical approach for communities to follow. The CRS can help communities understand community resilience—specifically, the perils they face, what they can do to avoid or limit the impacts of those perils, and where the resources will come from for those actions.

Being Vulnerable in a Resilient Community? Some Lessons Learnt from Coping with Financial Loss after the 2005 Floods in Switzerland

Ms. Corinne Bara outlined the importance of a social safety net as a coping mechanism. In August 2005, torrential rain in large parts of Switzerland caused floods and landslides that gave rise to the costliest natural event in the past hundred years in the country. By means of a compact social safety net, private individuals and company owners were able to cover a large part of their financial losses. Yet there were several hundreds of individuals who had unmet recovery needs after the floods and had to rely on charities to help them cover their remaining costs. These findings from the Swiss case were linked to research on resilience and vulnerability, and the findings combine the two concepts to demonstrate the need to take a closer look at the differential ability of individuals and groups to cope with a natural event—even in very resilient societies. The aim is to draw lessons learned for further research on resilience and vulnerability.

Dimensions of Organizational Resilience

Ms. Rita Parker presented her thesis on the importance of resilient organizations. In an unpredictable future, resilient organizations are pivotal for a nation's security, progress, and well-being. Resilience is now being embraced by governments, corporations, individuals, and social groups, having moved beyond the disciplines of ecology and engineering. This changing application has engendered different perspectives on, and interpretations of, the concept of resilience and approaches to it in widely divergent milieus. These range from protection of critical infrastructure, national security, and response to addressing international piracy and supply chain security. Partnerships and interdependencies within and across organizations and sectors inevitably impact levels of resilience, and the weakest link—even if unforeseen or discounted—may have an impact out of proportion to its supposed relevance. Organizations have the potential to provide an existing systemic contribution to a holistic resilience continuum. If the fundamental attributes of resilience, based on a holistic systemic

integrated approach, are adopted by organizations and then communities, ultimately nations will benefit.

Resilience: A Complex Problem

The symposium, the first of its kind, was an ambitious attempt to create an international forum that brings together thought leaders from around the world to examine the powerful concept of resilience as it applies to homeland security and defense. This effort presented the enormously complex and diverse nature of resilience as the basis for improving societal abilities to respond to and recover from disruptive events. Collectively, the proceedings that follow show a small sample of the many research projects in the resilience domain that reflect individual findings and a connectivity with international partners in research and thinking.

The ultimate goal of the symposium was to initiate a dialogue for maturing the thinking of scholars and policy makers around the world to help better contain and manage disruptions in the fabric of society whether they are from man-made or natural causes.

International Perspectives on Resilience

Professor Bert Tussing

In May of 2009, out of the Israeli blue, I was contacted by Brigadier General (retired) Meir Elran, a Senior Fellow and Director of the Homeland Security Program at the Institute for National Security Studies at Tel Aviv University in Israel. For reasons I have yet to fully understand, Meir told me about a study he was intending to begin, comparing societal resilience between Israel and the United States, and asked if I would be interested in joining him in the endeavor. After a brief discussion, I told him that I would but that we would have to change the focus of his intent. In my mind, resilience had to be first challenged, and then demonstrated, before it could be studied. Therefore, while I was convinced there were things to be learned from Israel—a people under a persistent and enduring threat—I was not sure what could be gleaned from any recent American experience. That said, I opined that learning from the Israeli experience was certainly something Americans should be able to gain from, while praying we should never have to share it.

In the course of that first conversation, Meir and I arrived at a common conviction that the suggested study was too narrow in its scope (particularly given the relative immunity the vast majority of Ameri-

cans have enjoyed against any looming perception of threat—either natural or man-made). We ended our conversation by agreeing that we would be better served by expanding our "test bed" to include other democracies that have been tried, and proven to a greater or lesser degree the "resilience" of their people. Almost simultaneously, we settled on the notion of examining the British experience, given its history surrounding both World War II and the infamous "blitz"; and the more recent experience with violent terrorist elements of the Irish Republican Army. Settling upon that introductory foundation, we agreed to a face-to-face meeting to continue to develop the concept.

We arrived at that meeting with another shared conviction that the examination we had in mind was too "Western." If our intent was to really examine the question of resilience among democracies under a persistent and enduring threat, we should look to other areas of the world. Based upon some of his previous research and established relationships, Meir suggested India and Sri Lanka, an extension that made immediate sense to his less-travelled colleague in the discussion. But how were we to garner expertise from those countries, and perhaps others like them? How, indeed, were we to grow interest in the endeavor beyond our own?

At least here I was able to make something more of a contribution. At the time, Meir was working as a visiting fellow with the Near East South Asia Center of the National Defense University, and had developed a bit of an interest there. For my part, I had had the privilege of working with a number of organizations and think tanks in Washington, D.C., whose focus on homeland security and defense, I thought, might lead them in an interest in the direction I was now sharing with my Israeli friend. In relatively short order we had garnered the interest and support of The George Washington University's Homeland Security Policy Institute, the Heritage Foundation, the National Guard Bureau, the University of Maryland–based National Consortium for the Study of Terrorism and Responses to Terrorism (START), and others. Over time, commitment and interest ebbed and flowed; but a particularly important partnership in the initiative took shape with the Homeland Security Studies and Analysis Insti-

tute. As the Department of Homeland Security's federally funded research and development center, the Institute became the launch pad for what eventually took place at the International Symposium on Societal Resilience conference held in Fairfax, Virginia, on November 30–December 2, 2010, and led to the formation of the International Resilience Research Network.

Through it all, however, the original intent of comparing and contrasting societal resilience among democracies remained a constant theme. As a function of the same, there was no question that this inaugural forum, generously supported by the DHS Science and Technology Directorate, would include an international panel and researchers devoted to the same. And given the international constituency represented in the symposium—representatives from Australia, France, India, Israel, Singapore, Sri Lanka, Switzerland, the United Kingdom, and the United States—one would be hard pressed to accuse the forum of being limited in its scope.

One might expect such a representation to be characterized by diversity; and indeed (as I will discuss later) there were differentiations to be noted. But more noteworthy, in my mind, was the commonality of the issues surrounding societal resilience that served as a cohesive thread through the presentations. The first speaker sounded a note that would reverberate through several presentations when he noted that resilience can only be measured when it is tested. Another speaker would observe that the challenges of attaining resilience are multiplied in a nonhomogeneous society; an easily defendable assertion, but one that left me with the question as to whether in today's world there are many examples of a homogeneous society to be found. A host of other common themes were expressed through the presentations, including:

- The role of the media, and how that role could serve to facilitate, or denigrate resilience in a society
- The ability of governments to facilitate, but neither dictate nor replace the role of community in advancing and achieving resilience

- An accompanying position that resilience is enhanced as people are afforded ownership in their own fate; and diminished to the degree that they rely too heavily on the government
- A primary contribution that may be made by the government in advancing resilience among its people is the open and timely dissemination of information surrounding mitigation, response, and recovery
- Education was a vital component in preparing and empowering a people prior to predictable crises, as well as a means of managing expectations
- Manifestations of resilience progressed from the individual, to the community, on through to the nation
- Without providing for and achieving individual and community resilience, national resilience may be unattainable

Of course, in addition to these pronounced commonalities there was diversity in perspectives surrounding resilience among the panelists. Professor Keerawella noted what might be a unique capacity of the Sri Lankan people to "move on" following disaster (one would assume without regard to how they were handled or mishandled by officials). Lieutenant Colonel Peltz offered an assessment of Israeli resilience that postulated "whatever works in the routine will work in an emergency." Mr. Sommade suggested that France has a good history of response to disaster on the part of the national government, but less so for localities, where "resident response" (which the American venue would portray more as "recovery" than "response") was poor. Brigadier Srinivasan opined that much of the resilience to be observed in India, constructed on building blocks that begin with the individual, is concurrently reliant upon "personality which stems from a value system and upbringing." Such a common sense declaration is refreshing, and not nearly as pervasive as one might hope.

Taken together, however, we might arrive at a conclusion that the things which inspire and maintain resilience in one people are not necessarily all that unique from others. How we work to instill those things, beginning with a conviction surrounding their importance

and commitment to their ultimate product, remains a challenge. Hopefully, before disaster strikes or catastrophe visits our peoples, we can lead them to a greater degree of readiness. While it may remain true that resilience can only be measured when it is tested, one would hope that our preparations will steel us to the test.

About the Author

Bert Tussing is the Director of the Homeland Defense and Security Issues Group at the U.S. Army War College's Center for Strategic Leadership and holds the Elihu Root Chair of Military Studies. He joined the Center in October 1999 following nearly 25 years in the United States Marine Corps. He is a Distinguished Graduate of both the Marine Corps Command and Staff College and the Naval War College and holds master's degrees in national security strategy and military strategic studies. He has served as a consultant on three Defense Science Boards; on the Center for Strategic and International Studies' "Beyond Goldwater-Nichols Study"; and as a member of the Senior Advisory Group for the Defense Department's "Strategy for Homeland Defense and Civil Support." He is a senior fellow at George Washington University's Homeland Security Policy Institute; a member of the Board of Experts for the University of California–Irvine's Center for Unconventional Security Affairs; a member of the Pennsylvania State University's Homeland Defense and Security Council; and on the Steering Committee of the Homeland Security/Defense Education Consortium Association. In December 2009 he completed an appointment to the Department of Homeland Security's Homeland Security Advisory Council, assisting in the development and execution of the department's congressionally mandated *Quadrennial Homeland Security Review.*

About the Panelists

Dr. Gamini Keerawella

Head and Professor, Department of History, University of Peradeniya, Sri Lanka

Dr. Gamini Keerawella is a Senior Professor of History at the University of Peradeniya. He was the recipient of the Indian Ocean Centre for Peace Studies Senior Visiting Fellowship at the University of Western Australia; Senior Fulbright Fellowship at the University of California, Berkeley; Japan Foundation Fellowship and Visiting Research Fellowship at the Institute of Developing Economies, Tokyo; and Scholar-in-Residence at the Center for Theory, Baroda, India. He was the Founder Director of the National Integration Programme Unit and has served as Secretary, Ministry of Ethnic Affairs National Integration and Mineral Resources Development, and Adviser to the President of Sri Lanka. Professor Kearawella has written two books: *From National Security to Human Security: Evolving Security Discourse in Sri Lanka* and *Japan in South Asia in the Context of the New Discourse on Peace and Security*.

Lieutenant Colonel Rami Peltz

Behavioral Sciences Branch, Israel Defense Forces

Lieutenant Colonel Rami Peltz is the Head of the Behavioral Sciences Branch, Home Front Command, Israel Defense Forces. He is responsible for the population behavior officers functioning in the command's headquarters and field units. His branch is engaged in research of population behavior during emergencies, promoting resilience, assisting in preparing the psychosocial setting for the local authorities, and preparing people with special needs. During emergencies, Lieutenant Colonel Peltz is responsible for assessing the national psychological status and evaluating the capacities and knowledge of the civilians, as a basis for recommendations how to best meet their

needs. He participated in the Search and Rescue Israel Defense Forces team to Haiti and took part in a research delegation to Thailand after the tsunami. He was actively involved in the Home Front Command efforts during the missile attacks on the Northern (2006) and Southern (2008/09) regions of Israel and participated in search and rescue efforts in the aftermath of the terror attack in Hilton Tabba.

Christian Sommade

Délégué Général, Haut Comité Français pour la Défense Civile (Executive Director, French High Committee for Civil Defense)

Christian Sommade has been the Executive Director of the French High Committee for Civil Defence for 10 years. As such, Mr. Sommade relaunched the activity of the High Committee 10 years ago, as one of the major think tanks in France on the issues of resilience and on emergency and crisis management against catastrophic threats, with a focus on chemical, biological, radiological, and nuclear (CBRN) issues, critical infrastructure protection, and societal resilience. In the framework of the committee's activities, Mr. Sommade has also been a trainer on crisis management for the French Ministry of Interior and many private companies, as well as a consultant on different resilience and security matters. Before that, Christian Sommade spent three years in Washington, D.C., to develop and promote the French nuclear, biological, and chemical defense industry in the U.S. homeland security market. Before this appointment, he worked for eight years in Giat Industries as Manager of the CBRN defense division. He has worked as a project manager for two years on a large audit of the French civil defense for the Prime Minister Dept. Between 1985 and 1990, Mr. Sommade worked as an export manager for SP Company, an engineering and industrial firm specialized in CBRN collective protection and air raid shelters. Between 1983 and 1985, Mr. Sommade was a junior consultant for a large engineering firm in the field of civil defense planning and audit. Mr. Sommade graduated from University Paris Sorbonne–Law & Human Science University with a master's in public law and an advanced diploma in

defence and from University Paris 13 with a master's in marketing and communication. He is a graduate of the seventh session of the High Studies Institute for Internal Security of the French Ministry of Interior.

Dr. Matt Qvortrup

Research Director, Resilience Centre at Cranfield University, UK Defense Academy

Dr. Matt Qvortrup is acting head of the Resilience Centre. Having earned his doctorate in politics from Brasenose College, University of Oxford, he has taught at the London School of Economics (2000–03) and was a visiting Professor at the University of Sydney and at the University of New South Wales (2005). Dr. Qvortrup served as Head of the Gun Crime Section in the British Home Office (2003–04), where he was responsible for the most successful gun amnesty in British history. Described by the British Broadcasting Corporation as "the World's leading authority on referendums," Dr. Qvortrup has worked as a consultant for the U.S. State Department, Elections Canada, and the U.K. Electoral Commission and is currently affiliated with Chatham House, The Royal Institute of International Affairs. During 2009 he was an adviser to Barack Obama's Special Envoy to the Sudan. Dr. Qvortrup has written several books, including *Balloting to Stop Bullets*; *Referendums on Nationalism and Ethnic Issues: A Comparative Study of Referendums*; and *Government by the People*, as well as numerous reports and refereed papers in academic journals.

Brigadier K. Srinivasan (Retired)

Establishment Director, Centre for Security Analysis, India

Brigadier Srinivasan guides and supervises the work of research fellows. His area of work includes conflict resolution and peace building, terrorism, disaster management, and the role of civil society in conflicts. During his active army career of 35 years, he participated

in the 1965 and 1971 wars and in counterinsurgency operations in Jammu and Kashmir, and he has held several important commands, as well as instructional and planning assignments. He is a graduate of the Defence Services Staff College and College of Defense Management. Brigadier Srinivasan is an active member of the working group on nontraditional security of the Regional Network of Strategic Studies Centers set up by the Near East South Asia Center for Strategic Studies, National Defense University, Washington, D.C.

Dr. Norman Vasu

Assistant Professor, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore

Dr. Norman Vasu is an Assistant Professor at the university's Centre of Excellence for National Security. He is Deputy Head of the center and coordinator of the Social Resilience Programme. Prior to his current role there, he was a tutor at the Department of International Politics at the University of Wales, Aberystwyth, from 2000–02. At the same university, he was a lecturer on International Relations for the Centre for Widening Participation and Social Inclusion, from 2002–04. Dr. Vasu was also a Post-Doctoral Fellow with the Institute of Defense and Strategic Studies, Nanyang Technological University, from April 2005 to March 2006. Dr. Vasu has authored *How Diasporic Peoples Maintain their Identity in Multicultural Societies: Chinese, Africans, and Jews* (2008) and edited *Social Resilience in Singapore: Reflections from the London Bombings* (2007). He has published widely in journals such as *Asian Ethnicity*, *The Kantian Review*, and *Jane's Homeland and Security Monitor*, as well as writing for several newspapers on topics surrounding multiculturalism, national security, and social resilience. His current research interests include the theories and practice of multiculturalism, transnational communities, and nationalism.

Part 1

The Philosophy of Resilience

Part 1: The Philosophy of Resilience

Introduction

Brigadier General Meir Elran (Ret.)

Societal resilience has become a highly visible buzzword in the last decade. Major natural and man-made catastrophes made it clear that managing mass disasters has become one of the major challenges to organizations of all kinds, including government, business, and non-governmental organizations (NGOs). It is now widely accepted that while most of these calamities are unavoidable, many of their tragic results can be significantly mitigated. This can be achieved if people, organizations, communities, and societies as a whole are intelligently prepared in advance in a manner that allows them to return to normal functionality in a relatively short time.

This is the essence of resilience: The capacity of a system to react to disruptions according to their severity—to bend rather than break—and to bounce back from the post traumatic status to adequate, if not improved, operational capacity. As a leading component in a strategy to stand up against the outcome of catastrophes, resilience has great value. However, in many cases the political discussion on resilience is trivial and shallow. The academic discourse is widely dispersed,

often unfocussed and not very useful for practical purposes because it tends to dwell on the intricacies of terms and definitions rather than on how to set out a theoretical basis for action. The net result is that even though there seems to be an ostensible agreement that resilience can serve as a useful concept, it is still far from being a tool that can be used by the people who need it. In very few cases one can trace the required continuum between the scholarly based theory, the solidly devised programs, their sound implementation, and thorough evaluation. The gap between the high-yield potential of the theory of societal resilience and its practical adoption by the communities around the world as a framework for action is far too wide. This is the case even for those communities where programs of promoting societal resilience have been executed and have generally shown a clear pattern of success.

Part 1 of these proceedings suggests three ways to begin bridging this gap. While analyzing the theoretical framework of societal resilience, each report strives from a unique angle to provide useful leads and recommendations to address the troubled nexus between theory and practice. The three reports all provide concrete directions for closing the gap between theory and practice in the field of societal resilience. The last two, authored by Meir Elran and Dr. Alka Sapat, respectively, specifically share the central suggestion that in order to make the notion of resilience less abstract and academic and more tangible and practical, it should be presented in quantitatively measurable terms. This kind of exposition might not only be more comprehensible to decision makers and the educated public, but will also enable a relatively clear vision of the dynamic nature of resilience and specifically the progress that can be made by practical programs to enhance resilience.

Research in the Philosophy of Resilience

Dr. Patricia Longstaff is David Levidow Professor of Communication Law and Policy, Newhouse School of Public Communication,

Syracuse University. Dr. Longstaff came to the study of resilience as part of her ongoing search for ways to manage and regulate systems with high uncertainty. She has published several papers in this area, including multidisciplinary analysis of the concept of resilience and its implications for public policy and community/organizational planning for "surprises" such as terrorism and natural disasters. She received funding from the National Science Foundation to lead a cross-disciplinary investigation of resilience and has presented her ideas at conferences around the world. She is a faculty member of the Institute for National Security and Counterterrorism (INSCT) at Syracuse University and a member of the Technical Advisory Board for the Community and Regional Resilience Institute (CARRI), U.S. Department of Energy. She is also a Research Affiliate at the Harvard University Program for Information Resources Policy (PIRP). She is a member of the U.S. State Department's Advisory Committee on International Communications and Information Policy (ACICIP) and a member of the Board of Directors of the International Telecommunications Society (ITS). Longstaff was a James Martin Senior Visiting Fellow, Oxford Martin School, University of Oxford (2010-11).

Dr. Longstaff has a global reputation in resilience theory and practice. In her report she explores the role that blame attribution plays in reducing the resilience potential of human organizations. Her previous work has identified resilience as an important strategy for any complex system that must operate under high uncertainty, one that should be considered as a complement or even a substitute for the traditional strategy of resisting dangers. She suggests that in our "New Normal" environment, where refined information is critical, the blame game plays a major disruptive role in reducing the adaptive capacity of organizations to respond to unexpected disruptions.

Dr. Longstaff advises that the most important first step for organizations who must work in the New Normal is to acknowledge the implications of operating in a complex and adapting world, in which errors and failure are not avoidable. Therefore they need more flexibility, fewer unbreakable rules, more improvisation and deductive tinkering, and a lot more information about what's going right and

going wrong in order to adapt to surprises. And here lies a clue to the reluctance of many organizations to implement a resilience strategy: It requires major changes of basic values and attitudes, as it challenges some very closely held assumptions about how the world works and especially our desire to control things. The organizations and communities that wish to survive in the New Normal will have to publicly acknowledge, Longstaff says, the uncertainty they must deal with and then start playing to win with rules that will actually work. This is a new direction for politicians and organizational decision makers, but one she thinks they can successfully implement if they are clear about which systems are really not predictable or controllable by the usual means.

Brigadier General (retired) Meir Elran is a Senior Fellow and Director of the National Homeland Security Program at the Institute for National Security Studies (INSS), Tel Aviv University, Israel. He joined the Jaffee Center, now incorporated into the Institute for National Security Studies, in 2003. Elran had a long career in the IDF Military Intelligence directorate. His last post was as the Deputy Director of Military Intelligence (1987-1989). Other positions that Brig. Gen. (ret.) Elran held in the IDF included Assistant Director of the Research Division for Evaluation and Deputy Commander of the IDF's National Defense College. Elran's main areas of research are the interrelations between the society and military in Israel, homeland security, and societal resilience. He has published numerous articles on these issues. He is co-editor (together with Shlomo Brom) of *The Second Lebanon War*, published by INSS and Yediot Ahronot Press in 2007. In 2009 he was an international fellow with the U.S. National Defense University's Near East and South Asia Strategic Studies Center, where he edited a comparative research study on chaos management.

In his report, Brig. Gen. (ret.) Elran strongly argues for a systematic measurement system which will gauge the societal resilience of communities on an ongoing basis. This community resilience index will not only expose the present state of resilience of a given community, but will possibly enable a degree of prediction of the capacity of those

communities to react in a resilient manner to catastrophes. A central theme in his report is the focus on comparative methodology: The argument is that the best representation of the community's societal resilience can be attained when the gauging process is continuous, and when it compares different communities of similar characteristics. Furthermore, it is argued that a substantiated methodology of comparative measurement will provide a wide picture of societal resilience of the society as a whole, and enable a rational distribution of efforts to promote the resilience of the more vulnerable communities. Elran also calls for an international effort to conduct comparative studies of societal resilience of different countries, which will help the promotion of the understanding of the significance of the concept and its implementation around the world.

Dr. Alka Sapat is Associate Professor of Public Administration at the School of Public Administration, Florida Atlantic University. Recently, she completed two National Science Foundation-funded projects; the first involved research on resilience, vulnerability, and long-term displacement and housing issues following hurricanes, and the second focused on the role of the Haitian-American community in long-term recovery and resilience issues following the Haiti earthquake. Her research interests include disaster and crisis management, environmental policy innovations, climate change policies, environmental justice, federalism, and technology policy. Dr. Sapat's teaching interests include environmental and public policy, research methods, and disaster management. Dr. Sapat's work is published in *Public Administration Review*, *Natural Hazards*, *Natural Hazards Review*, *Policy Studies Review*, *International Journal of Public Administration*, and other scholarly venues.

Dr. Sapat takes another step forward in introducing a Resilient Policy Index, which has been developed and implemented in 57 coastal counties in Florida that are most likely to experience the full brunt of major hurricanes and to produce large numbers of displaced persons. Data collected in the last three years already provide sufficient volume to reach interesting conclusions of what makes a community more or less resilient. She is, of course, aware of the pitfalls of

quantitative studies when dealing with a complex issue like societal resilience. Furthermore, she acknowledges that translating concepts, concerns, and metrics to develop and design effective policies is not an easy task. Future research could explore the challenges in translating research concepts and metrics to applications in public policy and implementation.

Dr. Sapat concludes that major obstacles can surface in generating the political momentum necessary to adopt policies to develop resilience, especially for projects that are costly in the short-term and whose benefits manifest only over a period of time. Projects that would involve further government involvement or bigger budgets are likely to face opposition in a climate of economic uncertainty and anti-government sentiments. Developing the capacity for a resilient infrastructure that is both responsive to immediate needs and for long-term resilience to disasters will remain a challenge.

The issues of incorporating scientific thinking and information into planning, practice, and decision making remain a challenge. Identifying and finding solutions for these challenges could form part of a potential long-term research agenda on resilience.

Is the Blame Game Making Us Less Resilient? A Reexamination of Blame Allocation in Systems with High Uncertainty

Dr. P.H. Longstaff

Abstract

This report explores the role that blame attribution plays in human organizations that are complex adaptive systems or in a period of high uncertainty. It gives a brief overview of complex adaptive systems, lists their important attributes and discusses how military and security organizations (and the environments in which they often find themselves) exhibit those attributes. This is followed by a short discussion of resilience—an important strategy for complex adaptive systems that must operate under high uncertainty. The report then discusses the roles that feedback and adaptation play in organizations that operate under high uncertainty, and the role that blame can play

in reducing that feedback and adaptability. This is followed by a short discussion of the role of blame in western philosophical thought and how it may be consistent with new ideas about resilience. The conclusion section offers next steps for a broad discussion of the Blame Game and recommendations for organizational change to minimize its ill effects.

Introduction

Everybody talks about the Blame Game and they seem to know that it is not always a good thing but they don't know what to do about it. Who wants to be accused of dodging their responsibility or covering up some else's bad deeds? This is especially difficult and dangerous if it is government being accused and the event has become political. An event like a natural disaster becomes political when it is cast as

> … the product of failures of public officials or agencies. This involves specific temporal, spatial and causal representations of the problem, which highlight the responsibility of some and minimize the responsibility of other (f)actors.… [and] when influential actors in the political arena succeed in framing them as blameworthy violations of crucial public values. (Brändström 2003)

Unfortunately, when an event like a natural disaster or a terrorist attack becomes political the information about what actually happened may become more closely guarded in order to protect those who may be blamed. This can have tragic consequences because it is not possible to manage any kind of system unless we receive accurate feedback about what is happening in the system and to the system. This is particularly true for systems with high uncertainty (including security and military organizations)—where you don't know for sure what's going to happen next or what the results of your actions will be. If the "surprises" that occur in these systems are concealed because they are seen as "failures" of the system or "errors" of the person in charge, the system cannot learn or adapt to the changes that the surprise makes obvious.

Blame is often appropriate where known dangers have been ignored, but it may not be appropriate as a reaction to Black Swans (possible but unlikely events) and New Surprises (never happened before and not predicted) and problems that have emerged from underlying processes over which the person has no control. In some cases, the energy it takes to fix and apportion blame is diverted from the adaptation process with little pay-back. The people in these systems often try to resist (stop from happening) similar surprises by creating new constraints on the system—often these are constraints that will rob the system of resilience in the long run. This is a significant problem in many countries and in many organizational cultures including the military, NGO's, corporations large and small, and the media. It deserves a broad and open debate. The resilience of our organizations and communities may depend on it.

If this is your organization, reconsidering internal and external Blame Games is one very visible way to signal friends and foes alike that you are ready to play to win in the new environment.

This report will look at one of the implications of what has been called The New Normal: a time of higher uncertainty for many businesses and governments, with fast and strong disruptions in many systems (Lowell 2008). Many of our modern organizations and technical systems have become so interconnected, complex, and adaptive that they have become essentially unpredictable. The Law of Unintended Consequences is now familiar to everyone who has tried to manage a large organization or enforce a complex policy. Have our world views kept up with this change or are we still assuming a "clockwork" system where credit and blame are relatively easy to assign? What are the costs for failing to acknowledge the harm that inappropriate Blame Games can do the resilience of our systems? What have philosophers had to say about blame or unintended consequences?

Learning with Stories

It is widely accepted that one of the most efficient ways of teaching new ideas is through stories. To see an idea on a Power Point slide is one thing, but to hear how it plays out in the real world is another. Stories give us a frame for learning. If we hear enough stories with the same outcome we begin to change our collective narrative of how the world works. Blame stories are probably as old as humanity because they teach the norms of a group—what kinds of behavior is rewarded and what kinds are punished. Whenever someone is blamed in a modern organization it becomes a story that is told and retold in an effort to understand its meaning. If the story is, "She had to be fired because they needed to show that they dealt with the problem" then the meaning is, "this is an organization that sacrifices individuals even when they did nothing wrong—so if you don't want to be sacrificed stay away from anything that might have undesirable consequences." This is not easy in organizations with frequent job turn-over and it's often not possible to predict when surprises will appear in the system or where they will show up. So, let's tell some stories.

Story # 1 Joanna and the Measures of Success

> This is a story about Joanna.[1] Joanna works in an organization that is undergoing a lot of change in its resources and its mission. She has worked her way up the ranks and is now the manager of a section with an important function. She is the third person to have this job. The first person, Tom, worked with a consulting firm to develop the technical and human resource systems for this function. In order to measure the success of the new section it was decided that each year they would count the number of CX3's that the section handled successfully. During Tom's tenure and that of his successor, Mary, the number of successful CX3's continued to climb each year but the actual functioning of the section became more problematic as all attention was focused on CX3's. Tom and

[1] I am indebted to Commander Simon Atkinson of the Royal Navy who helped me develop the outlines of this story. As far as we know, it is fictional in its particulars—it is not about a real person or a real organization.

Mary were both rewarded for their outstanding achievements with more important jobs. Joanna saw that there were problems developing but was told by her boss that since the problems she observed were obviously not getting in the way of CX3's there was just no spare time or resources to deal with them. He was, in fact, very unhappy that she had brought these problems to his attention because now he might have to do something about them—and since he had been told, if something went wrong he could not claim ignorance. He decided she needed to be transferred. But before he could arrange the transfer, one of the developing problems reached a critical level and the operation of the section was brought nearly to a stand-still. Joanna was called into the office of her boss's boss. She tried to explain that parts of the system had been drifting for a long time and that she had tried to do something about it. It was decided that the failure happened on her watch and so she would be held responsible. And it was decided that she did not show appropriate loyalty by bringing her boss into her excuse. Joanna was transferred to a lower level job in a distant section. Other people in the organization got these messages from these events: never send bad information up the chain of command; don't try to fix systemic problems—just try to move on before they break; what you count is the most important thing; systemic problems will be deemed Human Error and the closest person to the failure will be punished. This incident resulted in annual reports in the next two years that showed the section performing brilliantly with increasing CX3's; the systemic problems identified by Joanna made a reappearance three years later in a much larger form; another promising manager was sent to the hinterlands. The systematic problems are now starting to affect other sections but no one knows much about how the problems started.

Of course, eventually the systematic problems may spread to the entire organization and the person at the top will have to take the fall. The attribution of credit and blame in this organization is, itself, a systemic problem and it causes undesirable results. In the complex world where this organization operates, it's not easy to find things to count—to be accountable to all the stakeholders. But emerging problems are definitely not counted or even talked about. This negative feedback gets recognized only when it can't be avoided and things reach a crisis level.

Story #2 Tom and the Black Swan[2]

Tom is the manager of group that administers communication systems for a consortium of emergency response organizations in Large City. His group has sorted out some tricky interoperability problems among the local fire, police and ambulance radio systems, cross-trained people from each service and developed ongoing contacts among them. He has received awards for some of his groundbreaking work from national organizations. One day at 9:00 AM there is an electrical power failure that affects all of Large City and the surrounding area. At 4:00 PM there is still no information about what caused this failure and rumor has it that they don't know the cause yet. The emergency response organizations have been told it may be another eight hours before power is restored. The next morning there is still no power and the communication systems used by the emergency response organizations are running out of battery power. They did not purchase larger (much more expensive) batteries because they were told (by Tom, who got this estimate from the Electric Company) that the maximum power outage was likely to be 24 hours. Tom and his team go into action and put together temporary communication services based on the telephone system but they are not going to last for long since the battery power for mobile phone handsets and transmission towers is rapidly being exhausted. Everyone is advised to limit use of the communication equipment to real emergencies. After the power is finally restored, a commission of inquiry is set up to find out exactly what happened. Three deaths are blamed on the communication problems of emergency services—and their families are suing the city. The spotlight turns to Tom. A popular radio talk-show host is calling for his resignation. How could he have recommended such inadequate systems? Several members of the City Council are calling for new regulations for the use of these communication systems in times of crisis. The city manager tells Tom that his department is being broken up and resources reassigned to individual emergency response organizations. He is offered a non-managerial job in the fire department.

Not only will Tom suffer but all the good work he has done in organizing the emergency response organizations is being undone in an effort to "fix" this problem. Everyone in city government (and

[2] Black Swans are said to be possible, but highly unlikely, events.

even some people in the media) know that Tom is not to blame for the deaths but if they stand up for him they are likely to get tarred with the same brush or accused of trying to orchestrate a "cover up." The really thoughtful ones know that the city will be worse off if the department is broken up and a good manager is punished.

Changing the Narrative

But where would you start if you wanted these stories to turn out differently? Neither is just an internal problem. Outside stakeholders expect accountability. Everybody rightly expects that people who cause problems because they are lazy or incompetent or corrupt should be held accountable—or blamed and punished—in order to make sure the organization is working properly. There is an assumption that if you get rid of one bad cog the whole machine will work perfectly again because they caused the problem—it's just a matter of finding the right cog. But as we see in the stories above (and as we all know) it's almost never that easy to identify the real cause. Maybe it's time to reexamine the idea of causality in complex organizations that have to operate under high uncertainty.

But let's be clear. Lazy, incompetent, and/or corrupt people should always be blamed if they cause problems. It's the Joanna's and the Tom's that we are going to deal with here.

The New Normal: Cogworld or Bugworld?

Authors Brian Walker and David Salt have asked us to reconsider our views about how the world works. They describe the difference between the simple systems we often assume we are dealing with and the difference between Cogworld and Bugworld (Walker 2006). They describe *Cogworld* as a system of interconnected cogs with large cogs driven by smaller ones and those smaller ones driven by very tiny ones. The size and behavior of the cogs does not change. It is *complicated*, but it responds to any changes in the speed of any of its cogs in a linear and predictable way. This is much like the clockwork universe

of Newtonian physics—gravity and other forces interacting with matter in ways that only require accurate measurement and the right formulas to be predictable. *Bugworld*, on the other hand, has lots of bugs. They act as individuals and as groups. The bugs interact with each other in ways that change with the conditions of their environment and with natural selection processes. The behavior of the system that emerges from these interactions is often nonlinear and *complex*, making predictions in Bugworld very difficult. Just understanding the component bugs and bug groups will not explain the actions of the system. For human organizations, knowing if you are operating in Cogworld and Bugworld is important because management strategies which work in one will not work well in the other.

Bug-like systems can be living or they can be technical. We often call these things *complex adaptive systems.* Think of throwing a handful of buttons on the floor and then connecting them in various ways: some are connected by heavy string, magnets connect some, and others are connected only by dotted lines on the floor. All the red buttons are connected to each other and some of the red buttons are connected to blue buttons. Most (but not all) of the blue buttons are connected to one yellow button while all of the red buttons are connected to a black button. The red buttons move quickly and the blue ones move very slowly, but yellow ones each move at a different pace. The group of buttons is sitting on top of an active earthquake area. Could you predict the location of any one of the blue buttons a week from now? Could you predict the number of buttons that would move if someone pulled the string at one of the yellow buttons?[3] Think how much more difficult your prediction would be if the buttons were changing due to forces that you may or may not be able to perceive.

Some complex systems are *adaptive* because they *evolve* when individual things (such as organisms or people) called "agents" operate independently in response to forces in their environments. In

[3] This is an adaptation of the "Buttons and Strings" metaphor used by Stuart Kauffman to explain complex systems in *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (New York: Oxford University Press, 1995), pp. 55-58.

some systems these agents can "learn" from one another when some agents obtain more resources and their actions are then copied by others. In some systems an important change may not be learnable in the current generation by other agents (for example, the change is a mutation in an organism's genetic structure). But if that change makes an individual more successful in reproducing itself, the change will eventually become part of the system because these individuals leave more offspring. This is evolution by *natural selection*.[4] Organizations and whole communities sometimes adapt in this way. They adapt when they look at what is working for others and change what they are doing. Or, over time, more organizations survive that have developed a new strategy or capability that is appropriate for the new environment.

This is hardly breaking news. Management theorists have been using these ideas about complexity, adaptability, and unpredictability for at least 50 years.[5] In what would become one of the more influential business books of the late twentieth century, Peter Senge suggested that businesses must learn to adapt to change by creating "learning organizations" (Senge 1990). But he knew it wouldn't be easy.

> Business and other human endeavors are also systems. They, too, are bound by invisible fabrics of interrelated actions, which often take years to fully play out their effects on each other. Since we are

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4 For example, a mouse with better hearing is more likely to survive the presence of foxes in her environment and will leave more offspring than other mice. Over many generations these better-hearing offspring will also leave more offspring and gradually the number of mice without the acute hearing will decline.

5 Theorists like Alfred Chandler have been thinking about firms in turbulent times since the 1960's; see Alfred D. Chandler, Jr., *Strategies and Structure: Chapters in the History of American Industrial Enterprise* (Cambridge, MA: MIT Press, 1962). For recent ideas, see also Robert Axelrod and Michael D. Cohen, *Harnessing Complexity: Organizational Implications of a Scientific Frontier* (New York: The Free Press, 1999); Ralph D. Stacey, Douglas Griffin, and Patricia Shaw, *Complexity and Management: Fad or Radical Challenge to Systems Thinking?* (London and New York: Routledge, 2000); Peter Schwartz, *Inevitable Surprises: Thinking Ahead in a Time of Turbulence* (New York: Gotham Books, 2003).

> part of that lacework ourselves, it's doubly hard to see the whole pattern of change. (Senge 1990)

Senge set out to destroy "the illusion" that the world is created by separate, unrelated forces and to develop understanding of *dynamic complexity* where "cause and effect are not close in time and space" and obvious interventions do not produce the expected outcome (Senge 1990). Subsequent writers, such as Robert Louis Flood, have expanded on this idea, expanded the evidence against predictability in complex business situations, and warned of the consequences for assuming that these processes are capable of being controlled.

> An "A caused B" rationality is a source of much frustration and torment in people's lives. If a difficult situation arises at work, then an "A caused B" mentality sets up a witch-hunt for the person or people who caused the problem. (Flood 2000)

This "witch-hunt" causes otherwise successful people to be fired or demoted when they fail to predict the future—at untold costs to an organization. In organizations charged with security and defense constant changes of personnel can be even more destabilizing. Of course, the security and defense sector is not alone in this. Many private industries are becoming more complex as they become more interconnected and the forces working on them become more global than local. We are witnessing the birth of many complex adaptive systems. But our theories about the causes of surprises in these systems remain in Cogworld. And this may be keeping us from becoming more resilient in The New Normal.

All of us would prefer to operate in a system with more certainty and many of us will cling to any idea or evidence that seems to give us predictability. But the surprises in the economic, political, environmental, and other systems of the early 21st century have left many questioning our ability to make long-term predictions in these large complex and adaptive systems. The credibility of "expert" predictors is being challenged in a wide range of disciplines and publications (Schulz 2010). Experts have a large stake in prediction because it gives them a place at the table and any suggestion of uncertainty will

only result in them being replaced by somebody who offers certainty. Of course, relying on an expert opinion is a good way for policy makers and managers to avoid blame when things do not go as predicted. And many of them feel that leadership requires that they exhibit absolute certainty in their plans—even if there is a lot of uncertainty around. As difficult as it may be to accept, there are some surprises that we will not be able to predict so we must be ready to respond to them.

Resilience in Systems with High Uncertainty

When confronted with a potential danger, most of us would prefer a strategy that will keep the danger out or act as a buffer to keep us from being affected by it. This is called a *resistance* strategy and it is a good plan if you know the nature of the danger(s) you are likely to face. If you are likely to be threatened by an army with spears and swords, building a wall around your city will act as a buffer and stop harm to those within. While there will be some temporary defensive measures put in place in case of attack, sooner or later the city will return to normal. But building a wall around your assets (literally or figuratively) may also keep out other things (like water and food to the besieged city) and keep those who are being protected from taking advantage of opportunities outside the protected area.

When an individual or group (species, business organization, community, etc.) must operate in an environment where resources and dangers are too unpredictable for a resistance strategy, it is often good to develop *resilience* (Gunderson 2003). This seems to come in two forms. *Engineering* resilience means the system will bounce back to do exactly what it did before it was "surprised" by some sort of disaster or crisis. *Biological* resilience means that the system will bounce back but to a different operating mode that has adapted to the changes in the environment brought on by the disaster or crisis (Holling 1996). If the environment has changed, you do not want to bounce back to doing what you were doing before (because you would still be vul-

nerable), even if that is what most of us would *like* to do. Resilience strategies are increasingly interesting for dealing with surprises like natural disasters and terrorist attacks since it is difficult to successfully resist these dangers in all cases.

Resilience, Learning and Feedback

Even engineers (who might be expected to believe in Cogworld) know that their technical systems can be full of surprises and in need of resilience strategies. At conferences on resilience engineering in 2004 and 2006 a consensus seems to have developed that the management of large scale technical systems must have good feedback and needs to:

- Get smarter at reporting the next [adverse] event.
- Detect drift into failure before breakdown occurs.
- Chart the distance between operations as they are and as they are imagined to be to avoid management that leads to brittleness.
- Constantly test whether ideas about risk still match reality.

They conclude that management in these systems requires:

> *"… experience, intuition, improvisation, expecting the unexpected, examining preconceptions, thinking outside the box, and taking advantage of fortuitous events. Each trait is complementary, and each has the character of a double-edged sword" (Nemeth 2008).*

All of these traits require that managers have the authority and flexibility to respond to surprises. That makes their actions somewhat unpredictable. And if they aren't following SOP and there is a bad outcome they might expect to be the next victim of the Blame Game. Note, also, that all of these strategies require that managers really know what's going on. If their people are afraid to report changes or unexpected outcomes because they are afraid they will be blamed and punished it will make surprises almost inevitable. Most of these

traits have been written about extensively, but a few deserve a deeper look here.

Improvisation

Human organizations can look a lot like technological systems in that they become complex and unpredictable when several pieces are put together. Most complex technologies are designed as component parts of a larger whole and each part is designed by a different team (sometimes a different company). Each component must perform a function and respond to different variables in the larger systems. But they must also work with the other components that are performing other functions and responding to other variables. As the larger system gets more of these variables it becomes more mathematically intractable—it becomes virtually impossible to work out the equations for the interactions of the whole. This is often called the "curse of dimension" but it is often unacknowledged in the design phase. The inevitable surprises that happen when two components are put together are handled with *ingenuity* not *engineering* (Homer-Dixon 2002). There is often a process that looks a lot like the trial and error and adaptation seen in resilient biological systems. And a system that is designed to change, while still maintaining its basic functions and feedbacks will be more resilient in the face of these surprises. This means that, at its boundaries (where things come together) the system itself (or the humans that control it) must be good at *improvisation*. There is work in progress to understand this concept for technical systems and agent-based computer programs, including building models for cooperative improvisation by collaborative systems (Sawyer 2005).

For human organizations that must deal with the surprises that happen in situations of high uncertainty the ability to improvise is one that should be cherished. But it is often punished instead.

Improvisation that is a failure to follow SOP that has a bad (if unintended) result is likely to be the focus of blame—and is likely to reduce the amount of improvisation in the next crisis. This can make

the whole system more brittle and more prone to cascading collapse. Good improvisation needs accurate, real-time information about what the system is doing and how it reacts to attempts to change things. Improvisation is a strategy for dealing with surprises NOW by taking the resources immediately at hand and reorganizing them in a different way in order to continue an important function. It cannot be planned for except to make the system easy to adjust when on-the-spot improvisation is needed. If you have time to try a variety of things, you might use Deductive Tinkering.

Deductive Tinkering

But sometimes the environment is so uncertain (or you have so little information about it) that you have to randomly try lots of things hoping that one will work. Birds lay several eggs because they live in a dangerous environment and some eggs will be lost to predators. Businesses often develop many products in prototype form but abandon them if they do not meet specific targets. Thus, both *a limited investment in large numbers of the same things* and *diversity in the things tried* can be tools for resilience. These systems with high uncertainty need to generate *novelty* in order to survive. It should be noted at the outset that survival using these strategies does not necessarily involve anything even close to *stability* in the short-term fortunes of the individuals of that species or the units of an organization. A Deductive Tinkering strategy requires a willingness to accept failures and/or to deal with the same challenge in different ways. Predictability is difficult because survivability often depends on luck. The few eggs and a few products that survive do so only because they were lucky enough to find themselves in exactly the right environment for them to thrive. No one could have predicted which eggs or which products would be so lucky. This "try stuff" strategy is not seen often in government administration because it is supposed to treat everyone the same way. And when the tinkering doesn't work there is a tendency to find somebody to blame—putting an end to this way of discovering new strategies.

The Role of *Trusted* Feedback and Information

In systems with very high uncertainty it is often not possible to verify information before acting on it, this requires that the sender of the information be trusted. Information functions that must be trustworthy in times of crisis include: scanning for changes in resources and changes in trustworthy individuals, damage detection, intruder detection, and the detection of dangerous trends. There will often not be time to verify these reports before some action must be taken. If the reports are false they can result in an inappropriate use of scarce human and technical resources in times when those resources are already stretched to the limit. Building trust in the individuals or organization that may be providing this type of information is often critical. But building trust is not something you can do overnight. It needs to start before a surprise happens and it usually built by multiple interactions that turn out well.

Unfortunately, very large and complex organizations are often difficult to trust because they become opaque, making it difficult to verify the information that they give to outsiders. It becomes difficult to see what's going on in them: who does what? Under what conditions do they do it? Sometimes even the people in the organization can't answer these questions. As noted above, this makes it very difficult for multiple organizations to adapt to each other. And this can lead to some bad surprises when they have to work together. Of course, sometimes this is a *good* thing when it keeps an enemy or competitor from adapting to your strategies. But when dealing with trusted organizations/individuals that you want to adapt to a situation with you, good feedback about what's going on can prevent a surprise from becoming a crisis.

This can be illustrated by a chilling story. In *The Great Influenza: The Epic Story of the Deadliest Plague in History*, John M. Barry gives us a cautionary tale with direct relevance to the possible surprises of the 21st century. The tragedy was compounded by a failure to understand what was necessary for resilience. Governments lied to the public and the press about the extent of the epidemic in order to further wartime

morale and prevent "panic." Many in positions of leadership assumed that the virus and its transmission were predictable and would not change, but the virus mutated, making very specific and top-down strategies useless. The people in leadership positions also failed to collect and disseminate the knowledge that was being generated at the local level (nurses and local doctors were able to see what was working but could not communicate it). All of this meant that people got their information via rumors and, if they believed the government, did not take the steps that would have made them more resilient and, perhaps, more resistant. It is clear that people needed to know what was going on. They needed the ability to ask specific questions (without fear of being labeled unpatriotic) because generalized information was not always appropriate for their specific situation. This information would have allowed them to decide if they should move from danger or shift resources to build resistance and/or resilience strategies. What they did *not* need was isolation, because this led to fear.

> In virtually every home, someone was ill. People were already avoiding each other, turning their heads away if they had to talk, isolating themselves. The telephone company increased the isolation: with eighteen hundred telephone company employees out, the phone company allowed only emergency calls; operators listened to calls randomly and cut off service to those who made routine calls. And the isolation increased the fear. Clifford Adams recalled, "They stopped people from communicating, from going to churches, closed the schools, … closed all saloons … Everything was quiet."

Then as now, scapegoats are a tempting strategy (one local official blamed the influenza on "foreign settlements" in his city—mostly Italians) because they divert attention and emotional energy from what's actually going on in order to short-circuit the feared eventual Blame Game. But succumbing to such temptations destroys the best resilience asset government can give its people: a trusted source of information about what is actually going on so they can make decisions about their own strategies and the strategies they want their government to adopt.

Accountability, Feedback, and Blame

Some readers will be surprised to learn that it is often difficult (or impossible) to pinpoint one cause for surprises or malfunctions in complex technical or human systems. A lengthy investigation by independent parties is likely to come up with a list of things that contributed to the incident. Many of these things will indicate problems with the system and not with individuals in the system. But if it is the system, then is the person in charge of the system at fault? Who is accountable? We often demand accountability because we think it will improve performance. But "if accounting is perceived as illegitimate, … intrusive, insulting or ignorant of real work, then any beneficial effects of accountability will vanish or backfire. Effects include decline in motivation, excessive stress and attitude polarization …" (Woods 2010). They also include defensive posturing, obfuscation of information, protectionism, and mute reporting systems. Clearly, the rules for accountability must be understood by everyone and perceived as fair in order to accomplish improved performance. And it may be important to distinguish between accountability (the ability to account for or explain things) which the organizations want to encourage from blameworthy actions that result in some form of punishment. It has been observed that accountability can be seen as forward-looking while blame is backward-looking. Error in complex adapting systems is inevitable, blame is not.

"Human Error" as Cover for Deeper Problems

When something bad happens it is often attributed to "human error." This is dealt with "by enforcing standard practices and work rules, by exiling culprits, by policing of practitioners, and by using automation to shift activity away from people" (Cook 2010). This can make the system less flexible and more prone to surprises. And labeling a bad result human error is controversial because it often identifies a symptom and not a cause of the bad result. The person who is identified as having committed the error (or who had the surprise happen on their "watch") may just be the last person to "touch" a deeper problem with

the system(s). For example, managers are often told that they must ensure that their systems are *both* safe and efficient. There is evidence in technical and human systems that efficiency is actually the enemy of resilience and safety since it typically takes all the redundancy and backup capabilities out of the system (Hollnagel 2009). An efficient organization is generally described as one that gets the most output for the least input. This often means replacing humans with machines. These machines will be very efficient at delivering a service under typical conditions but not capable of improvisation when there is a change in conditions. And if they are not backed up with some sort of redundant system they may fail entirely.

You can also get more efficiency by training employees for very specific jobs that they can do very quickly under the typical conditions. Having employees cross-trained to do several jobs is expensive and takes time away from what they are supposed to accomplish. But when conditions are not typical managers will have very little flexibility to improvise staffing levels.

These tradeoffs between safety and efficiency are seldom acknowledged in the planning process. Meeting budget or output levels for the quarter sometimes seem more important. The potential problems are left unacknowledged, waiting to surprise everyone. But these deeper problems are not dealt with in the typical after-incident analysis and a human is found to blame—because they are usually easy to find.

> Large and intrinsically dangerous systems have a few well-defined humans at the sharp end. Those humans are closely identified with the system function, and so it is unlikely that a bad outcome will occur without having them present. (Cook 1994)

Blame and Resilience in Philosophy

In order to set the context for any new formulation of blame in systems with high uncertainty we must include a very short discussion of both resilience and blame in Western philosophy. The author under-

stands that this is only the barest beginning of a discussion and that it needs a much wider and deeper consideration.

Philosophers have always asked questions like "What is the best way to live?" A brief reading of the history of ethics in Western cultures reveals that the question has never been answered to everyone's satisfaction, and remains the subject of passionate scholarly debates. Most of the great minds who have tackled the questions have not addressed the issue of whether the rules for living a "good" life should be different in stable communities and in ones with high uncertainty. But there are some hints. For example, some of the disciples of Socrates thought that the good life was one in which individuals free themselves of the need for anything (to be as independent as possible) and thereby avoid the vagaries of changing circumstances—much like the folks who go "off the grid" today. This would certainly make them resilient to the absence of the goods and services they have decided to go without, but not very helpful for the local economy. And they could not, by themselves, provide for their own security and defense, so their resilience could fail catastrophically in the event of an invasion. This seems to be consistent with what is seen in many other systems: increased resilience at one level (the individual) can decrease the resilience of another level (the group).

This tension between what is good for the individual and good for the society remains the basis of many ethical and political debates today. Can we blame someone for putting self interest above public interest? In one case there seems to be little doubt: when they have said they will put the public interest above their own and they are being paid to do it. In some countries/cultures there is very little debate about whether public officials and public employees can be blamed for a variety of unethical behaviors: failure to give their full attention to their job, taking unearned or illegal compensation, and failure to follow the law, for example. In other countries/cultures these examples are not recognized as non-debatable. This leads us back to the larger philosophical debates started by the Greeks.

In Alasdair MacIntrye's seminal book on the history of ethics he traces the history of concepts that mitigate blame even when it *is* the cause: ignorance, compulsion and mistake (MacIntyre 1998). Beginning with Aristotle, blame is linked to the concept of the prudent man.

> But [the concept of the prudent man] has no particular connection either with caution or with self-interest. It is the virtue of practical intelligence, of knowing how to apply general principles in particular situations. It is not the ability to formulate principles intellectually, or to deduce what ought to be done. It is the ability to act so that principle will take a concrete form. Prudence is not only itself a virtue, it is the keystone of all virtue. (MacIntyre 1998)

However, MacIntyre believes that Aristotle recognized that to be prudent is NOT to avoid all risks and that error is a part of being human.

> Yet any account of men as agents which only introduces the facts of weakness and failure by a kind of afterthought is bound to be defective. For human desires are not straightforward drives to unambiguous goals in the way that biological instincts and drives are. Desires have to be given goals, and men have to be trained to reach them, and the point of having principles is in part to detect and diagnose failure in the attempt to reach them. Thus fallibility is central to human nature and not peripheral to it. Hence the portrait of a being who is not liable to error could not be the portrait of a human being. (MacIntyre 1998)

Much later, Baruch Spinoza takes up this theme and decries the propensity to judge the actions of people against some idealized person who we have constructed by "our own limited and chance experiences" (MacIntyre 1998). The question of whether we can blame someone for the unintended consequences of their acts depends on if they are obeying a moral imperative and the norms of "voluntariness" in their society (MacIntyre 1998). For a more Utilitarian approach to questions about the consequences of an action one would ask, Was it the most good for the greatest number of people? (MacIntyre 1998).

The problem with all these great ideas is in their application. What is the most ethical thing for public officials and employees charged

with the security of a nation do to? Should they pursue a "resistance" strategy to all known dangers? Even if that strategy costs the society more than it can afford to spend or crushes other values? What is the most good for the greatest number? Can we plan for resilience in the advent of a terrorist attack knowing that some people will die? Can a public official be blamed for the unintended consequences of actions done in a situation where predictability was very low? Are public employees to be judged against some "perfect" public employee who never makes mistakes? Are the intentions of public servants important or just the consequences of their actions?

Conclusions and Recommendations

Erik Hollnagel has studied reliability in many critical technical and human systems. He has written extensively on (and I have cited above) the role that blame plays in these systems (Hollnagel 2010). He suggests a balance between accountability and learning. He admits that setting out all unacceptable behavior in advance (particularly in systems with high uncertainty) is not possible and so there must be a *mechanism* that is perceived as relevant and fair for making these decisions. He suggests building a "Just Culture" that balances concerns for fairness with organizational cohesion, loyalty, and safety. This balance will be different in each organization and the balance will probably have to be reexamined periodically (Hollnagel 2010). In many organizations it will make sense for the specifics of this new culture to emerge over time as it adapts to changing uncertainties. Imposing something from the top down that does not allow for adaptability will only make the organization more brittle and liable to things like failures that cascade throughout the system.

The discussion in previous sections indicates organizations can also increase their learning (and their resilience to surprises) by distributing both data and stories about things that have worked *and* things that have gone wrong in a way that:

- accounts for the problem and is *blame-free* if that is

appropriate

- rewards people for reporting or contributing information/ opinions about a problem or an incident
- blames individuals or systems and explains the basis for that blame if that is appropriate

These stories begin to create alternative narratives about the organization for both internal and external audiences. Those narratives might show an organization that:

- has created a alternative SOP for times of crisis—when accountability and blame will be different.
- has decided when improvisation and deductive tinkering is going to be OK and is dedicated to defending (and learning from) good tries (Ditchley Foundation Conference on Resilience 2009)

So, how would an organization with a Just Culture treat Joanna and Tom?

Story # 1 Joanna and the Measures of Success

In a Just Culture Johanna would have been rewarded for contributing information and opinions about possible problems in her department—even if nothing was done about her concerns. She would never have been punished for bringing them to the attention of her boss and this would never be seen as disloyalty to that boss because the boss would not be blamed for things that he did not predict. The organization would account for the problems and identify any causes and/or places where information was bottled up. It would distribute this accounting and any changes in operations (like what would be counted to determine success and how systems would be evaluated) to as many people as possible in the organization. That accounting might blame Joanna's boss (and his boss) for failing to respond to the concerns—but only IF the organization had made clear that this kind of behavior is not acceptable. It would never blame anyone for behavior that has always been seen as acceptable. Joanna and other

managers who ran divisions that had to operate with temporary or permanent uncertainties would be given permission to do some deductive tinkering on their systems and to improvise in cases of a sudden surprise. The lessons from these departures from SOP would be spread throughout the organization—both the successes and the failures—but without attributing blame to the people who had given them a good try.

Story #2 Tom and the Black Swan

Tom would not be punished because he was the closest person to the problem and the last one to touch the issue of batteries. The inquiry into the problem would include an explanation to citizens about the cost of preparing for Black Swans like the one that happened. The city will have had arranged in advance to have some of its SOP become flexible in order to encourage improvisation that improves the immediate situation. The city would prove to all employees that it supports good tries and it will not make employees into scapegoats. In fact, Tom would be rewarded for his improvisation during the power outage. The city would work with the electric company to set up plans for emergency power for first responders without blaming them for the past outage. This spirit of learning without blame is picked up by the media and the citizens.

Blame Multipliers

After a surprise a number of things may operate to multiply the urge to blame somebody. The best way to neutralize them is to acknowledge them.

- *Hindsight bias.* We all know this and we all do it. It's easy to see from hindsight what would have made something turn out differently. This is a common but fundamentally unjust rationale for blame.
- *Confirmation bias/motivated scepticism (especially "hot" beliefs like politics/religion).* We see it every night on TV talk shows.

A surprise is seen through the lens of a strongly held political belief and (surprise!) the people who hold another belief are to blame for some bad outcome.

- *Overconfidence in knowledge—the* "*planning fallacy.*" People who believe in Cogworld are more likely to lay blame when there are unexpected bad outcomes. They believe these outcomes must have been caused by a failure to get the right data and apply the right theories. Their response to a bad surprise is often to impose more constraints (more rules) on the system, making it more complex and adding uncertainty.
- *The media.* The media and their role in the Blame Game is a problem/opportunity that needs immediate attention. This cannot, in a democracy, be dealt with by banning this kind of journalism or speech. Journalists have a very important role in holding governments accountable and suggesting blame. What is needed is a dialog on the role of accountability and blame in systems with high uncertainty. A more nuanced view of these concepts is not impossible—as I hope this report has shown. A dialog with the media about these issues should be held as soon as possible. The next surprise where people are looking for somebody to blame may be just around the corner.

To Bravely Go …

But perhaps the most important first step for organizations who must work in the New Normal—is to acknowledge the implications of Bugworld. In this complex and adapting world, errors and failure are not avoidable. The challenges these organizations will face are sometimes predictable but sometimes brand new. They will need more flexibility, fewer unbreakable rules, more improvisation and deductive tinkering, and a lot more information about what's going right and going wrong in order to adapt to surprises. But going here will not be easy because all these changes challenge some very closely held assumptions about how the world works and our desire to control things. The organization that survives in the New Normal will for-

mally and publicly acknowledge the uncertainty it must deal with and then start playing to win with rules that will actually work. And one of the best places to start implementing those new rules is in the way blame is apportioned in times of surprise.

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Measuring Societal Resilience

Brigadier General Meir Elran (Ret.)

Introduction

Faced with acts of terrorism targeting their societies, policymakers have, broadly, two basic options. The first is to focus on the reduction of the threat of terrorism. The second is to limit terrorism's impact by attempting to limit the capacity of terrorists to achieve their political objectives—even if they succeed at committing the terrorist acts themselves.

Policies aimed at reducing the terrorist threat have been widely used by governments over the past several decades—and for good reason. On the other hand, policies aimed at reducing the impact of terror remain less developed and underappreciated. However, these policies, too, could be very useful for societies facing terrorism.

For those advocating impact-oriented policies, an obstacle to pressing their case has been a lack of coherence and precision in the theoretical framework and the practicalities of the alternative response: How should a government or the public measure the indirect social and

political impact of a terror attack? How can they assess the capacity of a society to rebound once terror hits? Without answers to these questions, advocates of impact-oriented policies are left with ambiguous concepts, often without sufficient hard evidence. Quantified and substantiated data could add arrows to their quiver.

This article will share some methods and guidelines for how the questions of measurement can be answered. In particular, it shares ideas about measuring "societal resilience," a central concept in understanding the impact of disasters in general and terror in particular. The article begins with a brief explanation of the societal resilience concept. It then moves on to a description of how scholars in Israel have proposed measuring societal resilience. Finally, it will propose how measurements of societal resilience in different liberal democracies can be compared and how these measurements can, in turn, be compared to those of other societies and, in particular, to the societal resilience of societies from which terrorist groups operate.

The Concept of Societal Resilience

Societal resilience has become a central notion in disaster management theory and practice. Together, with economic and infrastructure resilience, it is now increasingly recognized as a major component in the framework of the community's capabilities in standing up to the severe challenges of natural and man-made hazards.

There are numerous definitions of societal resilience. Most center around three main characteristics: The first component is the society's capacity to contain a disaster or a series of catastrophes in an adaptive manner and to react to them flexibly (by bending rather than breaking), in accordance with the magnitude of the disasters and the severity of their consequences. The second attribute is the capacity of the affected community to bounce back from the low point of functionality reached following the disaster. It is commonly suggested that a resilient community recovers more swiftly than a vulnerable one. The third feature is the skill of the community in utilizing the unfortunate

circumstances constructively by learning from its flaws and hence enhancing its functioning or by "bouncing forward" to an even more resilient position than before the disaster occurred. To encapsulate the theory, *a resilient community would flexibly contain a traumatic experience, would expeditiously adapt to its consequences, and would bounce forward to an improved functional level.*

As suggested above, the proponents of societal resilience are still struggling to position the concept in a more central role as a basis for the overarching strategy of disaster reduction. Even though it has long become a common buzzword in the political and professional lexicon, societal resilience is still lagging in significance and financial investment behind other components of resistance which are designed primarily to thwart the disaster altogether or at least to minimize its consequences. Similarly, within the context of response and resilience, elements of economic and infrastructure resilience attract more attention than that of societal resilience.[1] This is perhaps because societal resilience is less tangible and hence more ambiguous for policymakers and stakeholders alike. Being an abstract and somewhat "soft" concept, societal resilience lacks the allure of expansive technical projects, which are easier to model, comprehend, and demonstrate. The result is that societal resilience is still, to a large extent and in many countries, a secondary tool in the fight against natural and man-made hazards. There is an urgent need to reconstruct this state of affairs and to grant societal resilience its necessary position in the realm of consequence management.

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1 "… the United States is pursuing a strategy capable of meeting the full range of threats and hazards to our communities.… As we do everything within our power to prevent these dangers, we also recognize that we will not be able to deter or prevent every single threat. That is why we must also enhance our resilience—the ability to adapt to changing conditions and prepare for, withstand, and rapidly recover from disruption." The President of the United States, *National Security Strategy* (May 2010), p. 18, www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf. See also Cabinet Office, *The National Security Strategy of the United Kingdom—Security in an Interdependent World*, presented to Parliament by the Prime Minister, Cm 7291 (The Stationery Office: March 2008), pp. 25-43, http://interactive.cabinetoffice.gov.uk/documents/security/national_security_strategy.pdf.

Why Is It Necessary to Measure Societal Resilience?

Societal resilience is by now a reasonably structured theory that has been transformed into a constructive framework for action. However, it still lacks, in many cases, the needed credence and impact as a leading component alongside the other, more concrete elements of disaster reduction. This is also because societal resilience as perceived presently is not commonly tested in the field before, during and after disasters, and hence is too often faced with skepticism as to its operational validity. Ostensibly, societal resilience is supposed to provide a clear sense about the actual capacity of a society/community at any given time,[2] with at least a general basis for a credible prior forecast as to the conduct of the community during and after a time of crisis. However, this is not yet sufficiently the case. In most instances the reference to societal resilience is vague and subjective in nature, based on qualitative assessments[3] or wishful thinking by the local stakeholders.

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2 On vulnerability and resilience measurement, see Kathleen Tierney, "Disaster Response: Research Findings and Their Implications for Resilience Measures," Community and Regional Resilience Institute Research Report 6 (March 2009), pp. 6-7, www.resilientus.org/library/Final_Tierney2_dpsbjs_1238179110.pdf. See also Barry E. Flanagan, et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management*, vol. 8, iss. 1 (2011), www.bepress.com/jhsem/vol8/iss1/3/.

3 P.H. Longstaff, et al., "Building Resilient Communities: A Preliminary Framework for Assessment," *Homeland Security Affairs*, vol. VI, no. 3 (September 2010), www.hsaj.org/?article=6.3.6. See also Community and Regional Resilience Institute, *Toward a Common Framework for Community Resilience* (CARRI: December 2009); the model of *Community Assessment of Resilience Tool (CART)*, designed by Betty Pfefferbaum and Rose L. Pfefferbaum of the Terrorism and Disaster Center of the University of Oklahoma Health Science Center, www.oumedicine.com/Workfiles/College%20of%20Medicine/AD-Psychiatry/CART_description_060509.pdf; and Susan Cutter, Christopher Burton, and Christopher Emrich, "Disaster Resilience Indicators for Benchmarking Baseline Conditions," *Journal of Homeland Security and Emergency Management*, vol. 7, iss. 1 (2010), www.bepress.com/jhsem/vol7/iss1/51/. For an Australian view on measuring organizational resilience, see Amy Stephenson, John Vargo, and Erica Seville, "Measuring and Comparing Organisational Resilience in Auckland," *The Australian Journal of Emergency Management,* vol. 25, no. 2 (April 2010): 27-32, www.ema.gov.au/www/emaweb/rwpattach.nsf/VAP/(9A5D88DBA63D32A661E6369859739356)~Measuring+and+comparing+organisational+resilience+in+Auckland.pdf/$file/Measurin

It can be suggested that the tools and models currently available are not sufficient to measure the precise level of resilience of a society/community until a catastrophe actually occurs. Even in a post-disaster situation, there are no commonly accepted modalities to judge the real societal resilience level of a victim community. Most accounts would be impressionistic in nature, not based on recognized benchmarks, and comparative at best. Even retrospectively, the information about societal resilience is often scarce and insubstantial, making it difficult to learn from it whatever is needed for gleaning the necessary lessons for future cases.

The best position would be if the stakeholders were familiar with the societal resilience status of a community *before* a disaster happens and also on a continuously updated basis. This kind of information is critical for planning, prioritizing, budgeting, and evaluating resilience-enhancement projects. Indeed, measuring the societal resilience of a community should be a central and an integral part of the preparatory stage, rather than a post-factum part of the ongoing learning process. This is especially true for communities that face continuous hazards with similar characteristics. In these cases societal resilience measurement can provide a solid basis of knowledge and perhaps also serve as a platform for a cautious forecast, if the database is systematic and diverse enough.

A few words of caution are in place. It seems that the most difficult hurdle for a successful measurement model would be the extent of heterogeneity of the society under survey. Since societal resilience is perceived as being rooted in the cultural, sociopolitical, and economic attributes of the community as a whole and on the demographic fabric of its members, it can be assumed that the more homogeneous the community is, the easier it will be to measure its characteristics. A cohesive and united community, in terms of its values and social composition, is likely to produce a clear picture of its resilience. However,

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g+and+comparing+organisational+resilience+in+Auckland.pdf. For a Canadian model of developing a portrait of community resilience, see Canadian Centre for Community Renewal, *The Community Resilience Manual*, Section 2, and Worksheet 8, http://communityrenewal.ca/community-resilience-manual.

present-day communities are becoming more heterogeneous. This is even more evident in the case of large mega-polities or national societies at large, that are rapidly taking on an obscure social texture. Not only might this lower the societal resilience level, it also hinders the measurement process and makes its results less reliable. We should remember though, that the hypothesis that homogeneous communities are more resilient remains a hypothesis. Until we measure societal resilience and collect and compare the relevant data (as proposed in this article), we cannot know which types of communities are most resilient.

The Generic Methodology

Phase One—Measuring Community Resilience

The model that is introduced here is a product of deliberations conducted in 2009-2010 by scholars and civil servants who are members of the Israeli Network of Societal Resilience Researchers. The discussions have resulted in a primary quantitative model for measuring societal resilience at the community level. It is based on a similar exercise conducted in 2002-2003, during the Second Palestinian Intifada. The extreme suicide terrorist acts of the period challenged the resilience of Israeli society, prompting concern on the part of the government as to the capacity of the public to withstand the protracted and severe pressure. Consequently, a survey was commissioned by the Israeli National Security Council to gauge societal resilience and to assess its ramifications.[4] Unfortunately, there was no follow-up to this initiative on the official level.

[4] The project was initiated and directed by Reuven Gal, then the deputy director of the Israeli National Security Council. The results of the study were presented by Dr. Gal at the Herzliya Conference in 2003. See "Think Tanks and Reports," Herzliya Conference, Previous Conferences, The 4th Conference, 2003, www.herzliyaconference.org/eng/?CategoryID=160&ArticleID=944.

Essentially, the reconstructed model is designed for the Israeli circumstances, namely to examine the social effects of the challenges arising out of the ongoing fight against different faces of terrorism. It is based on the assumption that terrorism is designed as a tool for psychological warfare against civilians, in order to perpetually demoralize the adversary's society by assassinating innocent civilian bystanders. Terrorism is meant to serve, fundamentally, as ongoing leverage designed to create an atmosphere of instability and fear that leads to a social and political ripple effect that will, in turn, advance the cause of the perpetrators. *The ultimate response to terror would hence be a strengthening of the nation's societal resilience; this would hinder terrorists from achieving their political goals, even if terror attacks take place.*

However, even though the present model is primarily designed to deal with a terrorist-prone environment, it is believed to be applicable also to other countries and to an all-hazard model, to include man-made and natural disasters and their effects on the societal resilience of affected populations.

The model is based on collection of data, and analysis of its implications, as gathered in selected communities in Israel, which will represent the entire gamut of the Israeli society: urban, rural, cooperative (kibbutzim), towns with minorities (largely Arabs), settlements, and communities both in the center (near Tel Aviv) and the periphery (elsewhere). The selection of communities will also be based on a threat assessment of exposure to terrorism. In each of the selected communities, data will be gathered for the general population and also for selected groups, based on age, gender, religion, faith, ethnic origin, and special needs/disabilities.

> The goal of the procedure is primarily to measure the magnitude and the time factor of the relapse and the bouncing back of the population examined following the traumatic episode (or series of catastrophes): to gauge first the extent of the initial reaction and then to chart and quantify the trend of the recovery process. This is in order to explore when and if the resumption of functionality reaches the level held before the occurrence of the event, or whether

the population can even reach new heights of social capacity as a result of a constructive learning process.

The Israeli model is designed to respond to scenarios in which terrorism assumes a protracted pattern, consisting of a long series of different attacks against different civilian targets. The most notorious example was the situation during the Second Intifada, when hundreds of diverse terrorist attacks were launched with varying magnitudes and damage during a long period of four years. Similarly, though not as extreme, scenarios took place during other campaigns (2006, 2008-2009), when terror was used daily against the population for several weeks. In such circumstances, it becomes even more acute to comparatively examine the changing rate of societal resilience of the communities directly hit by the ongoing attacks, those that are in direct or further proximity to the areas assaulted, and of the population at large. Such a sequence of events is not exclusively limited to the Israeli scene.

In practice, the model is based on unifying three layers: The first layer registers the frequency, magnitude, and damage of the traumatic episodes. The model calls for the construction of a continuous database which will enable a comparison of routine, uneventful periods to times of crises.

The second layer registers *the behavior of the public* before, during, and following the disaster(s). The hypothesis is that different communities and different sectors of most of the (heterogeneous) communities may react in diverse manners to the challenge. In practice, the second layer will monitor four categories of the public's conduct: a) the daily routine will be measured by the level of attendance at work and school; use of public transportation; watching TV, listening to the radio, and using the Internet and social networks. b) The economic conduct will be monitored as reflected in home shopping and visiting malls, stock exchange trading, and banking transactions. c) Manifestations of stress will be measured by referrals to emergency rooms, use of community clinics, urgent appeals to local hotlines, calls to the MDA (Israel's Red Cross), visits to municipal

emergency and stress centers, reported violence within and outside the family, and automobile accidents. d) Entertainment and leisure will be surveyed by measuring the frequenting of movies and theaters, restaurants, and hotels and by the levels of vacationing and traveling abroad.

The third layer will monitor the *perceptions of the public* as recorded by surveys and polls in times of peace and during times of crisis. The model will collect data on the following main perceptual categories: personal condition, such as mood, anxiety, and confidence; perceptions of personal, community, and national states of security; feelings about routine conduct; the rate of optimism concerning one's individual and societal future; fear of terrorism/other hazards; attitude of solidarity and willingness to continue living in the community/country; trust in the local/military/national leadership; confidence in one's personal/community preparedness; and pride in the nation and country.

Once the data is collected for all three layers, a comparative analysis can be conducted to examine the state of behavior and the mood of the public and the different sectors of the population. The information is expected to provide a multidimensional matrix of similarities and differences—on the community level—comparing times of peace to times of challenging circumstances and pre- and post-trauma tendencies of those in the different communities. These comparisons will eventually enable us to measure the degree and speed of bouncing and bouncing-back patterns in each of the monitored communities in different circumstances. It might also provide us with a reasonable appreciation of the societal resilience of the country at large.

Phase Two—Multinational Comparison of Societal Resilience

The suggested community model can also be applicable for other societies with similar cultural, social, and political characteristics. This might be particularly the case for liberal democratic societies that face

severe threats of terror. In principle and with some modifications, this model might also be useful to credibly gauge the community resilience of other nations with regard to other hazards, both man-made and natural.[5]

In practice, such a model can be an intriguing step towards the construction of an international comparative matrix of societal resilience. This matrix would perhaps be worthwhile not only for comparing the results attained in each country separately. It is also possible to imagine an evolving and Integrated *International Societal Resilience Index*, based on the comparative model that might provide an agreed flexible structure of knowledge, through which each participating nation, its formal and informal institutions, will be able to examine the accumulating data, analyze its meaning and implications, and draw the relevant conclusions and lessons. All of these could help to strengthen international cooperation and information sharing, to expand knowledge, and consequently to improve the capacity of different nations to enhance their community resilience.

It would probably be necessary to conduct a preliminary comparative societal resilience study in order to examine the impact of the different cultural and political backgrounds of the participating nations on their respective responsive reactions to major hazards. Since comparative study of the influence of culture and sociopolitical characteristics on the post-traumatic behavior of communities is still not very advanced, we do not know for certain to what degree different societies react differently to similar challenges. Based on the limited knowledge that is available, the initial suggestion is that even if there is some marginal dissimilarity, at least in most cases, democratic, Western-style societies will essentially manifest the same patterns of behavior

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5 For a possible start for such a project, see: Council of the European Commission, *Risk Assessment and Mapping Guidelines for Disaster Management*, Commission Staff Working Paper, SEC (2010) 1626 final (Brussels, Belgium: 21 December 2010), http://register.consilium.europa.eu/pdf/en/10/st17/st17833.en10.pdf. The newly formed International Network of Resilience Researchers (https://www.signup4.net/public/ap.aspx?EID=HOME58E&OID=50), established in 2009 under the auspices of the Homeland Security Institute (www.homelandsecurity.org/) and assisted by the U.S. Department of Homeland Security, can be an excellent host of this project.

and perceptions when they face similar challenges. Perhaps in a later stage it would be possible and rewarding to examine if this thesis is universal in nature, irrespective of the specific attributes of diverse nations. These assumptions still have to be empirically substantiated.

Phase Three—Societal Resilience and the Balance of Adversaries

Another worthwhile model would quantifiably examine the impact of massive disruptions caused by adversaries on each other's societies as part of an ongoing open conflict. The past several decades have seen a pattern of asymmetric conflicts, in which countries threatened domestically by extreme terror look for forceful, violent leverage on the social and political settings of the terrorists and their supporters. In the agonizing context of the war on terror, liberal democracies—challenged by states and non-states actors that adhere to different sets of values and resort to terrorist strategies so as to overcome their weakness—find it necessary to search for strategies to weaken the basis of support for terrorism within the societies that they face. When massive terror is indiscriminately used against civilian targets, considered to be the weaker link of democratic societies, the democracies are subsequently obligated to react in different, sometimes conflicting ways to neutralize the perpetrators. In many cases, the strategy aims at isolating the terrorists from their social and political environment by benevolent means. If this strategy is less than successful, armed pressure is also used, indirectly or otherwise, on the civilian population in order to disassociate it from the enemy, causing collateral damage—sometimes massive—to civilians.

As this pattern is applicable to many Western powers that are engaged in the international war on terror, the Israeli experience might also be relevant in this context. In the past decade Israel, has been engaged consecutively in major terrorist campaigns on three different fronts (the Palestinians in the West Bank in 2000-2004, Hezbollah in 2006, and Hamas from the Gaza Strip from 2005 to 2009). In these three campaigns, the terrorists launched their attacks on civilian targets

causing severe and protracted disorder with significant effects on the civilian population. In all cases, Israel reacted militarily in order to eliminate the threat and to restore stability, using its military might also in civilian environments from which the terrorists operated.

Not entirely dissimilar scenarios have taken place in other theaters of war, such as in Iraq, Afghanistan, and Pakistan, where the Western democratic coalitions operate against militant insurgents and supporters of terror. These difficult situations raise a challenging issue: It is quite apparent to us that the terrorists aim at eroding our societal resilience, hence making it necessary for us to react defensively by enhancing our social capacities to withstand their pressure and to make their goal as futile as possible. At the same time, it is acceptable that when necessary and feasible, democratic states defend their basic interests including through offensive countermeasures to be waged in terrorist-controlled territories. In these areas of combat there are often civilians, not all innocent bystanders, who live and suffer sometimes heavy losses when military objectives are targeted. This vicious cycle unfortunately creates an issue of civilian resilience also on the other side.

Consequently, there emerges between the adversaries an active duel of resilience: The concept of terrorism is based on the vision of disrupting the basic social and political order of the terrorists' foes. This stirs a reaction that often leads to disastrous circumstances in the societies in which civilians live alongside the terrorists. The evolving process brings about a set of asymmetries in which the populations on both sides of the fence are prone to high risks, finding themselves tragically involved in a conflict that is not fought on the traditional battlefield between ordinary military forces. Who will be the first to show a sign of vulnerability? Which society is more resilient to stand up to the profound challenges posed by the other? It is not a simple symmetric duel, as the basic values and the social- political systems on the two sides are often very different. Societies governed by democracies might possibly react and behave differently than societies governed by autocratic systems. It is difficult to predict which one will prove to be more or less resilient in facing the severe challenges. We need to be in

a position to know better not only our own capacity in terms of societal resilience, but also the social picture of the opponent. Measuring and consequently assessing the societal resilience on the two sides might help us to ascertain the prospects and perhaps also to gain the upper hand in this complicated struggle, based primarily on psychological warfare.

So far, most of the study of societal resilience has centered on our own communities facing different challenges. The time may well have come to start studying the social environment of the adversaries, which is so very central in the context of the global struggle of democracies fighting for freedom and tranquility against terrorist tyranny. This venture will not be simple. It requires not only access to data but also basic knowledge and understanding of issues and processes in the adversaries' camp that are usually lacking in our midst. Still, this kind of venture is no less important and rewarding than collaboration in a comparative study of our own resilience as we face natural or man-made hazards.

Summary

The study and practice of societal resilience has significantly progressed in the past few years and has become a solid theoretical basis for the management of response to a variety of man-made and natural hazards. However, most of the important academic work done thus far has been qualitative in nature and has covered specific cases following extreme occurrences in particular circumstances.

This paper has attempted to focus on the need to expand the base of knowledge and interpretation, and also the prospects of reasonable forecasting as to how communities might respond to traumatic challenges. *This calls for more comparative studies, based on a more quantitative analysis of responses of a wide variety of sectors and communities to different types of threats.* It has been suggested that it is not only important to measure the precise level of societal resilience of communities but that doing so is methodologically feasible. Once one identifies

and understands the obstacles, it is possible to collect the necessary data on the conduct and perceptions of the selected communities and to assess the ramifications of the constructed picture.

A further step beyond gauging the societal resilience of a given community and comparing it to others to receive a national picture could be the comparative study of the societal resilience of different nations, based on the model of measuring their own communities. Such a comparative model could enhance cooperation between different countries. This needed collaboration, based on a quantified shared index, would facilitate an international comparative survey of responses to different challenges. It could serve as a constructive platform for improving the preparedness of the partners for different hazards that they might face.

More challenging, but not of lesser significance, would be the measurement of societal resilience of adversary societies. Such an endeavor would not only facilitate the thorough study of counterterrorist response strategies but would also significantly improve the capacity to mold the offensive thrust against the perpetrators of terror and to calibrate it in accordance with the sociopolitical capacities of the adversary. This might serve as a powerful tool for refining the international war on terror and shaping its tactics for the proper context.

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Multiple Dimensions of Resilience: Directions for Future Research

Dr. Alka Sapat

Introduction: Outline

The focus of the proposed report is to identify directions for future research in understanding societal resilience to disasters. In doing so, it will: a) focus on the gaps in our conceptualization of resilience and analyze issues with respect to measures and metrics; b) present a Resilience Policy Index using metrics and indicators on emergency capacity and community resilience for coastal regions in Florida; and, c) discuss issues related to resilience and future directions for research. Florida was chosen as it represents an area that is highly vulnerable to natural hazards like tropical storms and hurricanes that worsen with climate change, as well as ecological damage from urban sprawl.

The report is organized as follows: the first part focuses on conceptual issues in defining resilience, which is followed by a discussion of the challenges in measuring resilience. Using counties in the coastal regions in Florida, metrics related to the concepts discussion in the first

section and measured and combined into a Resilience Policy Index in the second section of the report. The third and last section of the report concludes with a discussion of some of the unresolved issues in the conceptualization and measurement of resilience, including some recommendations for future research on the topic.

Conceptualizing and Measuring Resilience

Resilience is often understood as building capacity to prevent or withstand shocks and to respond to slow and rapid onset disasters. However, definitions of resilience go beyond this understanding and over the years, this concept has been defined in a number of different ways and in a number of different disciplines and emphases such as: physical resilience (Gordon 1978; Bodin and Wiman 2004), engineering and seismic resilience (Miles and Chang 2006, Bruneau et al. 2003); ecological resilience (Holling 1973; Waller 2001; Gunderson 2000; Longstaff 2005), community resilience (Coles and Buckle, 2004; Pfefferbaum, Reissman, Pfefferbaum, Klomp, and Gurwitch, 2005), individual (Masten, Best, and Garmezy 1990; Egeland, 1993; Butler, Morland, and Leskin 2007), and social resilience (Adger 2000; Godschalk 2003). In a seminal piece on the topic of community resilience, Norris, Stevens, Pfefferbaum, Wyche, and Pfefferbaum (2008) summarize some of these prior conceptualizations of resilience and in a shift from previous definitions, they contend that resilience needs to be understood not as an outcome but as "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance." Based on this definition, they discuss four sets of capacities encompassing-economic development, social capital, information and communication, and community competence—that together provide a guide for disaster readiness.

At times, resilience has also been conceptualized as the capability and its ability to offset vulnerability. To a large extent, resilience is seen as being the reverse of vulnerability; for instance, Godschalk (2003) points out mitigating social vulnerability to urban hazards and inte-

grating those activities with economic development and social justice could help achieve a resilient system. Similarly, Simpson (2006) links the concept of community resilience, defined as a community's capacity to recover, also discusses resilience in the context of its ability to offset vulnerability. Mayunga (2007, 4) however, points out that "conceptualizing resilience [as the opposite of vulnerability] may not be desirable because it does not add much to our understanding," implying that resilience and vulnerability are not necessarily mirror opposites.

Along with these various definitions of resilience, are the various components of resilience that are taken into account in various indices related to disaster risks. Simpson (2006) provides a good summary of issues related to measuring dimensions of resilience. Similarly, teams of researchers from Texas A&M University (Mayunga 2007; Peacock et al. 2009), University of South Carolina (Cutter, Burton, and Emrich 2010), and others (Sherrieb, Norris, and Galea 2010) have developed and refine baseline indicators and indices of community resilience. Cutter et al. (2010) discuss baseline indicators and related social economic infrastructure along with institutional capacity (mitigation) and community competence variables. Peacock et al. (2009) use a different conceptual model based on a combination of the community's capital resources (social, economic, physical and human), and the four phases of a disaster-mitigation (perceptions and adjustments); preparedness (planning and warning); response (pre- and post-impact); and recovery (restoration and reconstruction). In a more recent article, Norris et al. (2008) also focus on different dimensions of resilience and contend that these different facets cannot be captured by a singular metric; rather they point out that the value of the resilience concept is its ability to describe the characteristics of and interactions between stressors (disasters), adaptive capacities, and wellness. In addition, they also offer an important perspective on linking a network of adaptive capacities including economic development, social capital, information and communication, and community competence. Capacities and disaster readiness can in turn be enhanced through interventions and policies (Norris et al 2008).

For this report, this past research is valuable in that it indicates that resiliency involves a number of different dimensions, which include household, institutional and community capacities, resources, infrastructure, and policies; and that different metrics are needed to capture these dimensions. In the next section, dimensions of resilience in Florida are discussed with particular attention to resilience to potential displacement from catastrophic hurricanes. The focus on displacement issues stems from a larger project on displacement risk due to potential hurricanes and the research presented here is part of the larger project. In this report, the issue of resilience dimensions and metrics is used to discuss the variability in resilience across counties in Florida.

Resilience Dimensions and Metrics in Florida

In this section, the focus is on a discussion of the various indicators and variables to measure these dimensions, using coastal portions of Florida as a study area. *Coastal portion* is defined here as the coastal counties and the counties immediately inland of them—that is, *an area two counties "deep."* For Florida, this includes 57 of the 67 counties in the state; this area was chosen, as these are the counties that are most likely to experience the full brunt of storm surge and strong winds, particularly for major hurricanes moving onshore, that impact areas far inland from the point of landfall. These counties are those most likely to produce potentially large numbers of displaced persons. The discussion begins with a look at Florida and its vulnerabilities and then moves on to various dimensions of resilience.

Why Florida?

Florida is used as an example for discussing different dimensions of resilience, because Florida is considered to be one of the most hazardous states in the United States; it has been ranked by some researchers as the second most hazardous state in the nation (Thomas and Mitchell 2001). Located in the southeast portion of the United States,

Florida is a peninsula with the eastern shore along the Atlantic Ocean and the western shore bordering the Gulf of Mexico, with approximately 1,197 miles of shoreline (American Safety Council for Florida Residents & Visitors 2008). The state is comprised of 67 counties and the capital is located in Tallahassee. It borders the states of Georgia and Alabama and covers 54,252 square miles of land, making it the fourth largest state in the country, behind California, Texas, and New York with a total of 18,089,889 citizens in 2006 (U.S. Census Bureau 2006).

Given its geographic location, Florida experiences many hazards, associated with hurricanes, flooding, and coastal hazards such as storm surge. This vulnerability to natural hazards is combined with an increasingly large population, with a high percentage living along the hazardous coastline. Over the last fifty to sixty years, Florida experienced exponential levels of growth; it grew from fewer than 3 million people in 1950 to over 13 million in 1991, and 80% of that growth was in coastal areas (Mileti 1999, 42). Figure 1 indicates the levels of population densities in counties in Florida based on U.S. Census data (U.S. Census 2007).

This combination of increasing population densities in a hazardous region has increased its physical, social, and economic vulnerability, putting more people and property at risk. In addition to increasing densities, the character of coastal residents has changed as well from seasonal to year-round residents. According to Cutter and Emrich (2006), many of these year-round residents are elderly retirees or service industry workers who keep the tourist industry afloat, and they are more racially and ethnically diverse than in past decades. These physical, natural, social, and economic characteristics of Florida, combined with its susceptibility to other slow onset natural disasters, such as sea-level rise due to climate change, render it an important area of study.

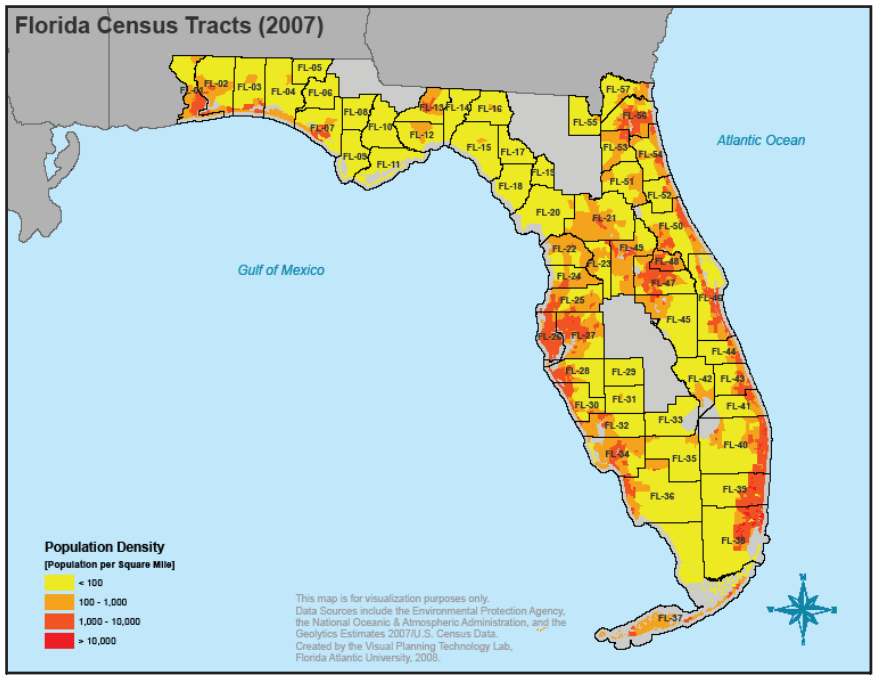

Figure 1: Population Densities by Counties in Florida

Resilience Metrics and Indicators:

As discussed in the previous section, past research shows that there are many facets and dimensions of resilience. In the last two or three years, several teams of researchers have also focused on finding appropriate metrics and indicators to measure these different dimensions of resilience (Sherrieb et al, 2010, Cutter et al., 2010; Peacock 2009).[1]

Using theoretical insights based on this past research, this report will focus on two of those dimensions discussed in the literature as a means of explicating the variability that exists across geographic regions in resilience to the problem of potential displacement risk due to catastrophic hurricanes. In particular, this report focuses on emergency capacity and community and economic resilience. The details

[1] Also see the Community and Regional Resilience Institute (CARRI) website and associated research reports on measuring resilience at http://www.resilientus.org/publications/reports.html.

of the indicators and their component variables representing these dimensions are presented in Table 1. We recognize that the variable list is incomplete, which is due to lack of data for the complete study area. For example, county-level long-term recovery planning and affordable housing planning factors should ideally be included to account for general pre- and post-disaster planning capacity, accelerated job recovery, accelerated school recovery, capacity to meet temporary and affordable housing needs, all of which are necessary to understand levels of community resilience to withstand disasters. Similarly, measures of physical resilience, measures of social and economic vulnerabilities, and the propensity or the probability of disasters (i.e. probabilities of being struck by storms, hurricanes, storm surges and resultant floods), and adaptive capacities to be resilient are not included here. Some of these omissions are intentional, since the focus of this report is to look at the variability in resilience levels only in some key dimensions only, as the focus of the report is primarily to explicate the policy implications and ramifications of these varying resilience levels. Other omissions stem from the lack of readily available data and useable resilience metrics.

Table 1: Summary of resiliency and policy indicators and variables

Component	Indicator	Variable (with directional effect on resilience)
Resiliency	Community and Economic Resilience (4)	Foreclosures (-); Housing Vacancies (+); Social Capital Groups (+); NGOs (+)
	Emergency Capacity (3)	Hospitals (+); Medical Services (+); Physicians (+)

Data Sources: HUD; USPS; American Medical Association; Citizen Corps; FEMA; National Center for Charitable Statistics; County Business Patterns NAICS; County websites.

Notes: (+) / (-) signs after each variable refer to the directional effect on resilience.

The Resilience Policy Index

Using these indicators, a resilience policy index was created by taking the average of the two sub-components: community and economic resilience and emergency capacity, which were converted to a standard

normal percentile. The community and economic resilience indicator combines four variables: two that measure social capital (number of social capital groups and non-governmental organizations (NGOs) and two that describe housing resilience (the number of housing vacancies and the number of foreclosures). The emergency capacity indicator aggregates three underlying variables measuring emergency capacity, which are the number of hospitals, physicians and other medical services in a county. Each of the variables in these indicators was normalized by calculating them per 10,000 people (for instance, number of physicians per 10,000 people).

For all indicators, I systematically ran correlations between individual variables that were grouped within an indicator and then between indicators within the index. None of the variables in the indicators were correlated with each other and neither did high correlations exist between variables across indicators. This prevented any duplication and redundancy and there were no problems of co-linearity or duplication of variables in the index.

Also important to note here is that for these indicators and their underlying variables, equal indicator weighting is applied in the strict mathematical sense, since no objective mechanism or theoretical literature exists to determine the relative importance of the different aspects of resilience. We recognize however that we are implicitly giving some measures more weight than others due to the number of variables used. Most of the variables included in the RPI exhibited skewed distributions and therefore, two approaches to process the initial data were undertaken. The square root or natural log transformation was applied (as needed) to variables in which a large number of outliers were detected. After the data processing was completed, the datasets were standardized using a standard z-score calculation. The variables contributing to the composite score of the RPI were examined for directional effects on resilience. Variables with positive effects on resilience were standardized by dividing the difference between the observed and the expected value by the standard deviation (Samuel-Johnson and Esty 2001). Variables having a negative effect on resilience were multiplied by (-1) before using the z-score standardization

approach (Samuel-Johnson and Esty 2001, Booysen 2002). Each indicator was then computed as the average of the underlying z-scores. The computation of the two RPI sub-components involves the average z-score of the underlying indicators converted to a standard normal percentile. Finally, the overall RPI was calculated by averaging the standard normal percentile of the four sub-component indicators.

The resulting resilience policy scores are measures of the relative resilience to natural disasters for 57 counties in the study area. Tables 2 and 3 below present the results of the index for the top 10 and bottom 10 RPI scoring counties respectively.

What is immediately apparent is that nine of the ten counties with top RPI scores are coastal counties. One inland county (Leon), ranked in the top ten RPI scores as well. Conversely, eight of the ten counties with the lowest RPI scores are inland and rural counties. To check the differences in the RPI scores between coastal and non-coastal counties, I ran a paired samples t-test. The mean levels of RPI scores was much higher for the coastal counties (for coastal counties, $\mu_1 = 58.90$, for non-coastal counties, $\mu_2 = 47.82$) and the t-test results shows the difference in DRI scores as being statistically significant ($p < 0.001$).

The results below also indicate that urban areas tend to be more resilient. Of the top ten most resilient counties, a number of them encompass cities or centers of political and economic power. For instance, Leon County, indicated as being very highly resilient on the RPI in Table 2 below, includes Tallahassee, the capital of Florida. Less resilient counties on the other hand, as seen by the counties listed in Table 3, are not only inland counties, but are also primarily rural areas, where emergency capacities are much more scarce and economic conditions are less favorable.

Table 2: Top 10 RPI scores with components Community and Economic Resilience and Emergency Capacity (Coastal + One Inland County)

County	Coastal Depth	Community and Economic Resilience Score *(Percentile)*	Emergency Capacity Score *(Percentile)*	RPI Score *(Percentile)*
Leon	2	88.22	84.36	86.29
Monroe	1	93.85	73.19	83.53
Santa Rosa	1	93.79	66.45	80.12
Escambia	1	69.86	84.55	77.21
Pinellas	1	57.32	96.82	77.08
Palm Beach	1	55.99	97.37	76.68
St. Lucie	1	79.17	67.46	73.32
Orange	2	51.04	94.64	72.85
Duval	1	51.82	93.66	72.75
Bay	1	61.30	79.48	70.40

Table 3: Bottom 10 RPI scores with components Community & Economic Resilience and Emergency Capacity (Coastal + One Inland County)

County	Coastal Depth	Community and Economic Resilience Score *(Percentile)*	Emergency Capacity Score *(Percentile)*	RPI Score *(Percentile)*
Dixie	1.00	50.67	23.20	36.9
Flagler	1.00	26.98	41.66	34.3
Wakulla	1.00	40.96	26.30	33.6
Okeechobee	2.00	33.74	31.16	32.4
Baker	2.00	31.24	27.02	29.1
Calhoun	2.00	39.45	15.52	27.5
DeSoto	2.00	23.06	24.70	23.9
Glades	2.00	23.30	19.96	21.6
Hardee	2.00	18.50	19.31	18.9
Holmes	2.00	19.25	18.48	18.9
Hendry	2.00	14.90	22.64	18.8

Issues to Consider for Resilience and Directions for Future Research

The index above helps us understand some of variations in the dimensions that are traditionally used to capture resilience, albeit with the caveat that this forms only part of the picture. The example of Florida and the metrics used to capture resilience also raises a number of questions that need to be fully explored in future research. These issues are raised and discussed below:

Complementary and Conflicting Dimensions of Resilience: Complementary relationships between different dimensions of resilience have already received some attention in past research. For instance, Adger (2000) points out that social resilience is linked to ecological resilience. In a recent detailed report, Gunderson (2009) also investigates the relationship between ecological and human community resilience; he discusses how ecological resilience can help understand human community systems and disasters, in context of anticipation of events, understanding vulnerabilities to change, developing adaptive responses, as well as robust renewal and recovery. The link between social and economic resilience is also supported by research that suggests that those who have better social networks are likely to have better access to economic resources such as jobs (Tierney 2010; Norris et al. 2008).

Conflicting relationships between different dimensions of resilience, have, in contrast received less attention and future research could pay more attention to these relationships. For instance, does individual and social resilience remain strong or increase, even when there is a lack of institutional/governmental resilience? An example of the same can be found in Haiti (or other developing countries that have faced disaster). Often institutional infrastructure in the form of physical structures or strong government institutions and norms may be lacking in these countries, particularly if destroyed by disaster, as happened in the case of Haiti, when a number of ministries (building and officials) perished in the 2010 earthquake. However, individual resil-

ience and adaptive capacities of the Haitian people has been strong as seen by efforts made at the individual level to cope with aftermath of the quake. Similarly, government policies might try to strengthen one type of resilience, which could have intended or unintended impacts of other forms of resilience. For instance, strengthening economic resilience (in the form of greater industrialization or more development) has had a negative impact of ecological resilience (seen in environmental impacts). In discussions on resilience, more attention and research is needed on these conflicting dimensions of resilience.

Resilience Indicators and Metrics: A second set of issues relates to the use of resilience metrics and indicators. An important issue that has been the issue of scale that has been raised in past research. Geographic scales (i.e. local, state, national), temporal scale (i.e. short term vs. long term) and institutional scales (i.e. global vs. local) are important factors (Willibanks 2009), along with the important of "fast" vs "slow" variables and their impact on resilience (Gunderson 2009). The different kinds of scales are often related, interactions occur across scales and significant relationship may exist between scale and resilience and sustainability levels. For instance, Willibanks (2009, 16) notes that the relationship between community *size* and sustainability is interesting; a larger size means access to a wider range of resources, but a smaller size means simpler decision-making processes, which can translate into greater agility. Definitions of what constitute a "community" or "society" in understanding community or societal resilience is also an issue: for e.g. a community could be a town, village, or a county, or alternatively, it could be a professional community (Willibanks 2009) or social network.

In addition to issues of scale, current indicators and metrics are often static, do not account for the fact that indicators will change over time, and do not take into account other interactions among variables. Cumulative impacts of hazards or policies to counter then, the lack of primary and other adequate data to inform metrics, the lack of longitudinal research on resilience metrics are also an issue. Furthermore, resilience metrics often rely on census data, which are problematical in terms of the errors associated with the data, as well as the

time periods for which such data is available. Finally, while a number of metrics to measure resilience have been developed, the transferability of such metrics across cultures, countries, and policy dimensions need to be carefully undertaken and considered.

Developing Policies to Increase Resilience: Finally, resilience has become the *'mot du jour'* and can be found in a variety of discussions and disciplines (ranging from resilience in children, to resilient bacteria, to resilient institutions). However, translating concepts, concerns, and metrics to develop and design effective and equitable policies is not an easy task. Future research could explore the challenges in translating research concepts and metrics to applications in public policy and implementation; for instance, major obstacles can surface in generating the political will necessary to adopt policies to develop resilience, especially for projects that are costly in the short-term and whose benefits manifest themselves only over a period of time. Projects that would involve further government involvement or bigger budgets are likely to face opposition in a climate of economic uncertainty and anti-government sentiments. Developing the capacity for resilient infrastructure that is both responsive to immediate needs and for long-terms resilience to disasters also remains a challenge. These issues continue to be a challenge to incorporate scientific thinking and information into planning, practice, and decision-making and identifying and finding solutions for these challenges could form part of a potential research agenda on resilience.

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Part 2

Ecological and Biological Perspectives of Resilience

Part 2: Ecological and Biological Perspectives of Resilience

Introduction

Dr. Curt J. Mann

The abstraction of human social resilience presents opportunities for thought. If we use our imagination and consider the concept of resilience a prism, we can imagine the many different facets of the prism representing the many different sides of resilience. It is all the sides of the prism that indeed make up the foundation of the structure. When the light strikes the prism, each face passes and presents a separate light; the resilience prism passes and presents the many notions of resilience. There is sagacity to consider all the experiences and knowledge of resilience represented as we envisage the emerging notion of societal resilience. By looking to the other facets of the resilience prism we are enlightened and assist the maturation of our thinking about preparedness and our national security generally.

The noun, "resilience," provides the notion of time, space, and form, which adds value to the evolving understanding of what preparedness

means in a post-9/11, post-Katrina, post–"you name the disruption" world. By looking to the experience and understanding of resilience found in the biological disciplines of medicine, microbiology, populations (epidemiology and epizoology), and ecology—especially ecology where scholarly consideration is based on the fundamental idea that everything is a system of systems—insight is achieved at a minimum.

The complex dynamic systems known as ecosystems provide important perspective and real lessons for the effort of considering human social resilience and what that may involve. The thought leaders in ecology have been considering resilience for nearly 40 years; it is a community that understands the importance of metrics and measurement, and the discipline has matured, refined, and perfected how resilience is considered. There are some who might consider ecology a realm only concerned with resilience from a reactive position, natural systems are always simply responding to various influences, and less about an operational perspective such as that to be found in man-made organizations and structures, and especially intentional man-made disruptive damage. While ecology may have been at one time concerned with reactive study, modern ecologists are involved in both understanding the triggers, variables, and metrics that make a system react, and using that knowledge of reaction to predict, design—or possibly better said—influence, and ultimately operationally act. The world of biology and ecology has hard-earned wisdom, much of which can be applied to assist with coming to terms with emerging notions of societal resilience.

Part 2 of these proceedings includes three reports, all with their own perspectives: one built from a thoughtful approach to understanding the complexities and dynamic nature of ecosystems; one quite practical from the experience of operational planning for a biological threat to a human population; and yet another from the perspective of ecology and natural systems that includes the importance of the sociological footprint in the ecosystem.

Each of these reports offers us a particular facet of the prism to look through and experience the writer's vision. Each of these perspectives

teaches us yet another way to consider what the resilience experience is and what human social resilience might entail, what might be important parameters to consider and measure, and what might be manageable, or at a minimum precognitively influenced for a positive social outcome.

I urge the reader of these proceedings to spend time with each of these reports and the distinguished researchers that authored them, and ponder the direct and the indirect thoughts offered to the emerging and developing notion of human societal resilience. The experiences from the world of biology and ecology are important to consider. The concept of preparedness is very much dominated by the operational concepts of emergency preparedness, emergency response, and disaster reaction and reduction. These perspectives are focused on form and maintaining form; and are understandable, very reasonable, and frankly quite expected. However, adding resilience into the goals of homeland security and national security allows for ongoing growth in understanding and improving upon preparedness and protection. Societal resilience will increasingly become important as we take our preparedness and security further upstream where we anticipate, build in, and develop sustainability.

Taking a resilience lesson from the world of biology and ecology and recognize that there is not really an end state, but merely a series of changing states over time, then the notion of adaptive management really starts to take root and allow public policy to evolve and adapt dynamically. The lessons to be found in the world of ecology continue. Preparedness and the newly emerging social resilience thinkers must respect the temporal nature of all dynamic systems, as well as the spatial context in which all things exist. It can never be the same in all places and all times. Additionally, there is the question of reversibility in which the world of ecology has experience. In other words, the discussion of returning to normal must be dealt with honestly. Ecological thinking teaches that state matters and the resistance to moving into an altered configuration or how things reorganize as a result of a change is where the effort of thought is to be placed, and not chasing some illusion of returning to the previous interpretation

of normal prior to a disruption. Lastly, the discipline of ecology provides one of the most important lessons to consider for the emerging human social resilience work and that is the work, by its very nature, is interdisciplinary.

Research in Ecological and Biological Perspectives of Resilience

Dr. John C. Pine is Director of the Research Institute for Environment, Energy and Economics at Appalachian State University in Boone, North Carolina. He joined the faculty at Appalachian in January 2009 from Louisiana State University. His book, *Natural Hazards Analysis*,[1] reflects his research associated with hazards, disasters, risk assessment and risk management. Dr. Pine's presentation during the symposium is based on a research project funded by the National Oceanic and Atmospheric Administration's Coastal Services Center through MCEER, University of Buffalo, and is focused on the resilience of coastal communities following Hurricanes Katrina and Rita in 2005.

Dr. Pine's discussion of the ecological indicators of a natural system undergoing change and the effect of human activity on that natural system demonstrates a traditional ecological thought process. However, Pine, true to an ecological perspective, takes us to a place where the human system is but one more of the systems that must be considered in the system of systems. He directs us to those human actions and inputs and these factors must be considered temporally and spatially. Moreover, he provides us with the important lesson to think more dynamically, specifically how social, economic, and natural systems work, or do not work, in concert. This is an important context when one considers the backbone of societal resilience. Dr. Pine causes us to think about the addition of the human system—the human actions and effects—as both an ecological partner and a distur-

[1] Pine, John C. *Natural Hazards Analysis*. Boca Raton, FL: CRC Press / Taylor & Francis. 2009.

bance, and it stimulates consideration of what might be sociological indicators in a community or culture in dynamic harmony or balance with the surrounding ecosystem. Furthermore, what might be some of those indicators present in the social fabric to predict some form of resilience within that community, or the culture of the people, in how they interact within the larger ecosystem.

Dr. Paula Scalingi is Executive Director and co-founder of the Bay Area Center for Regional Disaster Resilience. The Center is partnering with the Association of Bay Area Governments and the private sector Bay Area Council to assist regional stakeholders to develop a disaster resilience action plan for the 12 county San Francisco Bay Area. She formerly was director for the Pacific Northwest Economic Region (PNWER), a statutory consortium comprised of Alaska, Idaho, Montana, Oregon, Washington, the provinces of Alberta, British Columbia, and Saskatchewan, and Yukon and Northwest Territories. Since October 2001, she has assisted private/public sector and non-profit organizations across the nation to develop and implement activities to improve preparedness and resilience. As vice chair of The Infrastructure Security Partnership, a national coalition of engineering and built environment organizations and associations, Dr. Scalingi was the principal architect of the Guide to Develop an Action Plan for Regional Disaster Resilience (RDR Guide) and led a follow-on task force to develop the 2011 edition of the RDR Guide. In addition, she served on the Steering Group of the national Community Resilience System. Dr. Scalingi previously founded and directed U.S. DOE's Office of Critical Infrastructure Protection and served as director of the Decision and Information Sciences Division and the Infrastructure Assurance Center at Argonne National Laboratory. She also served in the U.S. Arms Control and Disarmament Agency, on the staff of the U.S. House of Representatives Permanent Select Committee on Intelligence, and in the Central Intelligence Agency.

Dr. Scalingi takes a socially complex operational problem involving a dynamic changing biological event and takes it through a planning process and to decision points at the end. Dr. Scalingi reminds us that while theory and exploring frontiers of new knowledge and new

thinking are important, we have to be realistic and make wise decisions in the here and now through rational planning and decision making. When it comes to who is on the front line of any event, and who has to react and respond, it is the local people involved. This is such a fundamental fact, and yet seemingly overlooked or too often forgotten. The biologist, the ecologist, and the epidemiologist has to think spatially to be successful, but Dr. Scalingi gives real-life examples and reminds us that one must do the planning on the ground—in the real world with the people, the community, the culture, and depending on the footprint of the event, the situation goes from complex to more complex. Dr. Scalingi helps us see the importance of organizing and planning for disruptive events through her large metropolitan area example with multiple political jurisdictions, multiple communities and cultures, including international border issues. She uses a methodology that recognizes the need for flexibility in the face of multiple variants and independent decisions, as well as the temporal nature of any event.

Dr. Lance Gunderson is a systems ecologist who studies how people understand, assess, and manage large ecosystems. He holds BS, MS, and PhD degrees from the University of Florida. He worked as a research botanist for the U.S. National Park Service in south Florida (1979-89), and as a research scientist at the University of Florida (1992-98). Dr. Gunderson was the founding chair (1999-2005) of the Department of Environmental Studies at Emory University and is currently a Professor in that department. He has been involved in the environmental assessment and management of large-scale ecosystems, including the Everglades, Florida Bay, Upper Mississippi River Basin, and the Grand Canyon. He has co-edited five books, including *Panarchy: Understanding Transformations in Human and Natural Systems*; *Resilience and the Behavior of Large-Scale Systems*; and *Foundations of Ecological Resilience*.

Dr. Gunderson provides a very helpful discussion of the complexity of the word, "resilience," and by doing so assists us in opening our minds and leaving behind our own perspective and potential bias concerning our interpretation of what the concept behind resilience

might mean. Gunderson forces us as critical readers and thinkers to remember the immense probability of the unknown. He further provides a very thought-provoking discussion of the history of how the term "resilience" came into use within the ecological science community. The term provided the opportunity for those involved in the science of ecology and natural systems to understand a phenomenon, a complex dynamic, that must be accounted for when critically thinking about how the environment works, or more appropriately adapts. One nugget that Dr. Gunderson provides for our consideration that is applicable to the topic of human social resilience thinking is that the ecological perspective of resilience is an ecosystem that can exist in any number of configurations, or stable states, with some being more stable than others, and the shift between these states is the principle of resilience. This perspective from the ecology community offers a way of viewing the subject, a process of thinking and analyzing, absent any judgment and emotion. Dr. Gunderson also re-reminds us of the importance of time to the concept of resilience. Due to the dynamic nature of a natural system, the collection of complex ongoing interactions, including the notion of stability, size, or amount of disturbance a natural system could take before having to adjust to an alternative configuration is the very important variable of time. Time and how much importance is placed on that value are crucial to defining resilience in a humanistic or sociological way.

Please enjoy these reports and look beyond the specific examples and descriptions they provide to the area where interdisciplinary connections are made and new ideas are born. By attempting to understand more of the facets on the resilience prism, a larger structure may become visible, and with it, wisdom.

Indicators of Ecological Resilience: Building and Sustaining Resilient Communities

Dr. John Pine

Introduction

This report examines the nature of natural systems and its contribution to our understanding of community resilience to natural and human caused disasters. We have seen in our coastal areas the broad impacts on our social, economic and natural systems and the interdependence of these systems. We thus focus on coastal communities to help us understand just how these systems are coupled and what we might be able to do to reduce adverse impacts of disasters not only in coastal areas but for all communities.

Hurricanes Katrina and Rita in 2005 demonstrated that communities may be significantly impacted by a disaster and that community resilience is dependent on economic, social and natural resources. The BP Deep Horizon oil spill of 2010 further showed that our natural,

economic, and social systems are interdependent and a significant change in one system impacts the others. This paper explores the linkages between natural, social and economic systems and the need to measure and understand the contribution of these resources to the disaster recovery process. Further, the need to engage community partners in the selection and use of indicators of resilience is described. Finally, the value of natural resource indicators is examined for its contribution to hazard risk reduction and management for coastal communities.

The resilience of coastal communities is fundamental to our long-term sustainability, given the threats associated with coastal storms and the long-term challenges presented with global climate change and sea level rise. Resilience involves the ability to rebound and adapt to external shocks and is a desirable characteristic of both natural and human systems in coastal areas worldwide (UN/ISDR 2002). Community is defined here in a social and ecological context and refers to an area where there is a defined legal civil boundary or natural area that includes a well defined natural system (wetland, basin, cultivated agricultural area, or wooded classification).

Our ecosystems have demonstrated that resilience is a natural process and may serve a positive role in dealing with the challenges that we face in coastal areas (Costanza et al. 1995). Natural systems and their processes provide an illustration of the value of diversity of functions, their linkages and the contribution that these functions make to the resilience of ecosystems in a coastal environment (Adger 1997). Natural, social and economic systems are diverse and provide clues to understanding what contributes to sustainability, the reduction of vulnerability and resilience of communities.

Building resilient communities is critical both in the United States and worldwide as a result of the urbanization of coastal areas, threats evolving from sea level rise and coastal erosion. Coastal communities are experiencing an increasing risk to hurricanes and resulting property losses and human suffering (Small and Nicholls 2003). On a

worldwide scale, Small (et al. 2000) contends that we need to quantify our exposure to natural and human caused hazards.

Increasing coastal populations are also experiencing changes in natural ecological systems such as coastal erosion, freshwater contamination, and saltwater intrusion. NOAA notes that coastal communities face increasing risks to water resources, agriculture, fisheries, tourism and human health as a result of this increasing exposure to natural hazards (U.S. Global Change Research Program 2009).

Resilience as it is applied to civil communities is complex and dynamic varying spatially and temporally. The nature of social, economic and environmental systems that influence a community's resilience is dynamic and a process that is constantly changing. Understanding these systems and their interdependence allows us to characterize a community's capacity to adapt to hazards and use coping mechanisms to recover from the adverse impacts of disasters. Research associated with community resilience is evolving to guide us in developing strategies that will allow communities to reduce losses and recover more quickly (Kumpulainen 2006).

Coastal areas are facing increasing risks not only from increases in population and development but also from the indirect impacts from changes in natural environments. For example, changing coastal landscapes in Louisiana have been impacted by erosion and subsidence and influenced by the construction of levees, roads and other protective measures. These coastal dynamics were heavily influenced from changes in sediment supply due to change in land-use and hydrological modifications. We have constructed and deepened navigable channels and increased the vulnerability of coastal communities and ecological systems to storm surge and flooding. Finally, development in coastal areas has resulted in higher demands for groundwater withdrawal and water contamination from runoff. To say the least, we have created stress in coastal environments.

Coastal communities are viewing climate change as a potential threat, acknowledging that long-term change may include lower levels of precipitation as well as increases in the frequency of extreme tem-

peratures. Threats from climate change are not prospective but can be observed now. The U.S. Global Change Research Program (2009) stressed that this is not a future threat but one that is having present day impacts. Understanding that human, economic and social systems are inter-dependent is fundamental to climate change impacts.

The interface between natural and human caused disasters may allow for new and novel interactions to occur and allow environmental change to introduce new species into regions with significant adverse impacts. As the earth becomes transformed by human influences, long-term environmental change may provide the means for inadvertent change in ecosystems. The ecosystem may see degradation in some areas and productivity in others. The result is that this change can result in new conditions, threats and hazards resulting in unforeseen disasters. Hobbs (et al. 2006) observed that new species combinations may evolve along with changes in ecosystem functioning which result from intentional and unintentional human agency. Changes in natural systems are resulting from or in response to human induced conditions. Human impacts have resulted in the extinction of some animal, plant or microbial population and allowed the introduction of species not previously present in that region. Change in urban erosion, cultivated areas or coastal landscape development can cause stress in the ecosystem and lead to unexpected new species. Hobbs notes that, "direct (e.g. removal of natural soil, dam construction, harvesting, pollution) and indirect … human impact has resulted either in major changes in the abiotic environment or a decrease in the original propagule species pool" (p. 2). Both conditions can impact parts of a coastal ecosystem that experiences chronic stress from environmental changes or disaster events. He raises the question as to under what conditions will novel ecosystems occur and as conditions change where these developments will take place.

Seastedt (et al. 2008) contends that historically authentic ecosystems are increasingly rare and introduced species living under new environmental conditions are increasingly common. Natural systems are adapting to changing environmental conditions. They propose four strategies to address sustainability issues for ecosystems under pressure

for change including: (1) support human adaptability, (2) increase ecosystem resilience by enhancing the adaptive capacity of ecosystems, (3) advocate human strategies to reduce climate change, and (4) support new, more beneficial ecosystem conditions Their strategies are a set of adaptive ecosystem management tools and procedures for enhancing the resilience of desired conditions and outcomes.

Ellis and Ramankutty (2008) contend that ecosystem engineering has supported human population growth over the past fifty years and as a result, are causing global extinctions and changes in climate that are comparable to any observed to date. They contend that four major forces are present: (1) Anthropogenic biomes offers a key view of the biosphere in a very human altered form, (2) Terrestrial biospheres have been altered by human residence and impacts, (3) less than 1/3 of the earth's ice-free land is wild, and (4) more than 80% of people live in densely populated urban environments. Humans occupy and impact more space on earth than remain in a wild condition. They conclude that humans have a pervasive influence on ecosystems and the capacity of the species that ecosystems support is intertwined with human systems. Nature is interdependent within anthropogenic forces.

The relationship between ecosystems and human systems is interdependent and ever changing (Folke et al. 2002). These systems are coupled in complex ways and must be seen as a whole rather than in separate parts. Folke (et al. 2002) contends that social, economic and ecological systems are intimately linked. Humans depend on services of eco-systems and can transform these systems to being either more or less productive. Human action has the capacity to weaken natural systems and thus reduce the capacity of natural systems to support human livelihoods. The result is greater vulnerability to natural and human caused hazards. Folke contends that the interdependence of natural and human systems is central to our understanding of resilience. The development and use of measures of social, economic and ecological systems will help us to understanding how these systems contribute to community resilience and how communities are able to recover from a disaster.

Resilience

The concept of resilience evolved from the physical ecological environment recognizing that natural systems are constantly confronted with many threats, hazards, or elements beyond the control of these systems. Some parts of natural systems flourish within a changing environment while we see that other parts of these systems are reduced. Holling noted this natural response to change and pointed out that change and adaptation are part of the natural condition (1973). He acknowledged that maintaining a status of equilibrium was countered by pressures or demands to shift the equilibrium state. He noted that pollution or natural resource use could shift the equilibrium in favor of some part of the natural system and work against others. Some parts of the system adapt and flourish while others fail to adapt to some pressure or threat and perish. The capacity to adapt and flourish despite a threat or hazard is central to the concept of resilience.

Holling (1973) examined the causes of decreases in fish populations including over fishing, changes in the physical or chemical environment, or the presence of a predator. Failure to adapt to these changes resulted in a dramatic decrease in specific fish populations in his study area. "Fishing … progressively reduced the resilience of the system so that" at some point, "the populations collapsed" (p. 9). He acknowledged that natural systems were greatly impacted by random events causing shifts in the system's equilibrium.

An alternative to this view is that systems experiences some random events and adapt over time. This view of resilience emphasizes persistence and adaptation in the face of threats. Resilience is thus the capacity of a system to change or a condition that permits adaptation from an existing situation. New opportunities may thus be created which allows the system to function. Thus resilience simply notes the capacity of the system to cope and change which may be positive or negative.

Walker (et al. 2004) introduces a more complex set of dynamics in resilience. He notes that resilience and adaptability have to do with

a specific system or closely related systems. He explains that natural systems may be interdependent with human systems and that when faced with threats, something more that adaptability must occur. Transformation must occur that alters the nature of the system, allowing it to cope and change. Change thus occurs that is dynamic and complex across systems. Resilience is the capacity of a system to adapt and recover from an external pressure for change so as to "retain essentially the same function, structure, and identity" (p. 2). He offers four elements of resilience including (1) latitude or the degree a system may be changed before its ability to recover is imperiled; (2) resistance or the ease the system may change; (3) precariousness or how close the current state of affairs of the system is to termination; and (4) the degree the system is influenced by other external pressures or threats. Walker suggests that where systems are highly interdependent, they may be transformed into a new system.

Resilience is not limited to natural, social or economic systems but is also used in characterizing organizational performance. The Resilience Alliance (2005) states that "the degree to which the system is capable of reorganization," is one of the three dimensions of resilience. Organizations must be able to maintain functional capacity when faced with external threats and pressures and the capacity to draw upon internal resources to effectively manage demands, challenges and pressures from the outside environment. Comfort (1994) goes further to describe how resilience is used in organizational dynamics as dynamic resilience where the aim is not at achieving a desired output but rather a level of functioning. The dynamic characteristic of resilience is the ability of the system or organization to bounce back or to adapt in a disaster.

Public, private and non-profit organizations also exhibit resilience dynamics as natural and social systems. They can be adaptive, self-organizing and reflect dynamic equilibrium states as suggested by Holling for natural systems. Organizations that focus exclusively on post disaster recovery rather than attempting to plan for and anticipate what should happen following a disaster will likely just return to their initial state. Returning to the initial state does not lead to a higher

state of functioning. The key to organizational adaptation is identifying potential problems and opportunities that may be presented in a post disaster environment and position the organization to adapt to the new situation (Tobin 1999; Comfort et al. 1999).

Tobin (1999) examined the characteristics of sustainable and resilient communities to conclude that they have lower risk and vulnerability to hazards have ongoing planning initiatives, high level of official political support and capability, have interdependent and independent social networks and an appropriate scale of planning. The key is that mitigation and recovery planning must work collectively to build and maintain a sustainable and resilient community.

A community initiative to mitigate the adverse impacts of disasters is but one way to reduce losses. The alternative that may have even greater benefits for local communities is enhancing local adaptation to long-term change. The key to adaptation is the recognition that the environment after a disaster is dramatically different from the pre-event situation and that change is required for successful recovery. This acknowledgment that adaptation is required for recovery following a disaster is also needed for social, economic and ecological systems; otherwise, the system will simply attempt to return to the initial state of functioning.

Research Thesis

Resilient communities are the product of their natural, social and economic resources. Understanding the nature of these resources and their interdependence is critical for the long-term sustainability of a community and especially in the recovery process from a disaster. Communities should be engaged in selecting and using indicators of natural, social and economic resources to ensure the sustainability of their community and in the management of the recovery process from a disaster.

Interdependence of Natural Systems with Cultural and Economic Systems

The capacity of a local community to withstand an external shock is dependent on local and regional natural, social and economic resources. Recovery from a disaster engages all parts of a community and is determined by the strength and diversity of local social-culture, the economy and environmental resources. Economy includes commercial and industrial operations as well as government, non-profit entities. The concept also includes constructed systems such as roads, bridges, airports, schools, hospitals, communications and utility operations. Examples of natural and ecological resources include agriculture, fishing or aquiculture, timber, oil and gas or natural resource extraction. A resilient community is one that has anticipated potential adverse impacts from a disaster and developed a comprehensive plan that enables local businesses that use ecological resources to continue following a disaster.

Ecological systems are interdependent with social and economic systems (Turner et al. 2003). They stress the concept of coupled systems such as the interconnectedness of human-environmental systems. Key points in their analysis include: (1) communities have coupled human-environmental systems which are exposed to hazards; (2) these systems are characterized by complexities, interconnectedness, and an interactive nature of components that give rise to vulnerability; (3) the nature of these systems is associated with place, (4) dynamics within coupled systems give rise to new hazards, (5) there are key interactions between these systems that allow opportunities for intervention, (6) both quantitative and qualitative data provide information on these interactions, (7) these systems allow for the development of metrics, measures and models to better understand these systems. They stress that human and biophysical systems are linked and should be treated accordingly.

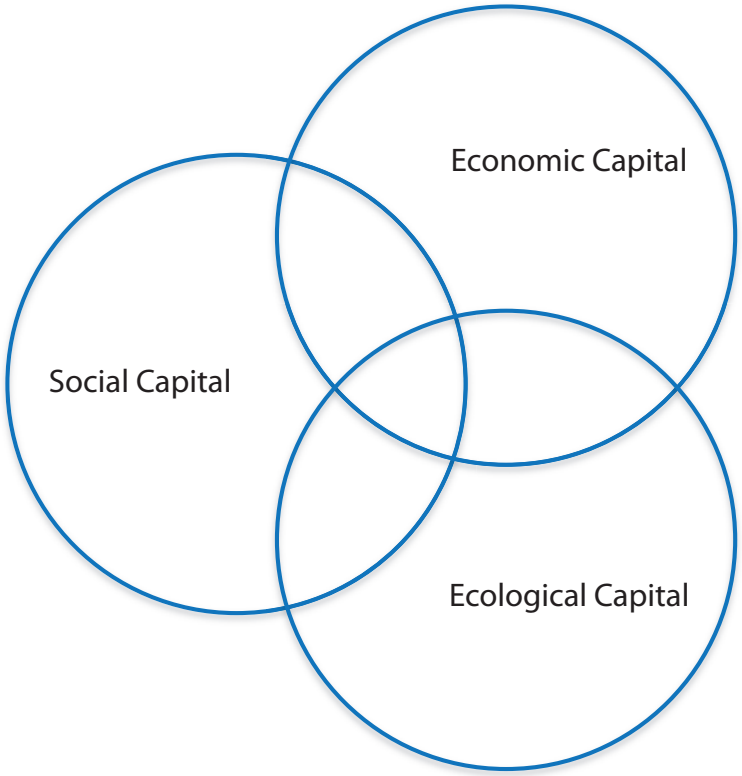

Figure 1: Interdependence of Natural, Economic and Social Systems (Pine)

The interdependence of natural and economic systems is illustrated in Figure #1 "Interdependence of Natural, Economic and Social Systems" by the damage sustained by fishing and agricultural operations in coastal areas along the Gulf of Mexico coast following the hurricanes of 2005. Although many boats were damaged or destroyed in the storm, fishing boats were moved to protected areas to ride out the storms. Although the fishing craft was saved the fish processing infrastructure was destroyed by the two storms. Although the Small Business Administration (SBA) provided low interest loans, much of the fishing industry infrastructure was not rebuilt. Small scale fishing operations found that it was not possible to resume business because of difficulties in getting their product to market.

The recovery of coastal Louisiana communities following Hurricane Katrina and Rita as well as the 2010 Gulf Oil spill demonstrate the interdependence of these natural, economic and social systems. Coastal communities all along the Louisiana wetlands characterize a strong cultural heritage and commitment to recovery, rebuilding and remaining in their coastal homeland, despite the risks associated with natural and human caused disasters.

With planning, the local community may be able to absorb and recover from the adverse impacts of a disaster or other external shock. Coping responses to these external stressors or challenges are the result of conscious planning and decision-making. Diverse adaptations may enable the community to recover more quickly and with fewer losses (Adger et al. 2005). Communities that appreciate the linkages between their local economy, the environment and their social institutions can strengthen their adaptive capacity and identify innovative strategies to recover quickly despite losses. For example, local fishing and shrimp business might have cooperative agreements with businesses in other areas so as to continue operations while processing infrastructure is repaired or rebuilt.

Each local community is unique with very different social, economic and natural capital. As a result, a community must identify and characterize their vulnerabilities to natural and human caused disasters and possible adverse impacts. Figure 2 “Intervention strategies to address vulnerabilities at different scales” illustrates that interventions to address community vulnerabilities (preparedness, mitigation or adaptation) may be initiated at a local, regional or national scale. Multiple interventions may thus be undertaken simultaneously at different scales to address community vulnerabilities.

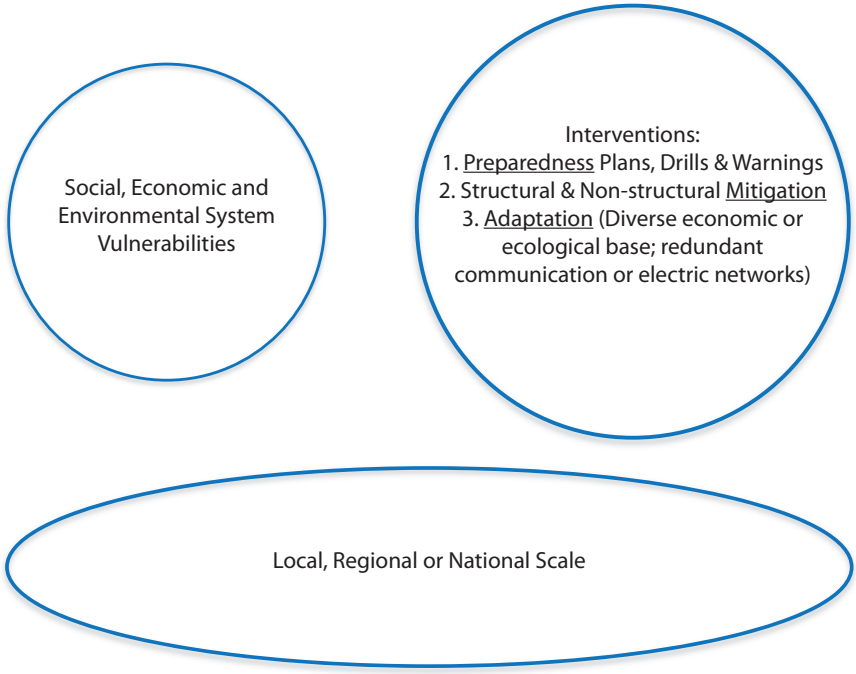

Figure 2: Intervention strategies to address vulnerabilities at different scales (Pine)

The model advocated by Adger (et al. 2005) provides examples of local action that can be taken to deal with vulnerability to hazards and adaptive capacity in social, economic and ecological systems.

Rose (2007) observes that "individuals, institutions, and communities have the ability to deflect, withstand, and rebound from serious shocks in terms of the course of their ordinary activities or through ingenuity and perseverance in the face of a crisis" (p. 383). The key is to encourage all parts of the local economy to identify strategies so as to maintain function or continue production when shocked. Proactive efforts to plan for resilience are critical prior to a disaster; these efforts can only be tested in the response to a disaster.

Resilience Indicators

The value of indicators as a tool for assessing program performance has been stressed by internationally and nationally (Brundtland 1987; and McAlpine and Birnie, 2005). The indicators thus become a means of measuring progress towards stated program outcomes within a public, non-profit or private sector entity. Numerous attempts have been made to use indicators of social, economic and natural systems to not only assess the impact of specific program activities but also as a tool for identifying problems or barriers to achieving desired program outcomes. The Brundtland Commission Report in 1987 and the Earth Summit in 1992 chart the use of indicators as a standard method for government, corporations and non-governmental corporations to measure progress towards desired outcomes. McAlpine and Birnie (2005) have provided an excellent example of a broad based set of indicators that reflect numerous local capital that impacts sustainability and resilience. The sustainability indicators provide a means of measuring a community's capacity to deal with change and adapt. Sustainability as used in many of these measures reflects the ability of a system to maintain a steady state or function over time. The indicators used by McAlpine and Birnie allow for a broad assessment of community assets over time (2005). Much of the data needed for this type of assessment is available at the local or regional level.

The key is to identify indicators of social, economic and environmental capital represent desired program goals, easy to collect at a local or regional scale, and are not too costly to collect. Unfortunately, indicators have not been identified that are a good representation of the program activity or service.

Methodology

Identification and Use of Natural System Indicators of Resilience

Indicators for assessing community resilience provide a means of measuring the recovery of a community from the impacts of shocks, disasters, and other external pressures for change. Vatsa (2004) suggests that resilience is one part of the vulnerability map and that we should identify a set of proxies to measure the capacity of the community to cope with a disaster (Winchester 1992; Cannon 1993; Blaikie et al. 1994; Bolin and Stanford 1999). This study identifies appropriate indicators from natural systems that can be used along with social and economic indicators to understand a community's capacity to cope with a disaster and recover from it.

With support from NOAA's Coastal Services Center, a project team composed of engineers, planners, economists, geographers and managers developed a tool for local communities to use to understand their vulnerability to disasters and to have a broader view of factors that could impact a community from a disaster. Included in this tool was a set of indicators for understanding the contribution of natural, social and economic resources to community resilience. Many of the natural resource indicators acted as proxies, which were viewed as an indication of the system's capacity to absorb the shock of a disaster and to recover from it.

The focus of the study was coastal communities along the Gulf of Mexico coast who were affected by Hurricanes Rita (2005) and Ivan (2008). Ecological indicators included the volume of fish, shrimp and oysters processed and was viewed as closely associated with the health of coastal areas and the Gulf of Mexico. These environmental indicators were proxies for understanding the degradation of inland coastal marsh areas or water features and could have an effect on the health of timber, cropland, wildlife, fish, shrimp and oysters. If a disaster impacted these natural areas, then the indicators would show the im-

pact healthy forests and crops, healthy wildlife, or fewer fish, shrimp or oysters. The initial set of indicators was used to monitor and assess the recovery process from Hurricane Rita in 2005. Three years later, Hurricane Ivan impacted the same area and provided a test on the resilience of these coastal communities to a natural disaster. These indicators are used as an illustration to show how the local community assessed change in natural systems during the recovery process.

In addition, the project team also developed a process for engaging community partners. Partnering with community members is not unique and reflected in other current efforts to develop community resilience indicators (Community and Regional Resilience Institute—CARRI). A similar approach was used to engage community representative in the NOAA Resilience Indicators Project.

Initial Findings

Resilience of Natural Systems

Extensive work to identify appropriate resilience indicators includes efforts to find signals that reveal how the natural environment deals with external pressures. Unfortunately, data is not readily available that reflects the subtle changes that occur to natural systems. The indicators that were chosen are indirect reflections of the health of natural systems and did help in assessing existing and emerging problems, diagnose anthropogenic stressors impacting the environment, establish trends for measuring environmental policy and facilitate communication with the public. Indicators, however, must be sensitive enough to react in a detectable way when a system is affected by anthropogenic stress and should also remain reasonable predictable in unperturbed ecosystems (Niemi and McDonald 2004). The key is to find appropriate ecological responses that reveal stresses within a natural system.

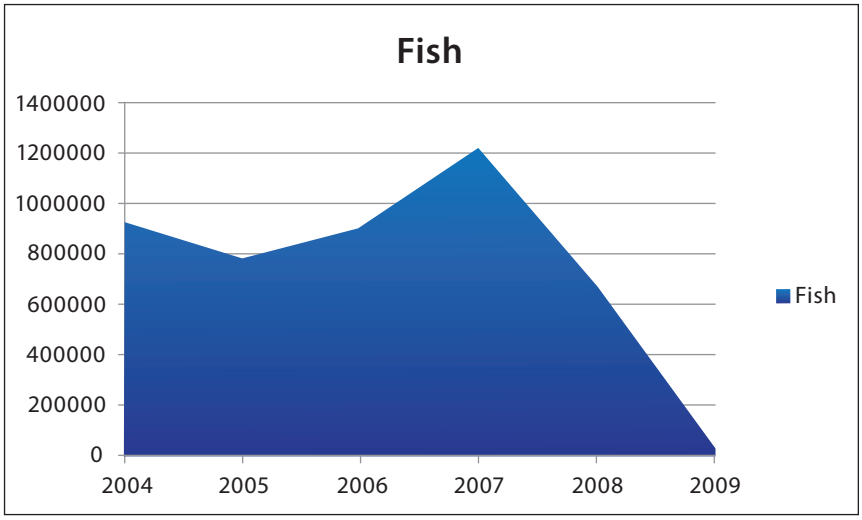

Figure 3: Pounds of Freshwater Fish Landed (Data from the Louisiana Wildlife and Fisheries Commission)

Vermilion Parish is one of the four communities studied in the project and has a very strong fisheries industry that includes harvesting crabs, oysters, shrimp, freshwater fish, and saltwater fish. Data was obtained from the Louisiana Department of Wildlife and Fisheries for landings of freshwater fish and shrimp; the landings data served as proxies for the health of coastal ecological systems. The data "Pounds Freshwater Fish Landed" shows a dramatic decrease in 2005 from 2004 for freshwater fish following Hurricane Rita. Despite a recovery of freshwater fish landings following the Hurricane in 2005, decreases in pounds of freshwater fish landed were observed again following the Hurricane in 2008. The data suggests that there is a decrease in fishing initially but a recovery period following the storms. The data suggests that there likely was a disturbance to the natural habitat in the study area but that the recovery of the natural systems that influence fish recovered. When using proxies to assess the recovery of natural systems following a shock, one should be cautious to determine if there are other factors that could influence what is being measured. In the case of freshwater fish landings, damage to seafood infrastructure required for processing fish might account for the

initial decrease in landings. Rebuilding the processing operations to handle the freshwater fish landings would take some time and not be able to handle large volumes of landings until operations (from docks, storage areas, roads, or bridges) were repaired.

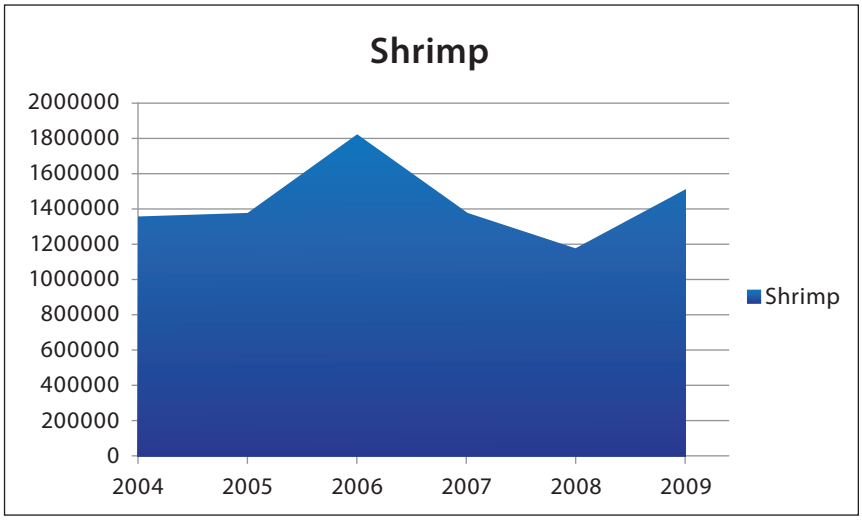

Figure 4: Pounds of Shrimp Landed for Vermilion Parish (Data from the Louisiana Wildlife and Fisheries Commission)

The Louisiana Wildlife and Fisheries Commission Data Management Program Office of the Marine Fisheries Division provided the data for both fish and shrimp. Figure #4 "Pounds of Shrimp Landed for Vermilion Parish" shows that the volume of shrimp caught increased slightly from 2004 to 2005, which was the year of both Hurricane Katrina and Rita. The volume actually increased from 14,000 to 16,000 from 2005 to 2006 but decreased in 2007. The catch decreased in 2008 following Hurricane Ike and increased in 2009. Local Vermilion officials stated that the storms had limited long term impact.

The indicators for fish and shrimp provide an illustration of what can be measured and do reflect potential changes in the natural environment. It is acknowledged that other factors than habitat damage could influence the volume of fish or shrimp; this will likely be true for any indirect measure of environmental change and adaptation.

There may be natural variability that occurs over time, which might be picked up by an indicator. Unfortunately, what is measured is a reflection of what may be available data and can be collected at a low cost.

Measuring Ecosystem Services

The project team considered natural ecosystem services as a possible indicator of natural systems. An examination of ecosystem services was determined to complement measures of resource extraction such as the volume of fish, shrimp, rice, or sugarcane and could have included timber resources. Ecosystem services reflect vital processes such as purification of air and water and protection of water and land resources, which support many plants and animals. The Heinz Center (2008) noted, "many of the services provided by natural ecosystems are less tangible and more difficult to quantify."

The examination of ecosystem services included four counties (parishes) and consisted of 32 zip codes that formed the mapping and analysis enumeration units for the project. Land Use/Land Cover (LULC) data were used to determine the extent of each type of land use within each zip code. LULC data were obtained from the USGS National Land Cover Database (NLCD). The NLCD is derived from Landsat TM satellite data which have a spatial resolution of 30m. Images were classified using a 21-class land cover classification scheme derived from the original Anderson Land Cover Classification Scheme for remote sensing data (Anderson et al. 1976). In the four-parish study area, 15 of the 21 recognized LULCs are present (Fig. 5).

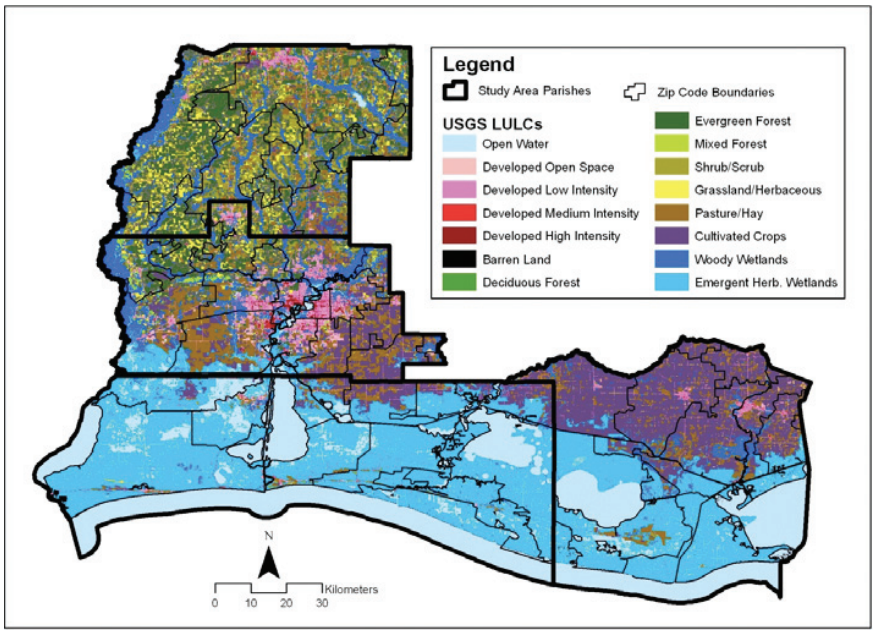

Figure 5: Four-Parish study area in southeastern Louisiana, USA. Fifteen of the 21 possible USGS land use/land covers are present within the study area. Data derived from Landsat TM satellite data – 30 m resolution (Renschler et al. 2010).

From the 15 LULCs present, two were omitted from the study (developed high intensity and open water) due to lack of influence from primary productivity. The remaining 13 classes were included in the analysis: emergent herbaceous wetlands (EHW), woody wetlands (WW), cultivated crops (CC), pasture/hay (PH), grassland/herbaceous (GH), shrub/scrub (SS), mixed forest (MF), evergreen forest (EF), deciduous forest (DF), barren land (BL), developed medium intensity (DMI), developed low intensity (DLI), and developed open space (DOS).

A pre-event baseline Gross Primary Production value determined using the boundaries of the LULC boundaries. Data from NASA's MODIS satellite was then analyzed to examine the impact and recovery of the area from Hurricane Rita in 2005. In order to determine an accurate condition of the study area prior to the hurricane in 2005, MODIS data was collected and examined from January 1, 2000 until

just prior to the hurricane event in 2005. Values from the MODIS data was obtained and averaged for each 8-day interval. A base-line was thus determined for each of the LULC boundaries in our study.

Twelve months of MODIS *post-event data* were collected to assess the resiliency of gross primary production in the ecosystem in the aftermath of Hurricane Rita in 2005. These data were measured in the same manner as the pre-event data. Starting with the 8-day interval immediately following the hurricane, the post-event MODIS values were calculated for each LULC type were plotted and compared to the pre-event baseline.

Post-event values were statistically assessed with the base-line values for a one-year period. Two main trends were revealed when comparing the post-event data with the pre-event base line gross primary production values. First, the data showed that there was a steady improvement in recovery in the first six months following the storm (September through March). The recovery then begins to decrease and decline from the April through September. The data which reflected a monthly assessment of the health of the ecosystem suggests that the system was resilient as it related to gross primary production; however, in the long term the system experienced a decreasing trend.

The measures for the gross primary production (GPP) differ from resource production in that the measures for freshwater fish landings or shrimp were for twelve-month periods and the data was collected on a far more frequent basis and averaged for a monthly assessment. It is quite possible, that the resource production measures also saw a similar increase in productivity initially with decreases during a single year. The resource productivity data was however, collected for a much longer period and showed the impact of the second hurricane that impacted the area in 2008. The study team concluded that annual measures are not as precise as monthly assessment measures and that additional data would be helpful in clarifying any seasonal trends in how the hurricane affected the natural ecological system.

Community Engagement and Resilience

The process of developing community resilience indicators provided a means for engaging local emergency management officials in communicating an appropriate local context for assessing the recovery processes. Including a process for articulating local context acknowledges that communities differ in many ways that shape their recovery. We found that through education and engagement, both the team and the community had a more realistic understanding of the community and what should be measured. The research literature stress the benefits of collaboration processes and that outside groups meaning to support local recovery and resilience can best serve a community through engagement (Wilson & Koester 2008).

We found that it was not always the indicators themselves, but the process of developing resilience measures and communication with local partners that influences the use of indicators in community recovery (McAlpine & Birnie 2005). This emphasis on process reveals that a qualitative assessment of a parish Office of Emergency Preparedness's ability to collaborate and communicate amongst stakeholder groups was an effective indicator of resilience. Our interviews with local emergency management directors stressed the importance of the "engagement" method of resilience building.

We saw firsthand that resilience is built through a process of inclusion, communication, and mutual learning, powered by an information system that represents diverse stakeholders. The recovery process is complex, dynamic and reflected in the quantitative resilience indicators. If appropriate indicators are selected and used throughout the recovery process that is to be monitored, the community input and self-knowledge will offer a basis for establishing a dynamic and useful information system. Engaging the local community in what is to be measured during the recovery helps in the selection of appropriate recovery measures that reflect the unique nature of the community.

Our interviews with local emergency management officials revealed that local officials share a common perspective that the primary deter-

mining factor in long-term community recovery and resilience is not limited to resources, but attitude (Pine 2009). Resilience is a combination of self-reliance and willingness to contribute. Further, distrust between organizations may grow during the recovery as a result of unilateral top down management strategies; this distrust is detrimental to the resilience process and has been termed psychosocial barriers (Haque, et al., 2002).

Collaborative processes and emphasis on communication can break down these barriers and lead to healthy recovery strategies for communities. These processes can also insure that all forms of local capital are understood and not an overemphasis on a single resource (Haque et al. 2002, 94, 95). This view is consistent within the community engagement literature for participation to be explained as a process to ensure that the local context is included in the recovery process. Basically, such a method trusts in local management, and assists in its vital roles. When this multi-level collaboration is successful, an increase in resilience can be expected.

Engaging local community leaders in disaster planning reveals elements of local resilience. Resilience is hindered by the inability of larger organizations to recognize pre-existing local relationships of trust and mutual understanding. Many studies speak of the importance of this trust in trans-boundary politics and environmental issues (Healy 2009, Haque et al. 2002). Acknowledging that the recovery process is more than just capital improvements and engages political and community social systems is a key step in ensuring that the recovery effort is focused and builds a resilient community.

The need to ensure local context and consideration in decision making is essential in dealing with short-term and long-term recovery. However, the distinction between immediate needs and long-term needs is, according to local emergency management officials in Louisiana, a critical element in the formation and communication of local context. Many immediate needs can be addressed while facilitating long-term needs. Conversely, it is possible to meet immediate needs but hinder long-term resilience. Resilience is dependent on the suc-

cess of local management programs and activities and collaboration within the communities.

The desired outcome is an appropriate implementation of recovery strategies that foster community resilience and allow for local collaboration, communication and engagement. This participation provides a means for not only information but also a stronger decision making process during recovery from a disaster.

Strategies for Enhancing Coastal Community Resilience

Strategies to reduce vulnerability and enhance resilience must be done simultaneously. We observed that local communities in the recovery process have the options and can choose to change and reduce future losses, or accept losses (Klein et al. 2003). Choosing to change means that we have to acknowledge the hazards that our community confronts and take steps to identify strategies for disaster reduction. Accepting the status of increased risk suggests that methods of sharing potential losses or identifying strategies for coping with these losses must be undertaken. We must position ourselves to adapt and recover from present and future threats. The key question involves what adaptation must be anticipated and how can we recover in ways that promote sustainability of both human and natural coastal systems.

Approaches to dealing with adaptation to coastal changes were suggested by Klein (et al. 2003). They suggested that communities enhance the capacity of physical infrastructure to withstand short and long term climate change. This may mean strengthening infrastructure or adding redundancy in coastal areas. They suggested that communities allow greater flexibility of vulnerable systems such as changes in land-use techniques. They determined that natural systems should be allowed to adapt. As an example, they recommended that increases in freshwater diversions be provided to areas that had been cut off by previous changes in channels, streams or large water features. They suggested that communities change trends that are increasing vulner-

ability and increase the use of land use restrictions and development in coastal zones. Finally, they recommended that efforts be increased to enhance public awareness of increases in coastal zone risks and approaches to risk reduction and preparedness. The four coastal parishes included in our study stressed building stronger physical infrastructure and public awareness of coastal zone risks rather than changes in land-use. The strategies suggested by Klein (et al. 2003) include the use of loss reduction, prevention, preparedness, and adaptation. In addition to these approaches we must identify strategies for enhancing the resilience of natural, social and economic systems in coastal areas. Further, hazard risk reduction and adaptation to immediate and long-term threats such as climate change must be ongoing.

If we are to reduce the vulnerability of both human and natural systems, we must have strategies and techniques as well as creative approaches in helping systems cope with crisis. Increasing adaptive capacity in systems is critical to the sustainability of coastal environments. We have observed the capacity of natural systems to adapt to stress, and shock. Human systems may have the capacity to exceed what we observe in the natural environment by utilizing creative adaptation in social and organizational systems. In order to unlock this creative adaptive capacity, we need to identify how social, economic and organizational policies and processes inhibit creative adaptation.

We saw strategies that stress short-term benefits over long term outcomes. This emphasis on immediate impacts is consistent with Klein (et al. 2003) who stresses that "Responses to environmental change are shaped by what is perceived to be politically and economically palatable in the near term rather than by the nature and scale of the threat itself" (p. 39).

Conclusions

Efforts to model community resilience have focused on the recovery process (Bruneau 2003). What may be missing is an understanding of the root causes and dynamic factors from the social, economic, and

natural environment that either support community recovery and resilience or inhibit this process. The use of indicators to monitor and assess the success of recovery efforts also allows us to examine possible linkages between social, economic and economic factors that impact the recovery. Examining the recovery progress using social, economic and environmental indicators allows us to view the entire process rather than just one part independent of the others. In most cases, recovery is assessed on just one of these areas without consideration of the others. Further the recovery is monitored without consideration of how regional factors might impact the community recovery process. It is critical to see if regional, national and international factors are impacting a community's recovery.

Pelling (2005) has stressed the importance of social capital in adaptation to community threats and that we should look beyond economic recovery. We see that if we are to build strong coastal community resilience, engagement of local communities is critical. Community engagement processes provides a means of ensuring that the adaptive capacity of the community to deal with hazards is examined and strengthened. Local planning and community engagement strategies are interdependent and open the door to innovative opportunities for strengthening community resilience.

In this discussion of resilience of coastal communities, the interdependence of social, economic and ecological assets has been stressed. Threats experienced by coastal communities are causing many residents and businesses to reconsider the long-term viability of their community. They witness firsthand the loss of jobs, a weakening of their regional economy, and especially the stresses so visible on local natural systems. They view the interdependence of the natural, social, and economic systems and the very real challenges that they face.

The success of coastal community resilience is thus inhibited by the complex relationships and interdependency of social, economic and natural systems. Communities that successfully adapt and recover from disasters manage the process by assessing each of these systems and appreciating that a single set of indicators will not reveal the

complex nature of problems. A limited understanding of problems in the recovery process will distort the adoption of appropriate responses that might be the key to a successful recovery. Given the chronic nature of many threats in coastal environments, the failure to successfully recover from a disaster will have long-term implications.

Local engagement and the use of indicators in developing and monitoring recovery strategies are key to building sustainable communities. By using a broad set of indicators that reflect the social, economic and natural systems, they can manage a recovery process that is unique to their community. Further, local conditions are coupled with much larger systems and may be impacted by regional, national or global dynamics. Local recovery actions form the basis for developing long-term strategies, but they must be managed within the context and awareness of larger systems.

Linkages between social and ecological systems are key to an appreciation of the changes that occur over time in coastal environments. These are not just natural events but in many cases human influenced. What we can count on is that if we fail to understand and acknowledge the challenges presented by changes in coastal systems, we will be overwhelmed by the adverse impacts of natural hazards and chronic environmental changes. Although the pace of change is slow, we must identify opportunities to adapt assist our human-social, economic, natural and organizational system cope with complex changes that are occurring in coastal environments. Successful adaptation is only possible through community engagement and recognition that these systems are interdependent.

The resilience of a community and its capacity to cope and adapt to external threats or pressures for change is linked to addressing its inherent social, economic and environmental vulnerabilities. Where a resilient community attempts to build adaptive capacity within the recovery process, the community may make a commitment to a sustainable future where they stress the importance of understanding the impacts of public policies and decisions. Community goals reflecting a commitment to the wise use of natural, cultural, and economic

resources is a critical step in ensuring that resources are preserved for future generations.

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Developing Bio-Event Resilient Communities and Societies: A Holistic, Systematic Approach

Dr. Paula Scalingi

Introduction

This report outlines an approach for developing resilient communities and societies using a multi-step process that builds upon more than a decade of regional initiatives focusing on infrastructure interdependencies and all-hazards resilience. This holistic, systematic approach enables determination of needed actions to improve community and broader societal capabilities to withstand events and disasters that significantly impact community health and safety, and to rapidly recover to normal or new normal conditions. This multi-step process maps relevant key stakeholder organizations and empowers them to work with government partners to develop a regional risk mitigation strategy. This is accomplished through educational workshops and a tabletop exercise; a baseline needs assessment from all-source data, results of interviews, focus groups and a stakeholder survey; with all

information integrated to determine areas of improvement and cost-effective solution options.

The end-result is a holistic, resilience Action Plan by a broad and diverse stakeholder group of government agencies, utilities, businesses, community and non-profit organizations. The Action Plan serves with other local preparedness activities as the foundation for a sustainable, ongoing, measurable process of improvement centered on a public-private partnership to move a community or society incrementally toward resilience to withstand any adverse significant event.[1]

Evolution of the Holistic Approach and Multi-Step Resilience Process

This process has been under development since the late 1990s. It has its origin in the U.S. Department of Energy as a means to address regional power disruptions and related infrastructure interdependencies challenges, then a priority concern in many regions in the United States. The process was first employed by DOE's Office of Critical Infrastructure Protection in nascent form in 1998 as part of the security preparations for the 2002 Salt Lake Olympics. It was viewed as a means to raise the awareness of local government, infrastructure security and operations personnel, and other key service providers about infrastructure interdependencies-related vulnerabilities that could impact the Games. The concern at the time was a terrorist attack or other manmade disruption or natural disaster, such as a prolonged blizzard. The tabletop exercise, called *Black Ice*, focused on the blizzard scenario and was designed by the key stakeholders themselves to address those vulnerabilities and challenges to their respective organizations that they deemed most important.[2]

[1] The Holistic Resilience Approach described in this report integrates theory with practice and is based on more than a dozen years of developing community and regional collaborative resilience initiatives with stakeholders in various regions of the US and in Canada.

[2] The concept of using a regional interdependencies-focused tabletop exercise to generate a disaster mitigation strategy was recommended by critical infra-

After the terrorist attacks of September 11, 2001, this multi-step process was adapted and further developed by public, private, and non-profit organizations in several regions of the U.S. and Canada. The approach has been used most extensively by the Pacific Northwest Center for Regional Disaster Resilience of the Pacific Northwest Economic Region (PNWER), a statutory non-profit organization chartered in 1991 by the states of Alaska, Idaho, Montana, Oregon, and Washington and the Canadian provinces of Alberta, British Columbia, Saskatchewan, Yukon, and the Northwest Territories. The multi-step process has been employed since 2002 to conduct successive initiatives focusing on different hazards, resilience needs, and infrastructure sectors. The most significant among these activities is an ongoing set of initiatives called the *Blue Cascades Series* after the first regional infrastructure interdependencies exercise held in Portland, Oregon in 2002. These initiatives have addressed physical attacks on energy, communications, and other infrastructures *(Blue Cascades I),* cyber attacks and disruptions *(Blue Cascades II),* a major subduction earthquake *(Blue Cascades III)*, a global pandemic *(Blue Cascades IV)*, disaster supply chain resilience *(Blue Cascades V)*, and a catastrophic flood *(Blue Cascades VI)*.[3] Each of these initiatives, using the multi-step process, resulted in a stakeholder-validated Action Plan that was rolled up into a single "master" *Blue Cascades Regional Integrated Action Plan*.[4] Another significant outcome of this nearly decade-long continual process of improvement was the creation of the public-private Puget Sound Regional Partnership, encompassing the greater Seattle area and across state and Canadian borders where interdependencies extend.

Most recently, the multi-step process has been used in the Puget Sound Region to undertake a holistic regional assessment of *bio-event*

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structure representatives who were part of security planning for the Games to provide a business case to demonstrate preparedness shortfalls that required attention.

3 Executive summaries and in some cases full reports on the *Blue Cascades* events can be accessed at www.regionalresilience.org.

4 *Blue Cascades Regional Integrated Action Plan,* updated November 2010, at www.regionalresilience.org.

disaster-related needs, capabilities, and gaps and development of an Action Plan to improve community and societal resilience to deal with health impacts of major events and disasters. This *Comprehensive Community Bio-Event Resilience Pilot Project (CBBER)* is the most ambitious and intensive use to date of the holistic resilience approach and multi-step process.

In addition, an increasing number of national associations are embracing elements of this approach for its value in bringing cross-sector and multi-jurisdiction representatives together with experts from diverse disciplines to examine all-hazards vulnerabilities, consequences, and preparedness gaps. In 2006, an outline of the process was incorporated into the *Regional Disaster Resilience Guide for Developing an Action Plan*, produced by The Infrastructure Security Partnership (TISP), a national association representing the engineering and built environment communities. The *Regional Disaster Resilience Guide* is now being revised and expanded by a Task Force of more than 100 experts and practitioners, and is scheduled to be published in the fall of 2011. The 2011 *Guide* has much additional information, lessons learned, and refinements to the multi-step process gleaned from these previously noted initiatives, including the Puget Sound Region *CBBER Pilot Project*.[5]

Multi-Step Process Evaluation and Validation through the Community Bio-Event Resilience Pilot Project

Until recently, this multi-step process has been largely ad hoc and not applied specifically to *bio-events* (i.e., disasters with extensive health and safety impacts), nor has its potential been rigorously explored and assessed in a major region and documented. The recently completed *Comprehensive Community Bio-Event Resilience Pilot Project* allowed

[5] *Regional Disaster Resilience: A Guide for Developing An Action Plan*, The Infrastructure Security Partnership (TISP), June 15, 2006. For information, see www.TISP.org.

this approach to be much fleshed out and refined to create an initial flexible model holistic approach to bio-event or broader resilience needs that can be customized for use by communities in any region, including across national borders.

The *CCBER Pilot Project* was a year-long effort to create this model and simultaneously assist communities participating in the Project, in this case the Puget Sound Region of Washington State cross-border into Northwest Canada. More than 120 companies, non-profits, government agencies and other organizations contributed to the Project, which was sponsored by the U.S. Department of Homeland Security Office of Health Affairs in collaboration with the Pacific Northwest Center for Regional Disaster Resilience.

With the completion of the Project, the intent is now to build on its results to further expand, validate, and refine the model approach through additional pilots and take steps to encourage research in key areas that remain to be addressed. Such research needs include how to apply the holistic approach and multi-step process, which has thus far been focused at the local level, to multi-state or multi-nation regions; requirements for sustainability and customization to any community or society; and practical metrics for determining resilience goals and achievements.

Rationale for the Holistic Approach and the Multi-Step Resilience Process

There are two overarching and inter-twined factors that necessitate a holistic, *stakeholder-driven* approach to community and societal resilience: the interconnectivity from the local to global levels that enables communities and societies to grow and thrive, and the need for horizontal (cross sector, cross-discipline, and multi-jurisdiction) and vertical (grass-roots to national) cooperation, collaboration, data exchange, and information sharing.

Interconnectivity Imperatives. Global societies from local to multinational levels are becoming increasingly challenged by natural and manmade biological and related threats that can affect human health, safety, the economy, and security. These threats range from all-hazards incidents and disasters, including human and animal diseases and water and agricultural contamination, to toxins and hazardous materials. Given that bio-threats and events do not respect borders, only through collaboratively understanding their potential consequences and identifying how to improve preparedness, response, and recovery, can communities and societies can become resilient. Assessing impacts is made all the more difficult by the increasingly complex physical and virtual linkages from the community to international level among infrastructures and essential service providers that are the foundation for much of today's global populations. These interdependencies exist at multiple levels and can cause vulnerabilities and cascading impacts that can have deleterious effects on health and human safety, economic, ecological, and security. Interdependencies can also seriously complicate response and recovery.

- A fundamental principle is that, because of interdependencies, individual infrastructure assets that underpin communities are only as resilient as the communities they serve, and those communities are in turn are only as resilient as the regions in which they are located.
- A corollary to the above is that regional resilience depends on understanding the nature and potential consequences of these highly complex interdependencies, which can only be accomplished through information sharing and data exchange among public, private, and non-profit stakeholder organizations.

Public-Private Partnering Essential for Resilience. This means that addressing interdependencies-associated resilience shortfalls requires unprecedented trust, communication, cooperation and collaboration among individuals, jurisdictions, nations, and private sector and non-governmental organizations, across diverse disciplines. At the international to local levels, there are ongoing activities, established

mechanisms, plans, technologies, and other best practices to improve resiliency. However, there is no formal approach that lays out a holistic path forward to bring together these local and national capabilities with key global constituencies, nor a strategy to address current and future bio-event challenges.

The following overarching holistic approach builds on current local, state/provincial, and national preparedness activities, as well as international initiatives, such as the United Nations "Human Security" concept, and other relevant activities to develop a model approach for creating all-hazards resilient communities and societies. The approach is designed to create a secure and trusted environment that can meet the needs of the broad stakeholder base, particularly private sector organizations and community groups that traditionally have been left out of local planning for major events and disasters.

Methodology

The purpose of the research and focus of the *CCBER* Pilot Project in the Puget Sound Region was to produce a holistic Action Plan for community and societal *bio-event resilience* that encompasses all elements of the "disaster life cycle:" prevention, protection, response, recovery/longer term restoration, and risk-based mitigation; and also to address communications, business and operational continuity, logistics, supply chains, resource issues, public education/training, and exercises. The process from initial convening of the core planning group to completion of the coordinated Action Plan was a little over a year.[6] The intent was to make the Action Plan a flexible and dynamic guide of useful activities that stakeholder organizations of any area—a village, metropolis, region of a state, or multi-state or multi-nation re-

[6] The Puget Sound Region has a decade-long experience in stakeholder collaboration on disaster preparedness that allowed the project to be completed in just over a year. Without this experience base, 18 months to two years might be needed.

gion—can collectively take based on their perceived needs to improve bio-event resilience.

The methodology used entailed:

- Providing a rationale for why community and societal resilience is important and what is required to develop the necessary capabilities;
- Providing key definitions and a detailed set of fundamental principles and assumptions that are the foundation of the holistic bio-event resilience approach;
- Employing the multi-step resilience process to provide information and facilitate development of requirements for a holistic bio-event resilience Action Plan.

Multi-Step Resilience Process

1. **"Mapping" (identifying) key stakeholder groups and organizations and convening core experts, public health and other government agencies, and public, private, and non-profit stakeholders to be part of a Stakeholder Work Group.** This Work Group represents the range of key stakeholders involved in public health, emergency management, and other government disaster-related roles and responsibilities, the private sector, community institutions, and other key organizations with vested interests in resilience.

2. **Developing and conducting one or more educational/training workshops for stakeholders to explore significant issues, address lessons learned from disasters and events, and provide guidance and insights from experts for incorporation into the Action Plan.** The workshops also identify broad areas of interest *(Focus Areas)* and respective specific issues of concern *(Priority Issues)* among private sector, non-profit, and government partners on response and recovery; and examine current plans, roles, and responsibilities, and expectations, interests, and constraints. A key deliverable from the workshops is a coordinated list of these

Focus Areas and Priority Issues, which will become the framework for the Action Plan. Overall outcomes from the Workshops are compiled in summary reports, coordinated with stakeholders, and incorporated into the initial draft Action Plan framework.

3. **Conducting a Baseline Needs Assessment of current resilience and response and recovery needs** using open source information, a regional stakeholder survey, focus groups, and interviews. This "gap analysis"—the foundation of the Action Plan development process—uses as its framework the Focus Areas and respective Priority Issues identified in Step 2 by the Work Group and the broader regional stakeholder community. For each Focus Area in the gap analysis, community resilience capabilities and findings and needs are identified. The research process involves collection of a wide range of data from local, state, and national government agencies, private sector organizations, and other sources.

4. **Developing the initial draft Action Plan Framework** from results of the aforementioned activities, using the Focus Areas and Priority Issues as the structure for the framework.

5. **Planning and conducting a regional tabletop exercise** with a scenario designed and, if the stakeholders desire, facilitated by the Work Group members themselves. This exercise is not an "exercise" to test existing plans, but rather an intensive discussion-focused workshop that utilizes a realistic and accurate scenario with a storyline format that includes events and "issues questions" to raise awareness and identify resilience shortfalls and needs.

6. **Holding a post-exercise Action Plan Development Workshop** to examine and prioritize findings and recommendations in the exercise report and information from other relevant activities.

7. **Producing the Action Plan**—a roadmap of prioritized activities—short-term ("quick wins" taking one year or less), medium-term (eighteen months to two years), and long-term (multi-year)—coordinated initially with the stakeholder work group and then with the broader stakeholder constituency.

8. **Developing an Action Plan Implementation Strategy** through

reconvening the stakeholders to prioritize the Plan's recommended actions, collectively determine leads for the activities, and set up work groups of interested agencies and organizations to define requirements, determine milestones, and identify sources of funding, and technical and other assistance.

Building or Enhancing a Resilience-Focused Partnership

A key objective and outcome of the multi-step resilience process is to either create or enhance an existing public-private partnership or other collaborative mechanism that can continue the resilience process. There are many benefits of the partnership—incorporating the private sector into disaster planning, bridging cultural differences among community groups and professional disciplines, building relationships and trust, and exploring and uncovering interdependencies-associated and other resilience gaps. For private sector organizations, one of the most significant benefits is the opportunity to gauge the effectiveness of, and strengthen continuity plans. For example, businesses and utilities involved in Puget Sound Partnership activities have reported upgrading their plans based on lessons learned from their involvement in Partnership activities.

One of the biggest benefits of the multi-step process is that many stakeholder representatives emerge out of the experience willing to form some type of collaborative entity to address shortfalls and the remedial activities they have identified. Moreover, some individuals "self-select" themselves for leadership roles, and one or more organizations may step into a facilitating role. This partnering mechanism, whether formally constituted or informal, has the role of generating and maintaining forward movement and momentum on Action Plan implementation. This is accomplished through administering and organizing the work, which will be undertaken with the oversight of the respective stakeholder work groups. This partnership or collaborative

mechanism is essential to build, maintain, and sustain the continuous improvement process that increases community resilience over time.

Development of the Multi-Step Resilience Process Framework

The initial foundation for creating resilient communities and societies is the Action Plan, which is produced as the final outcome of the stakeholder-driven multi-step process. As noted previously, the framework of the Action Plan and the accompanying Baseline Needs Assessment are organized into Focus Areas, each with several corresponding Priority Issues that are stakeholder-determined. In the case of the Puget Sound Pilot Project, the Stakeholder Work Group created was assigned this task with the goal of making the CCBER Action Plan as comprehensive as possible.

The Work Group selected 12 focus areas:

1. Regional Health and Hospital Resources
2. Public Health and Healthcare Plans, Resource and Policy Issues
3. Communications, Critical IT Systems, Information Sharing, Health Data Issues
4. Critical Infrastructure and Associated Interdependencies; Risk Assessment, and Mitigation
5. Business Continuity, Continuity of Operations, and Supply Chain Management
6. Response Challenges
7. Recovery and Long-Term Restoration Needs
8. Human Factors and Community and Family Issues
9. Legal and Liability Issues

10. Public Information, including Media

11. Training, Exercises and Education

12. Financial Challenges (funding/reimbursement).[7]

(For the CCBER Project Focus Areas with Priority Issues see Appendix A.)

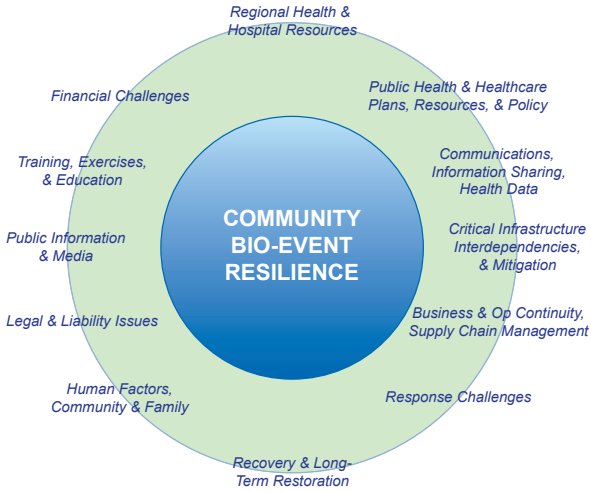

Figure 1: CCBER Project Focus Areas

Constructing the Baseline Needs Assessment

Undertaking a gap analysis that covers the identified Focus Areas is a basic requirement of the multi-step process to identify needs. It is also the most labor intensive element of the process. The assessment will continue for the duration of the project as information is collected from the workshops, tabletop exercise, surveys, interviews, and other

[7] While the exact number and phraseology of these focus issues may vary for different communities, stakeholders tend to identify the same categories of priority needs and issues. The TISP 2011 *Guide to Develop Regional Disaster Resilience* to be published in spring currently has 14 Focus Areas.

sources on capabilities related to all-hazards vulnerabilities, associated interdependencies and consequences, protection, mitigation, response and recovery and longer-term restoration.

For example, for the CCBER Pilot Project, the assessment utilized all sources, including results of activities of many regional and community resilience initiatives throughout the U.S. and Canada, articles and guides on regional collaboration and resilience, including the TISP *Regional Disaster Resilience Guide*. Other sources included focus groups and individual interviews with a broad range of key stakeholder representatives; regional surveys; proceedings and after action plans from dozens of workshops and tabletop exercises held over the last several years in the Puget Sound Region, as well as research focused on a wide range of data from public, local, state and federal government; private sector and other sources. These results were combined with lessons learned from many events and disasters, including the Seattle area H1N1 response. Websites for local jurisdictions and state departments of health and emergency management were investigated, as well as from regional consortia involved with resilience issues. Outcomes from various conferences on current public health and emergency management topics were also included.

While the CCBER Project baseline needs assessment entailed a vigorous, detailed "scrub" of regional capabilities by a small project support team, this element of the multi-step process can be made less labor-intensive if staff resources are limited. The goal is to provide enough of an overview or a community's relevant capabilities to address significant all-hazards events and disasters to enable an initial inventory of the more important resilience shortfalls.

Orchestrating the Regional Tabletop Exercise

The tabletop exercise is the most important element of the multi-step process in providing information on needs and recommended improvement actions, and essential to the success of the process itself. As previously noted, the tabletop is not an exercise in the traditional

sense but a scenario-based discussion workshop developed and largely facilitated by the stakeholder planning group. Stakeholders need to "see" how events and disasters could realistically affect their community and family's health, safety, and economic well-being, and debate what should be undertaken to enhance resilience. The regional tabletop provides the context and impetus for them to work together to determine what needs to be done on an individual and collective basis. The scenario-based discussion workshop is particularly valuable in focusing stakeholder attention on interdependencies challenges that can affect all aspects of the disaster lifecycle. Typical questions they might address include:

- Looking at past lengthy infrastructure outages and other disruptions from disasters and supply constraints, and other causes, what were some of the infrastructure interdependencies challenges that affected your organization most significantly?
- How would you get information to assess the impacts of all-hazards disruptions on critical infrastructures in terms of the magnitude and duration?
    - » Which agencies or organizations would you expect to be able to provide this information—how and how soon?
- What role do you believe utilities and other private sector stakeholders, and community and non-profit groups should play with local, state, and federal agencies in initial recovery efforts to restore essential services?
- How is movement of restoration resources (personnel and materials) into and out of regions—including cross-state and national borders—handled and how would these decisions be made?
- How are response, recovery, and restoration decisions made when they involve interconnected infrastructures and a range of different interests—local, state, and federal governments, infrastructure owners and operators, businesses, non-profits, community institutions, and various interest groups?

Producing the Action Plan

The Action Plan is developed through cross-referencing the capabilities and needs identified in the Baseline Needs Assessment with each of the Focus Areas and their respective Priority Issues, along with observations (findings), and specific recommended activities stakeholders can individually or collectively take to meet these needs. As previously noted, these activities are divided into short-term (a year or less in duration), medium-term (eighteen months to two years), and long-term (multi-year). The short-term activities are low-cost, readily executable actions ("low hanging fruit" or "quick wins") that can provide rapid benefits and help generate stakeholder momentum to undertake more challenging Action Plan projects.

The Action Plan should include a composite list of the recommended resilience improvement activities in an Appendix to provide the reader with a useful, straightforward checklist of what needs to be accomplished and in what timeframe. The Plan should also include a high-level implementation prioritization template that stakeholders can use to collectively designate the more important improvement activities they wish to undertake, and which organizations want to lead or participate in each activity.[8] It also is useful to include a glossary of terms that aid in using the Action Plan.

Examples of Action Plan Outcomes

Needs and recommendations in resilience Action Plans, while specific to the improvement requirements of a particular stakeholder constituency, are nonetheless similar across communities and regions. Appendix B of this report has examples from the *Comprehensive Community Bio-Event Resilience Pilot Project* of a subset of the more than 75 needs and findings identified in the 12 Focus Areas with a corresponding number of recommended actions to address them.

[8] For the template, see the Comprehensive Community Bio-Event Resilience Action Plan, p. 54.

Important Considerations

- The language used in producing the Action Plan and in documents supporting other activities in the multi-step process (e.g., workshop invitations and agendas, tabletop exercise scenario, educational backgrounders, etc.) should be in common, non-technical language and without acronyms. Because the majority of the stakeholders will be private sector or representatives or community groups of different functional areas and cultures, terminology and procedural documents typically used by government for training and exercises should be avoided.
- Along these lines, government protective document designations, such as FOUO (for official use only) should also be avoided. Because stakeholder deliberations are self-conducted "working meetings" and not discussions in the public domain, they are not subject to public disclosure. If the stakeholder planning group wishes, there can be a Non Disclosure Agreement for participating organizations to sign. In regions where there are already established resilience or homeland security partnerships, there may be a password protected website where documents can be posted and views exchanged.
- Close coordination among stakeholders of successive drafts of support documents for the multi-step process and the evolving Action Plan is crucial to its successful outcome, as is ensuring the progress of events meets the perceived needs of the key stakeholders. Organizations must believe they have a stake in, and ownership of the process and the Action Plan, or they will not invest staff time and continue to actively participate.
- Federal government seed money to jumpstart community initiatives is greatly welcomed at the local level and often prompts private sector organizations to provide funds or in-kind resources. The federal role, however, should be that of a partner and facilitator, not the lead.
- In some cases, the activities recommended in the Action Plan may have already been undertaken by localities and states or provinces, or stakeholder organizations in other regions or

nations, including international organizations. These "best practices" should be identified and leveraged where possible to help avoid "recreating the wheel" and to expedite progress in implementing the Action Plan.

- Potential lead and contributing organizations for each of the recommended activities likely will not be immediately specified upon completion of the Action Plan. Also, the activities may not be initially prioritized. Project leads and partner organizations, priority activities, and detailed requirements for each activity will be determined by local jurisdictions with the key stakeholders according to their own timetable and available resources.
- Implementation of Action Plan activities will depend on availability of resources and stakeholder goals and interests, which may change for a variety of reasons over time.

Using the Action Plan to Advance Community All Hazards Resilience

The coordination and finalization of the Action Plan marks the end of what is the first phase to develop the foundation for community resilience. The Action Plan is designed to be a dynamic roadmap leading towards enhanced resilience. Towards this end, it should be considered an integral element in a continuous improvement process in which lessons learned from events and disasters, as well as results from additional regional tabletops and conventional exercises, workshops, and other events, are incorporated as new needs with corresponding activities to address them.

As noted previously, there should be an existing collaborative arrangement, or a public-private partnership created, to undertake implementation of the Action Plan. This partnership may well be informal, with membership open to interested key stakeholder organizations and no defined organizational structure. Many government and business organizations for legal or ethical reasons are not able to join in

formal agreements to establish governance systems. If, however, the partnership does want a charter, models exist that can be used for this purpose.

The All-Important Facilitating Entity

Even more essential to Action Plan implementation is the availability of a facilitating organization or mechanism to reconvene stakeholders, assist in establishing the work groups to develop requirements for Plan activities, and provide basic administrative and logistics support services. The facilitating entity also can help in identifying potential implementation resources—grants and other financial resources, expertise, and tools and technologies that can be leveraged.

Key stakeholders may elect to set up this mechanism themselves or a local or state agency, or business, community, or regional group or association may take on this role. This mechanism optimally should be an established non-profit able to take in funds from different sources, public and private, for cooperative activities. There are a growing number of community resilience-focused public-private partnerships and various models for this type of mechanism across the U.S. and in other nations. In the U.S. alone, there are dozens at the multi-state, state, county and municipal levels. Examples of well-established resilience-focused partnerships that have facilitating entities include the Puget Sound Partnership for Infrastructure Security and Disaster Resilience (facilitated by the Pacific NorthWest Economic Region), the All-Hazards Consortium (nine Mid-Atlantic states), the Southeast Emergency Response Network (11 Southern states), the Southeast Wisconsin Homeland Security Partnership, the Safeguard Iowa Partnership, the New Jersey Business Force, State Partnership-Utah, Alaska Partnership for Infrastructure Protection, and the Ready San Diego Business Alliance.[9]

[9] FEMA has compiled an initial list of more than three dozen of these different types of partnerships on its website. See www.fema.gov/privatesector/ppp_models.shtm.

Challenges to Resilience Action Plan Implementation

There are broad and inter-related challenges to forward progress towards community and societal resilience once the initial foundation is laid with the stakeholder-validated Action Plan:

- Continuing and sustaining the stakeholder enthusiasm and momentum generated by the multi-step process,
- Securing necessary support and encouragement of government, private sector, and political leaders, and
- Obtaining resources to undertake implementation of initial Action Plan activities.

None of these challenges are insurmountable. Creating or enhancing an existing public-private partnership with a dedicated part-time facilitator or community or regional organization in this role is sufficient. Support from a few key leaders, particularly if these include county and municipal emergency management, public health and other key agency officials with disaster resilience missions, and major businesses in the community, helps assure success. Universities and colleges in the region can provide valuable support through providing expertise or meeting venues. Regarding resources, there are an increasing number of avenues, particularly with the new focus at the federal level on resilience in the U.S. and by an increasing number of national governments. With access to public seed money for useful resilience projects, increasingly local industry and business interests are also contributing to these efforts.

At the same time, impediments remain to providing public funds directly to regional mechanisms that need to be overcome. This is highly important, because most community resilience improvement activities will have no single lead organization but multiple entities involved. Traditional funding through state and local government may not be available or appropriate where funds and support from multiple sources are involved. Also, state and local governments express

concern about not being able to meet "unfunded mandates" arising from resilience action planning activities.

Measuring Progress Made

There is currently a great deal of emphasis among policy-makers and theorists on metrics for community and societal resilience. Consequently, there are many disparate efforts underway to develop infrastructure, community, and regional resilience measurement approaches and metrics. In many respects, this is placing the proverbial cart before the horse. There is as yet no agreed policy foundation on the scope or requirements for community and societal resilience, let alone what constitutes desirable levels of resilience.

This lack of criteria is due largely to the wide range of stakeholders that must to be taken into account and the need to address resilience from the component and asset levels to the infrastructure, community, regional, national, and in some cases global levels. Practitioners, policymakers, and stakeholders from different disciplines, functional areas, and sectors have very different visions of what resilience means and requires. Another consideration is that some industries are subject to federal, state, and local regulatory requirements and other standards and guidelines. Other than when legally obligated to provide security or resilience data, private sector organizations are not mandated to give government or external organizations information that could be used to ascertain resilience levels, or meet certain standards. In any event, metrics and methods to measure resilience will need to be developed and tested in communities with key stakeholders and refined before adoption.

While it is premature to attempt to devise ways to measure resilience in quantitative terms or attempt to rank communities (or organizations), there is a simple, practical, flexible, stakeholder-focused approach to determining progress towards community and societal resilience—the Action Plan. The Action Plan framework of Focus Areas and Priority Issues provides stakeholders with a self-developed broad

set of resilience criteria and the Plan activities are a resilience checklist for what they themselves have determined should be accomplished. Thus, progress towards community resilience can be measured in terms of Action Plan activities initiated, in progress, or completed.

- As the Action Plan is updated with additional needs and remedial activities over time, it can provide a running inventory and progress report of the increasing level of resilience in the community.[10]

Conclusion

This report has described a simple, flexible, holistic approach that empowers stakeholders to undertake a multi-step process to develop resilient communities and societies. The process can take as little as a year depending on the extent of cross-sector/multi-jurisdiction cooperation and disaster preparedness activities already underway in a particular community or region.[11] It is low-cost, practical, and operational, not an academic exercise resulting in a study. The process is not dependent on outside experts, but can be undertaken by stakeholder volunteers and in-kind resources and, as necessary, trusted *boots-on-the-ground* consultants already supporting local disaster preparedness activities and who understand the community in which they live, the infrastructures, culture, and importantly, existing stakeholder relationships. The outcome lays the foundation for an ongoing resilience process that addresses the disaster life cycle through developing a stakeholder-validated regional continuity strategy—a cooperatively developed Action Plan. Together with a supporting public-private partnership with a facilitating mechanism, a community can continuously work towards greater all-hazards resilience.

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[10] This informal means of measuring progress is utilized by PNWER for the Puget Sound Partnership with periodic updates of the Puget Sound Integrated Regional Action Plan. For the Integrated Plan, go to www.regionalresilience.org.

[11] A notional year long schedule for the multi-step process is provided in Appendix C.

Appendix A to Developing Bio-Event Resilient Communities and Societies: A Holistic, Systematic Approach

Comprehensive Community Bio-Event Resilience Pilot Project Focus Areas and Priority Issues

1. Baseline Regional Health and Hospital Resources
    - Hospital capacity issues
    - Staff availability
    - Availability of pharmaceuticals, medical and other materials
    - Availability of essential services, power, and fuel (including for backup generators, ambulances, etc.)
    - Critical vendor availability (elevator and equipment maintenance, technical assistance, food service, janitorial services, EMS, power generators—availability and technicians)
    - Hospital-related public safety and security issues
    - Access to personal protective equipment
    - Alternative care facilities
    - Other issues
2. Public Health/Healthcare Policy Issues that Affect Bio-Event Resilience
    - Level of key stakeholder understanding of pandemic and other bio-event-related health impacts and preparedness needs (e.g., radiological/nuclear, earthquakes, other major all-hazards disasters)
    - Effectiveness of preparedness plans
    - Prioritized distribution of vaccinations/anti-virals, other medical/hygiene supplies, and related issues
    - Determination of essential personnel for anti-virals
    - Surge capability for hospitals in a pandemic or other

bio-events

- Lab analysis capabilities
- Continued operation of pharmaceutical companies/retailers, grocery stores
- Pay for vaccines versus free distribution issues
- Disaster sheltering during a pandemic or other bio-event
- School closure/daycare issues
- Business closures
- Event cancellations (e.g., sports events, other)
- Social Distancing
- Travel restrictions (local, domestic, international)
- Quarantines (particularly related to air and sea travel)
- Insurance Issues
- National border-crossing issues
- Credentialing/certification for access to restricted areas
- Disinfection/decontamination and related issues
- Mass fatalities planning/mortuary-related issues
- Livestock issues
- Other issues

3. Information Sharing, Communications, Critical IT Systems, Health Data Issues
    - Alert and warning/notifications
    - Messaging to schools and other institutions with significant populations
    - Data collection capabilities (availability, including international information; collection, coordination, dissemination)
    - Information sharing issues (too much/rapidly changing/conflicting information, prioritization, integration of data, standardized approach/use of GIS)
    - Healthcare data-related issues

- IT Systems reliability, resilience, and security
- Telecommuting, including "last mile issue" and teleconferencing issues
- HIPAA restrictions on individual health information
- Availability of IT technical expertise (personnel shortages)
- Other issues

4. Critical Infrastructure and Associated Interdependency Impacts; Risk Assessment, and Mitigation
   - Identification and prioritization of critical assets, interdependencies-related vulnerabilities, and preparedness gaps
   - Ensuring confidentially of proprietary and sensitive information infrastructure-related data
   - Assessment of potential and cascading impacts on infrastructures and essential services, including impediments to response and recovery
   - Transportation
   - Emergency Services
   - Energy, etc.
   - Identification of potential mitigation measures
   - Other Issues

5. Business Continuity, Continuity of Operations, and Supply Chain Management
   - Identification of essential operations and business activities
   - Assessment of potential disruptions to operational and business services, including logistics, suppliers, customers, availability of truck drivers, warehouses, etc.)
   - Business liaisons in the county Emergency Coordination Center (EEC)
   - Identification of potential mitigation measures (e.g., relocation of services, redundant or back-up systems, and personnel)

- Administrative, budget issues
- Workforce policy issues (compensation, absences, isolation, and removal of potentially contagious employees, safe workplace rules, flexible payroll issues, etc.)
- Economic consequences
- Assistance to small businesses for contingency planning/continuity of operations
- Involvement of broad range of businesses in bio-event preparedness activities
- Notification and provision of employee information
- Training of employees
- Testing of continuity plans and procedures
- Other Issues

6. Bio-Event Response Issues
    - Incident Management/Unified Command/Area Command
    - Roles and missions (Federal, State, Local, Private Sector, and Community)
    - Decision-making (cross-jurisdiction, cross-sector, cross-discipline)
    - Cooperation, coordination, including cross-state and cross-national border, on plans, activities
    - Security for vaccine distribution in transit and for dispensing organizations on site
    - Security for grocery stores and pharmacies
    - Cross-sector/cross-discipline information-sharing (effectiveness of mechanisms)
    - Mutual aid agreements (cross-state and cross-border)
    - Availability of emergency managers and first responders
    - Resource requirements and management
    - Logistics and supplies availability
    - Other Issues

7. Initial Recovery and Long-Term Restoration Issues
    - Restoration management structure—what organizations and how organized, and Unified Command
    - Roles and missions (federal, state, local, private sector, and community)
    - Decision-making (cross-jurisdiction, cross-sector, cross-discipline)
    - Cooperation, coordination
    - Prioritization of service restoration
    - Resource requirements and management
    - Other issues
8. Human Factors, Community, and Family Issues
    - Understanding and dealing with psychological impacts
    - Identifying and addressing family assistance needs
    - Education and academic institutions (daycare centers, schools, colleges and universities, libraries, community centers)
    - Special needs populations and ethnic and cultural groups
    - Other issues
9. Legal and Liability Issues
    - For government agencies
    - For businesses (employee, insurance, contractual issues, information from/coordination with regulators)
    - Privacy issues
    - Ethical issues
    - Union-related issues
    - Liability associated with vaccine distribution and administering; volunteerism
    - Other issues
10. Public Information, including Media

- What information to convey, how (regional coordination process and mechanisms), and who is the spokesperson?
- Maintenance of public confidence
- Outreach to and information to area businesses
- Outreach to and information for cultural and religious groups
- Utilization of social networks
- Involvement of media as partner in preparedness
- Other

11. Training, Exercises, and Education
    - Target audiences
    - Tools (course curriculum, webinars, workshops, train the trainers, etc.)
    - Resources needed and availability
    - NIMS/ICS training for private sector organizations
    - Focus on training from "business" perspective, not government
    - Inclusion of private sector organizations in full-scale exercises
12. Financial Issues (funding/reimbursement)
    - Federal, State, and Local Governments
    - Private Sector
    - Non-Profit and Community Organizations
    - For implementation of prevention, mitigation, and other health and safety resilience requirements
    - Loans and incentives to small and medium businesses for bio-event preparedness
    - Other Issues

Appendix B to Developing Bio-Event Resilient Communities and Societies: A Holistic, Systematic Approach

Comprehensive Community Bio-Event Resilience Pilot Project

Examples of Outcomes

Regional Health and Hospital Resources

- Activities to improve: surge capacity, including staff availability, disaster response and recovery resource management and hospital security capabilities; understanding of hospital and healthcare-related interdependencies and just-in-time supply chains; vaccine and anti-viral distribution procedures during disease outbreaks; collaboration among hospitals and between healthcare and public health.

Public Health and Healthcare Plans and Policy Issues

- Development of: a regional continuity plan and a single coordinated all-hazards disaster website; enhanced procedures for disaster-associated mortuary challenges, and a regional strategy for livestock-related bio-event challenges.

Communications, Critical IT systems, Information Sharing, and Health Data Issues

- Development of: triggers for emergency alerts and activities and ways to improve alert coordination and dissemination; an operational regional all-hazards two-way information-sharing capability that utilizes the State Fusion Center; a health resilience information exchange system to provide better monitoring, information collection, assessment and reporting; and a situational awareness capability to facilitate incident/disaster response.

Critical Infrastructure, Associated Interdependencies, Risk Assessment, and Mitigation

- Additional targeted and regional workshops on priority challenges, including evacuations, hospital/health communications and IT resilience, and chemical, radiological, or nuclear incident scenarios that require specialized scientific and technical expertise; development of an evacuation scenario assessment system and tools to evaluate health/safety and related economic impacts and mitigation options.

Business Continuity, Continuity of Operations, and Supply Chain Management

- Development of: a strategy for expanded outreach and awareness for area businesses that includes how to upgrade continuity plans; an on-line "Bio-event Community Resilience Lessons Learned"; a template for organizations to inventory pre-event and monitor post-event essential assets and resources; and a regional economic bio-event resilience risk mitigation strategy to address business continuity challenges.

Response Challenges

- Activities to: determine optimal criteria for an effective regional incident command/area management structure that integrates public health with emergency management and other necessary expertise; undertake further work on planning for evacuations and long-term sheltering, and certification/credentialing of medical, healthcare and other essential personal; develop a regional outreach, education, and awareness strategy for special needs populations; and identify what regional and national defense assets and capabilities and also private sector assets could be incorporated into preparedness planning.

Recovery and Long-term Restoration Needs

- Development of: an effective regional organizational structure for recovery and long-term restoration; an inventory of post-disaster recovery assistance that can be made available to stakeholders; a process for information sharing on private

sector and non-profit resources for disaster assistance, including procedures for resource acquisition and management; an assessment of regional psychological and economic factors that can affect post-event business retention that includes incentives to retain small businesses.

Human Factors, Community and Family issues

- Development of: bio-event resilience strategies for special needs populations, and ethnic, cultural, and faith-based groups; and procedures, including a coordination process for public guidance on vaccine availability and distribution.

Legal and Liability Issues

- Development of: a regional workshop focused on legal/liability issues and policy gaps, and a publication on disaster-related legal and liability issues for private sector and government organizations.

Public Information, including the Media

- Activities to: develop a regional public information strategy for bio-events, which incorporates procedures for involving the local and regional media; develop a single Internet website for regional emergency preparedness/management and related public health information with links to local jurisdiction and other relevant websites.

Training Exercises and Education

- Activities to: incorporate in a five-year exercise plan at least one tabletop exercise per year that includes the broad key stakeholder community; conduct an educational seminar for local media that includes government officials to address priority all-hazards disaster scenarios and public communication challenges; and develop a strategy as part of a broader regional resilience continuity plan for bio-event resilience training and education for businesses, community institutions, and the general public.

Financial Challenges

- Activities to: explore ways in which government assistance programs can be expanded to secure resources for pre-event mitigation activities for high-probability, high-consequence threats; develop a brochure outlining disaster assistance available from federal sources with criteria and guidelines for applying; and develop options for a regional disaster assistance non-profit mechanism to enable collection of assistance from non-government sources, including private donations.

Appendix C to Developing Bio-Event Resilient Communities and Societies: A Holistic, Systematic Approach

Notional Year-Long Multi-Step Process Schedule
(can be readily expanded for 18-24 month initiatives)

Month	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8
August	**Convene Workgroup;** Kick-off Meeting	**Educational workshop development begins**	**Begin Baseline Needs Assessment**	**Identification of initial Focus Areas & Priority Issues for Action Plan**				
September	Continue Work Group activities	**Continue to develop workshop**	**Continue Baseline Needs Assessment**	**Begin draft Action Plan Framework**				
October	Continue activities	Hold Workshop	**Continue Needs Assessment**	**Continue to incorporate data into Framework**				
November	Continue activities	**Produce Workshop Summary**	**Continue Needs Assessment**	**Continue to incorporate data into Framework**	**Begin development of tabletop exercise**			
December	Continue activities	Incorporate Summary results into Framework	Continue Needs Assessment	Continue to incorporate data into Framework	**Continue to develop exercise**			

Month	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8
January	**Continue activities**		**Produce initial draft**	**Continue to incorporate data**	**Continue to develop exercise**			
February	Continue activities		**Augment draft Needs Assessment**	**Continue to incorporate data**	**Continue to develop exercise**			
March	Continue activities			**Continue to incorporate data**	Conduct exercise	**Develop post exercise Workshop**		
April	Continue activities		**Incorporate exercise results**	**Continue to incorporate data**	**Produce/ coordinate report**	**Continue to develop post-exercise workshop**		
May	**Continue activities**		**Continue incorporating additional data**	**Produce initial draft Action Plan**	**Finalize Exercise Report**	Hold Post-exercise Workshop	**Undertake initial draft of Action Plan**	
June	**Continue activities**		**Continue incorporating additional data**			**Produce Workshop Summary**	**Incorporate additional data**	

Month	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8
July	**Continue activities**		**Continue incorporating additional data**				**Produce draft Action Plan for stakeholder review**	
August	**Begin wrap-up activities**		**Finalize and incorporate Needs Assessment into overall Action Plan Project Report**				**Produce new draft Action Plan with stakeholder comments**	Reconvene stakeholders to validate Action Plan and prioritize recommendations
September	**Project end**						**Finalize Action Plan**	**With stakeholders establish future collaborative process and structure for Action Plan implementation**

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Ecological Resilience for an Increasingly Surprising World

Dr. Lance Gunderson

Introduction

Humans have become a planetary force. We have modified earth and water cycles to meet our needs. We are now the major user of primary production on the planet. We continue to remove carbon from underground storages and release it (through land clearing and combustion) into the atmosphere. These biogeochemical changes have led in turn to unintended consequences, such as changing temperature and rainfall patterns (Pachauri and Reisinger 2007). Globalization has come to dominate the economic, social and political dimensions of our lives as well. One result of human globalization has been an increase in unexpected events. In other words, our world has become more surprising. Surprises occur when our expectations about the world differ from reality. Surprises are a consequence of living in an increasingly complex world, full of uncertainties and rapid change. How we deal with those uncertainties and change is key, not only to sustainability, but survival.

It is an interesting puzzle why the word resilience is becoming more prominent in our day-to-day use and lexicon. As a demonstration of the explosion in the use of this word, I did a Google search that found (in 0.05 seconds) over 14 million results! Of course the word resilience is applied in many different topics, and the search returned articles on psychology, individual self help, the title of a recent book by Elizabeth Edwards, a house paint brand, skin care products among others. These results are skewed towards individual well-being, which is not surprising for an internet search in the United States at this time. Yet another component of this may be related to an increasing more complicated world, subject to more and more surprises, shocks and crises. It is in this context that the resilience has been proposed and applied by scholars who study ecosystems (Holling 1973, Gunderson et. al. 2009), those who study social systems (Kahan et al. 2009) and those who study coupled ecological and social systems (Gunderson et al. 1995, Berkes and Folke 1998, Walker and Salt 2006, Gunderson 2010).

The word has existed for hundreds of years, and its etymology can be traced to the Latin word (*resiliens*), which arises from the combination of *re* (back) and *saliere* (to leap or jump). Many of the references on resilience mentioned in the prior paragraph involve the capacity or property of a system to rebound. This is physically manifest in materials, such as paint or human skin, whose elasticity is correlated with resilience. Psychological resilience of humans is described as the period of healing or recovery following a traumatic event, such as the loss of a loved one or surviving a natural disaster (Masten and Obradović 2008). Some ecologists have used a similar construct or definition of resilience, but others yet have expanded the definition to include a wide range of ecological phenomena, as described in the next section.

The remainder of this report is structured as follows. First is a section on ecological resilience, and how the concept has evolved over the past four decades. The second section describes how practitioners have applied the bundle of ideas associated with resilience theory to natural resource management. The report concludes with a summary.

Ecological Resilience

Origins and Definitions

The Canadian theorist C.S. Holling introduced the word resilience to the ecological literature in 1973. Up until that time, Holling was known as a scholar on developing mathematical and conceptual models to explain the complex relationships between predators and prey. Given the opportunity to write an annual review article, he proposed the word resilience to contrast the existing paradigm of stability and equilibrium centered behavior. He made two key propositions to explain the behavior of ecosystems; 1) they are structured and function around a number of variables and 2) that the interactions among those variables can produce many types of behaviors. At times, variables can influence other variables in ways that create negative feedbacks, which control system dynamics and lead to an overall stable system. One simple example is the control of temperature in a room. If the temperature goes down, sensors turn on a heater which inputs warm air until the temperature reaches a set point at which time the heater is turned off. Even though the temperature in the room is variable, it is stable within a small temperature range. Such feedbacks are apparent in predator prey oscillations, where both populations are influenced and controlled by the other (Holling 1973). Hence, stability can ensue or emerge from complex feedbacks and controls. Holling (*op. cit.*) defined stability as the "ability of … systems to absorb changes of state variables, driving variables and parameters, and still persist." At the scale of the planet, our climate has been relatively stable over the past few thousand years, oscillating within a few degrees yet kept around an equilibrium temperature because of complex feedback systems (Pachauri and Reisinger 2007). But Holling proposed that other dynamics were theoretically plausible.

The key insight from the Holling (1973) paper was that while some ecosystems exhibited stable type behavior (long term equilibrium with some fluctuation around such equilibrium), others did not. Holling (*op.cit.*) suggested that ecosystems could exist in any number

of configurations or stable states. In this sense, alternative structural and functional features that characterize an ecosystem were not only possible, but also present (if not common) in nature. He introduced the term resilience to describe the property that mediated the shift or change between alternative states as follows; resilience is "the size of a stability domain or the amount of disturbance a system could take before it shifts into alternative configuration."

The proposition that ecosystems could change between different configurations or structures was a new paradigm for ecologists. As such, this idea was debated, evaluated and tested in many different settings and contexts. It was a set of ecologists who examined ecosystems subject to disturbances such as fire, floods, pests, storms, droughts, grazing and other pressures, who began to use this view of resilience to explain long-term changes in the systems that they were studying. Walker (1981) was among the first to use this view of resilience to explain succession in semi-arid rangeland ecosystems. Others, such as Sousa and Connell (1985) failed to find evidence of alternative configurations in ecosystems. Yet a series of papers, which used long-term data sets and focused on marine ecosystems, provided the empirical and field based confirmation of alternative stable states. The first was an article by Hughes (1994) who documented a phase shift in reef ecosystems in Jamaica following a hurricane; in which the reef biomass shifted from coral dominance prior to the hurricane to algal dominance after the hurricane. Hughes (1994) and colleagues (Bellwood et al. 2004, Hughes et al. 2003, Pandolfi et al. 2005), went on to document how subtle changes in reef fish communities (removal of key herbivore species) and increased nutrient additions altered the way that these reefs configured following the removal of species during the hurricane. Estes and Duggins (1995) documented alternative states in cold-water marine ecosystems; how the removal of key predators (sea otters) would result in the shift from a kelp dominated system to one in which sea urchins dominated. Steneck and colleagues (2004) indicated (as with the coral systems) how such state shifts (and hence resilience) was due to shifts in abundance of key organisms in food webs. Indeed, key reviews by Gunderson (2000) and

Folke et al. (2004) put forth examples from hundreds of ecosystems of such state changes. These changes were brought forth by a number of mechanisms, including loss of functional diversity (Walker et al. 1999), changes in food web structure, nutrient additions (Carpenter 2001), homogenizing of spatial and temporal patterns and alteration of disturbance regimes (Gunderson and Pritchard 2002).

Even with the preponderance of evidence for alternative configurations, ecologists were using resilience in two different contexts or meanings. Some ecologists, such as DeAngelis (1980) and Pimm (1991) used resilience to describe the time that it takes for a system to recover following a disturbance. Holling (1996) proposed terminology that captures the multiple meanings of resilience. Holling (*op. cit.*) used the phrase engineering resilience for situations in which the system returns to a pre-disturbance configuration, and in this case resilience refers to a recovery or renewal time. Holling (*op.cit.*) used the phrase ecological resilience, to describe the width or size of a stability domain, which, just as in the 1973 article, is the amount of a disturbance that the system can absorb before it flips into an alternative configuration. Both of these definitions suggest that resilience is not a fixed property of an ecosystem, but varies over time (and space), as described in the following section.

Resilience over Time—the Adaptive Cycle

In reviewing a number of ecosystems to develop ways to study impacts of climate change, Holling (1986) observed that ecological systems that were subject to periodic disturbances exhibited four distinct and usually sequential phases of change in the structures and function. The first two stages of ecosystem development have also been well described as primary or secondary succession. During early succession, plants convert solar energy to biomass and in doing so, modify the soils and microclimates change. During this phase, plants and animals compete for limited resources, and the winners are individuals and species that can process more energy and accumulate more biomass more quickly than competitors. This phase is charac-

terized by rapid growth, and is called the growth phase. Over time, structure accumulates and the system becomes more diverse and more connected and the system enters the second or conservation phase. Net growth slows, as more resources and energy are allocated to system maintenance rather than new growth. During the conservation phase, the system becomes increasingly connected, less flexible (more rigid) and more vulnerable to external disturbances. These phases also represent system maturation and increasing vulnerability to external variations or disturbances.

Forest fires, pest outbreaks, harvesting and hurricanes are all examples of the disturbances or broader scale variation in drivers that trigger the omega phase of ecosystem dynamics (Holling 1986, Holling and Gunderson 2002). This phase is a relatively rapid period of destruction (or creative destruction), during which the previously accumulated forms of structure and capital are released. Examples include fires that consume leaves and trunks, pest outbreaks that consume foliage, and storms that defoliate trees and topple tree trunks. Many of these forces are external stresses, which act upon internal vulnerabilities. The destruction phase is quickly followed by a reorganization phase, also called alpha or beginning phase, where a new system emerges, leading to the growth phase of a new cycle. The new trajectory may be very similar to the previous trajectory, or it may be quite different. All of these phases, growth, conservation, destruction and renewal, combine to form an adaptive cycle (Holling 1986).

Ecological resilience waxes and wanes throughout the four phases of the adaptive cycle. Early successional ecosystems are very resilient, in that they can absorb wide ranges of shocks or disturbances and recover into a similar ecosystem. However, the older the ecosystem and the more structure, then the more likely that a disturbance, such as fire, drought, or even temperature variations, can cause the system to change into an alternative regime. The ensuing trajectory can be a random result of what types of organisms become established and control the next phases of growth and development. The reorganization phase is where new ecosystems are likely to emerge, as new combinations of old and new elements (Allen and Holling 2008). Other

slowly changing variables can also influence subsequent trajectories. One such example is in freshwater marshes in the Florida Everglades. These marshes have recovered from droughts and fires for millennia. In recent times, cattails have replace the native plants in these marshes because the amount of phosphorus in the soil had increased (Gunderson 2001).

The growth and conservation phases of ecosystem development, in which energy and resources build structure and connectivity, have been demonstrated to be analogous to change in other systems, such as human organizations (Westley et al. 2002), modern cities (Elmqvist et al. 2004) and ancient cultures (Redman and Kinzig 2003). Long-term interactions between people and ecosystems have also described using these four phases for many socio-ecological systems (Walker and Salt 2006). For instance many indigenous cultures managed resources through different phases, and did different actions and policies corresponding to the phase of the system (Berkes and Folke 2002, Berkes et al. 2003). Natural disasters or human created instabilities, such as budget shortfalls, elections or changes in personnel (Scheffer et al. 2003, Westley et al. 2002) can lead to changes in organizations and natural resource management systems (Gunderson et al. 1995). In all of these cases of four phase dynamics, as resilience changes, the scale at which processes occur and influence these dynamics vary as well. The role of scale with resilience is discussed in the following section on panarchy theory.

Resilience and Scale—Panarchy Theory

The dynamics of ecosystems over time occur at specific scale ranges. That is, over successional periods of weeks to centuries, vegetation within a forest patch will grow, mature and senesce. Yet processes (such as photosynthesis, nutrient movement and physiology) are occurring within leaves at faster intervals. At larger and broader scales, climate may undergo cycles of more or less rainfall, with correlated floods and decades of droughts. How these processes that operate on characteristic time and space scales is the basis of a panarchy. The

word panarchy was coined by ecologists to describe a theoretical framework in which variables that operate at different scales interact to control the dynamics and trajectories of change in ecological and socio-ecological systems (Gunderson et al., 1995, Holling 2001, Gunderson and Holling 2002). A panarchy has three ingredients, 1) sub systems of adaptive cycles that represent system dynamics at a specific scale range, 2) dynamic systems that occur at different scale ranges and 3) coupling of those systems across scales at key phases of the adaptive cycle. All of these changes occur in phases described by the adaptive cycle, but each at a given scale. Panarchy theory suggests that in complex systems, abrupt changes occur as a result of the interaction between variables that tend to operate at slower time frames and broader scales, with those that operate over faster and smaller scales. Top-down control occurs when slow, broad features constrain and control the small, fast ones. For example, geology and soil types interact with climatic variables to determine the types of biota that thrive at a given locality. Much empirical evidence supports such hierarchical or top down controls (Carpenter et al. 2001, Foley et al. 2003). Panarchy theory was proposed to suggest that in addition to top down processes that control and constrain dynamics, that bottom-up or cascading processes can also occur. Many disturbance dynamics, such as forest fires or forest pest outbreaks are not the result of top down control by slower variables, but are examples where faster, smaller variables appear to control the system for periods of time.

Panarchy dynamics that link up scale (bottom up) have been named "revolt," suggesting that small events can cascade up to larger scales. When a level in the panarchy enters a phase of creative destruction and experiences a collapse, that collapse can cascade up to the next larger and slower level by triggering a crisis, particularly if that level is at a conservative phase where resilience is low. One example is in the dynamics of urban fires, which is similar to fire in ecosystems. The lighting of a match, strike of lightning or short circuit of an electrical circuit is a small, local phenomena. Under many conditions the local fire is quickly extinguished. However, under certain conditions (such

as extreme droughts or low humidity), local ignitions can create a small ground fire that spreads to the crown of a tree, then to a patch in the forest and then to a whole stand of trees. Each step in that cascade moves the transformation to a larger and slower level. So if not extinguished, fire can consume a house or similar structure and spread to other houses in a neighborhood. Hence part of the connotation of revolt is used to describe how fast and small events overwhelm slow and large ones. And that effect could cascade to still higher slower levels if those levels had accumulated vulnerabilities and rigidities.

The word "remember" describes interactions from the broad to the small scale. This type of cross-scale interaction is important for recovery and renewal at a specific scale. Once a catastrophe is triggered at a level, the opportunities and constraints for the renewal of the cycle are strongly organized by capital and resources that are made available from higher (larger) scale. After a fire in an ecosystem, for example, recovery and subsequent ecosystem development trajectory is a function of remnant resources (unburned roots and available nutrients), smaller scale recovery processes, and the importation of resources from larger scales, such as seeds supplied from other areas. Accumulated capital, evolved structures and other components of ecosystem memory (Berkes and Folke 2002) come into play at this stage.

The cross scale model of panarchy can be used to understand resilience. System states (and alternative configurations) exist at specific scale ranges, corresponding to levels within the panarchy. Those system states are comprised of entities (species in ecosystems, cells in organs, countries in the world), with a characteristic set of attributes or identity (Walker et al., 2004). How those states change is related to types and the timing of cross scale actions. Recognition that a window of opportunity opens up following a disturbance is critical to keeping an ecosystem in a particular state, or flipping it into another state. Also, during these times of renewal, larger scale systems play a critical role in influencing future trajectories and configurations. Recognizing key vulnerabilities during the development and conservation phase is also critical to understanding and preventing cascading phenomena that result in phase shifts. These models of change; resilience,

adaptive cycles and panarchy create the conceptual underpinnings for how humans attempt to manage complex dynamic systems. That is the topic of the next section.

Managing Ecological Resilience

Humans tend to manage ecosystems for a particular type of good or service. Ecosystems produce goods such as timber or water or food, which in turn drive economic activities. Ecosystems regulate biological and chemical processes, such as water purification, storm protection and pollination. Ecosystems also provide a wide range of cultural, spiritual and aesthetic services to humans. Whichever of these goods or services provided is correlated with specific ecosystem states. For example, rangelands are much more valuable for grazing when they are in a grassy state, rather than a shrubby state. The historic coastal marshes of Louisiana provided protection against storm surges more than the current degraded marshes. National parks in many countries were created to provide enjoyment of the scenery and objects therein.

Ecosystem management, therefore, can be simplified into two different objectives or goals. One goal occurs when the system is producing particular goods and services. In this case, humans attempt to manage the resilience of a system in order to keep the system in the desired state. However, there are many ecosystem types in which the state of the system has become degraded, overused, or is no longer supplying these goods and services. In this case, the goal of ecosystem management is to move the system from one regime to another. The second objective occurs when resilience is exceeded and the system undergoes a shift to another, undesired regime. Many large scale ecosystem management plans that focus on restoration such as the Everglades ecosystem or Platte River are underway because the goal is to restore or flip the system from an undesired state that is not meeting societal expectations to one that is more congruent with those expectations.

In ecological systems, practices that buffer or control the impact of disturbances can also help increase ecosystem resilience (Berkes and Folke 1998, Berkes et al. 2003). Prescribed fires in forests remove fuel and prevent large catastrophic fires from occurring. Levees buffer the impact of floods, just as natural floodplains do. Coastal marshes and forests buffer the impact of storm surges and wave actions during hurricanes. Shepherds limit grazing pressure by adjusting the livestock density. Many of these type activities limit the impact of disturbances by managing key linkages and processes that would propagate such disturbances.

Humans also maintain ecological resilience by developing the capacity for renewal following a disturbance. This is done by the maintenance and nurturing of various forms of capital. The case capital is used in a general sense to mean any accumulated material that can be used to help facilitate system functions. Obviously monetary wealth is a form of capital, and it can be used to facilitate economic production. Fiscal capital can also be used to help systems recover after they have been disturbed or destroyed. Natural capital works in a similar way; soils are a form of natural capital that facilitate crop production, or provides the bed for plant regeneration after a fire. Other forms of capital include things such as social capital, which is a network of trusted relationships, or intellectual capital, which is the ability to mobilize knowledge and understanding.

Regime shifts often create surprises for managers, at least the first time it is observed, because of expectations that the system would remain in the more desired state. Another reason that regime shifts are surprising is that many times managers are focusing on maximizing some type of production, such as fish, timber or water and may not notice that there are slowly changing aspects of the system which have eroded resilience. Surprises come in many forms, but at least three different types have been identified. One is a local surprise, in which a change in a broader scale variable has not been experienced at local scales. This might be manifest as a surprising rain storm, which unexpectedly appears and creates flooding. The second type of surprise is the type in which external variations intersect with internal vulner-

abilities to create a state shift. This is described as a loss of ecological resilience and ensuing state change. The third type of surprise is one of true novelty, in the form of species, actions or disturbances. The sudden appearance of exotic pest plants falls into this last category.

When faced with unexpected shifts in system state, managers have three choices on how to proceed. The first is to do nothing, which either ignores that a shift has occurred, or indicates that the shift is not important. In taking no actions, a manager may assume (or hope) that the system will return on it's own without intervention.

The second option for managers faced with a regime shift is to attempt to return the system to the previous (and more desired) regime. Many resource management problems, such as recovery of endangered species, restoration of habitat or remediation of pollutant spills are of this type. In all of these cases, the intent is to restore the system to a prior, or at least more desirable, state. The preferences about which state is more desirable are often difficult to discern, as are mechanisms and institutions for revealing those societal values. Some, such as the endangered species act, or the Grand Canyon restoration act are codified in law. In other situations, individual landowners decide which regimes are preferable, and which transitions they would attempt to pursue. In most cases, regime shifts in ecosystems carry great uncertainties about what caused the shift, and what can be done about reversing the shift. This is the context in which adaptive management was developed. Adaptive management is an approach to resource management that uses techniques to help managers learn while managing in very uncertain situations (Walters 1986, Walters et al. 1992).

The third option for managers faced with regime shifts is to avoid thresholds because the ensuing shift may be irreversible. In resource systems, the extinction of a species is irreversible, so a lot of effort is placed on avoiding that state. However, given a new regime from which there is no recovery, humans have no choice but to adapt. Climate change and the exhaustion of oil reserves pose situations from which there is little choice to adapt to these new situations. In

these cases, the best approach for a manager is foster experimentation in order to see what solutions are feasible and viable. Faced with such broad and irreversible changes, the foresight and creative abilities of humans is needed more than ever.

Resilience theory can change the ways and outcomes of how we think about and manage ecosystems (Walker and Salt 2006). Resilience theory questions our assumptions about change, as it is a very different mental model of how the world works. Resilience theory suggests that systems behave in ways that are, for the most part, unpredictable. Yet, most resource management practices that attempt to manage for stable equilibria (such as optimal harvest policies), or to stabilize key aspects of the system (such as controlling flow in rivers), in the long run fail because of the hidden erosion of resilience. Because of the ways in which ecosystems are organized, and the ways in which humans intervene in those ecosystems, these systems are characterized by both numeric complexity (lots of variables) and dynamic complexity (those variables interact in ways that produce surprising outcomes).

Resilience theory also suggests that rates of change vary over time. Some ecosystem properties change slowly and constantly, while other changes are abrupt or sudden. Once a system tips or flips, then managers are faced with a possibility that the change is irreversible. The latter requires adaptation to a new system (Walker et al. 2004).

One way to cope with the unexpected is to develop new ways to learn and understand. We learn as much by failures as we do by successes, so we need to focus on actions that are safe to fail, for people and ecosystems. Safe to fail policies provide room for mistakes, and the ability to learn from our mistakes. But such policies require institutions that build trust and social capital, and focus on learning by individuals and groups.

Adaptive capacity has been defined in the ecological literature as the ability to manage resilience (Gunderson 2000, Walker et al. 2004). Humans manipulate ecological systems to stabilize key ecosystem processes in order to insure an economically viable flow of goods and services. Yet, in doing so leave the system more vulnerable to change,

by eroding ecological resilience (Holling and Meffe 1995). That is, there is a tradeoff between optimality (efficiency) and resilience. Ecological resilience is difficult to assess and measure *a priori*, and is often only known after the fact. That is, the complexities, non-linearities and self-organized processes that generate regime shifts or ecological phase transitions are generally only understood after a shift has occurred, and then only partly. Even so, humans do manage for adaptive capacity.

Regime management has two key components that must be actively managed. Quite simply, they revolve around two basic questions of 1) What kind of system do we want? and 2) What kind of system can we get? (Clark and Munn 1986). The first question is the beguilingly simple but actually very complex. The issue of desirability is at the core of many social-ecological problems. For example, endangered species legislation states that the population size and trend of a species that is in danger of extinction is not a desired state. Similarly, the frameworks of multiple objective or ecosystem management were developed in acknowledgement that different people have different expectations or desires of system state. Take for example, the history of water management in the Everglades.

During the 20th century, the Everglades region went through four distinct management eras, each reflecting different expectations or desires around the water resources (Light et al. 1995). At the beginning of the century, flooding and a new administration at the state level led to the construction of canals to drain the wetland (Light et al. 1995). When flooding in 1947 overwhelmed the capacity of the early drainage system, more control of the water resources was sought by a massive federal state partnership. This led to the current geographical array of land uses (agricultural, conservation and urban development) that persist to date. For the first half of the century, flood control was the paradigm, with the desired state one in which unwanted, excess water would be removed in agriculture and urban areas. In 1971, a drought and increase in human populations led to another regime. This time, the desired system was one in which water could be both removed during times of flood and retained during times of drought.

In the mid 1980's nutrients associated with agricultural runoff were leading to unwanted regime changes in the remnant wetlands of the Everglades. The ecosystem regime shift from saw grass to cattails, signaled a loss of ecological resilience and invoked a new management regime to stop the spread of nutrients (Gunderson 2000).

The point is that we develop many different institutions to work through these issues about desirable and undesirable regimes. The question of what is desirable can change over time, as indicated by the history of water management in the Everglades (Light et al. 1995). Yet the design and implementation of those institutions remains an open and ongoing activity, as social values change, as well as the structure and function of management institutions (Olsson et al. 2006, Ostrom 2005).

While many social-ecological systems exhibits rhythms of change (Walters 1986, Gunderson et al. 1995, Folke and Berkes 1998, Berkes et al. 2003) many do not. Systems can become trapped when they cannot or do not change or adapt to new conditions, nor escape from a trajectory towards an undesired regime. Trapped systems exist in narrow management regimes, with few or no options for the future.

Summary and Conclusions

Ecologists and practitioners have had experience and learned from attempting to apply ecological theories of resilience to natural resource problems and issues. That has been done for a few decades, with some successes, many failures. But those failures have led to learning. That learning has occurred in individuals, groups and organizations. The lessons from these applications may have some dramatic implications for understanding and promoting societal resilience. While there is some evidence for many similarities between how ecologists view resilience and how social and humanists view the concept (Gunderson 2010), there are also some useful differences. Those differences focus on the capacity of human systems for the development of expectations, and the capacity to understand and manage.

Four proposals arise from prior scholarship on ecological resilience, which may form a foundation for a society that is more resilient to future shocks and change, whether it is increased variation in climate, changes in energy availability or new political environments and institutions. These proposals include a capacity to express multiple models of change, to encourage creative solutions, to foster and cultivate capital and act in ways that allow us to learn and adapt. Each is discussed in turn.

Managing complex systems requires approaches that understand and manage for change, not for stability and stasis. There is growing evidence that managing for stability in ecological systems erodes resilience, making them more vulnerable to change, rather than more robust to external disturbances. Management needs to be much more adaptive and flexible to deal with such dynamic systems. In many cases, rules that attempt to restrain or confine change often erode resilience as well.

Our ability to adapt to the future is only partly knowable. To confront the future, both known and unknown, depends on the development and implementation of creative solutions. The ability to develop new ways of conceptualizing is needed to solve old problems.

Various types of capital are needed to promote resilience. Those sources, both social and natural types of capital, should be protected and maintained. Social capital and trust are key ingredients for system resilience. They allow the flexibility in actions and the ability to tolerate occasional failures. Experience and wisdom are also forms of capital that are becoming less valued at a time when they should be more valued. Natural capital provides a buffer against management mistakes, as it is the foundation for renewal and restoration.

As our world is becoming more surprising we must develop new ways of conceptualizing and acting. Resilience thinking (Walker and Salt 2006) provides a paradigm from which new questions could be posed as to help discover how to become a more resilient society. Testing those questions would involve lots of experiments, some actions will succeed, others will not. It will be our ability to pose the key ques-

tions, test those questions through actions and capture that collective learning that will determine our ability to seek and achieve societal resilience.

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Part 3

Social, Organizational, and Cultural Perspectives of Resilience

Part 3: Social, Organizational, and Cultural Perspectives of Resilience

Introduction

Alex B. McLellan

Resilience is an overarching approach to securing that which is of interest to us, whether it is our individual families and homes or our homeland. This is one of the overarching value propositions embodied in the concept of resilience. Nevertheless, in arranging the program for the International Symposium on Societal Resilience, we needed to develop structures to group, perhaps somewhat artificially, certain elements of resilience. Thus, we arrive at the final of the three themes that examine societal, organizational, and cultural perspectives on resilience.

Social Resilience

Much of the literature talks of the importance of social capital as a key element in the resilience of both individuals and communities. Social capital is, in its simplest form, the value that is derived from networks, both informal and formal, within communities and society at large. The nature of networks, even social networks, is so complex and diverse that it is truly difficult to understand the relationships and interrelationships that exist and the extent to which these relationships influence the behaviors of the constituent members of the network.

Not that the aspects of physical resilience—for example, the ability of a building to withstand a specific disruptive event such as the storm surge resulting from a hurricane—are not important, but they are ultimately easier to measure, to see, to touch, and to implement. More often than not, this results in a heavier emphasis on physical resilience, the basis for which can be easily quantified. Social aspects of resilience—what makes some individuals, organizations, and communities better able to cope with either known or unknown disruptive events—are much less well understood, and only recently has study commenced on all aspects of social and cultural resilience considerations.

Organizational Resilience

Almost inseparable from other aspects of resilience, organizational resilience is the ability of organizations (and their systems) to withstand, respond to, and recover from disruptive events. It is somewhat easier to identify and implement than social resilience, once the decision to do so has been made. In the broadest terms, achieving organizational resilience requires an organization to undertake a holistic examination of its entire operation, understand the risks it faces and the impact of those risks on critical functions, decide what are the most critical and therefore needed elements of the operation, and determine how those functions can be quickly restored to some

predetermined level of functionality and later returned to normal. In some cases, this is a return to a "new normal," or as my colleague Rita Parker suggests in her paper, "bouncing forward."

Organizational resilience systems provide a model for continuous review and improvement that could well serve as the architecture for other forms of resilience. However, like almost all forms of resilience, save for ecological resilience, organizational resilience is ultimately dependent on individual resilience. Individual resilience is the ability of individuals to cope with stressful situations using resourcefulness and adaptive capacity to overcome an adversary or adverse event, which may have been produced by some hitherto unforeseen circumstance or series of circumstances.

Three Case Studies

In preparing the introduction to this theme, we choose to digress for a moment to mention, very briefly, three examples of organizational resilience that may offer potential best practices in organizational resilience. The examples cited herein are the explosion at the Buncefield Oil Terminal in the United Kingdom in 2005, the establishment of the PS-Prep™ Program in the United States, and the implementation of an emergent and promising construct called the business emergency operations center in the United States.

In 2005, just outside of London, a minor equipment failure at an oil terminal (or depot) in the United Kingdom resulted in a series of explosions, which destroyed most of the terminal and the fuel it was storing.[1] Of the 630 businesses in the area surrounding the terminal at least 400 were directly affected by the explosion and its aftermath.[2]

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1 The largest of the explosions, the first one, was the biggest explosion in peacetime Europe since World War II.

2 At the time of the explosion, the businesses in the area of the oil terminal employed approximately 16,500 workers. Of this number, 2,500 workers lost their jobs as a direct result of the explosion and its consequences.

The economic cost of this disaster was estimated at £1 billion.[3] Of this figure an estimated £600 million was the cost to the affected businesses. Reportedly, all businesses that had a fallback or some kind of a business continuity plan survived the disruption that was caused by the explosion.[4]

In the United States, the Department of Homeland Security, guided by requirements established in legislation, has established a voluntary private-sector preparedness program (PS-Prep) that seeks to improve the resilience of private-sector entities. The PS-Prep Program encourages private-sector entities to implement business continuity plans and organizational resilience through the use of consensus-based standards. Most specifically, these standards introduce the notion of a holistic approach that is built on a continuous assessment and improvement model, referred to as a management systems approach. Management systems, such as those embodied in popular standards like the ISO 9000 family, all share a consistent architecture, sometimes called the "Deming Cycle."[5] Given sufficient study and analysis, the standards adopted by DHS could provide a valuable and scalable architecture for many, if not all, resilience activities at all levels.

In Louisiana, following the landfall of Hurricane Katrina in 2005, individuals, whole communities, and many organizations faced significant disruptions when the levees in New Orleans failed and allowed sea and lake waters to flood low-lying areas of the city. The public response to this enormous disaster was less than speedy but extremely costly. Moreover, the recovery is still incomplete in many of the affected areas of New Orleans. Realizing that the private sector could supplement the response and recovery effort managed largely by the public sector, the state of Louisiana has implemented an interesting and potentially emergent best practice that engages private-sector organizations through the implementation of a business emergency

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3 The Final Report of the Major Incident Investigation Board, "The Buncefield Incident," Vol. 1 (December 2005).

4 Ibid.

5 The Deming Cycle, named after quality management guru William Edwards Deming (1900–93), consists of four repeating steps—plan, do, check, and act.

operations center that works in tandem with the state emergency operations center. While it is still too soon to determine the effectiveness of this model, it shows great potential as a vehicle to improve the natural resilience of communities and regions.

Each nation, indeed each region, state, province, prefecture, department, parish, county, shire, and municipality—every level of a society—has variances, sometimes significant, in their cultural perspectives. Our colleagues in Israel, for example, have and continue to face a constant and almost unrelenting threat of attacks from surrounding neighbors. The cultural perspective that this has generated among the Israeli people is a determination to restore order as quickly as humanly possible after a disruptive event. In the United States attitudes tend to vary, largely in proportion to the length of time between significant disruptions. Typically in the immediate aftermath of an event, levels of concern and resultant preparedness increase. Over time the level of preparations for similar events declines and Americans generally adopt an attitude that they will rise to the occasion when and if needed for future disruptions. Clearly the approach taken by Israeli citizens in response to their threats differs vastly from that of U.S. citizens and they are unlikely to ever be convergent over any period of significant time.

Nevertheless there is much to be learned about resilience from the culture and habits practiced by other nations. It is with this in mind that I take pleasure in introducing the thinking of three highly respected scholars, John Plodinec (United States), Corinne Bara (Switzerland), and Rita Parker (Australia).

Our challenge remains to discover innovative ways to learn about resilience from other societies even given their differing cultural perspectives.

Research in Social, Organizational, and Cultural Perspectives of Resilience

Dr. John Plodinec is the Associate Director for the Community and Regional Resilience Institute (CARRI) at Oak Ridge National Laboratory. In this role, he is responsible for identifying and evaluating technologies useful for enhancing community resilience. He also is playing a leading role in development of CARRI's Community Resilience System and he has also been heavily involved with CARRI's engagement with the Charleston, SC, region.

Dr. Plodinec recently retired as the Science Advisor from the U.S. Department of Energy's Savannah River National Laboratory (SRNL). In this position, he led SRNL's Laboratory-Directed Research and Development program, as well as developing strategic partnerships in areas aligned with the laboratory's primary thrust areas. As part of this effort, he developed CARRI's Resilient Home Program, aimed at improving the survivability of American homes to disaster. This built on earlier work he did while at Mississippi State University, where he led the university's efforts to establish programs related to severe weather. Dr. Plodinec helped his research group become the first entity in the state of Mississippi—and one of the first in the nation—to win a competitive award from the Department of Homeland Security.

Dr. Plodinec is also an internationally recognized expert in nuclear and chemical waste management. He was the Department of Energy's primary author for the Waste Acceptance Product Specifications, which govern all of the high-level waste glass products produced in the United States.

If you know nothing else about Dr. John Plodinec, then you need to know this—he is both a prolific reader and writer. In addition to the thoughtful and scholarly article Dr. Plodinec has written for these proceedings, I commend readers interested in resilience to review the extensive writing on the CARRI website blog pages that offer the assembled thinking of Dr. Plodinec and his colleagues. The blog can be found at http://blog.resilientus.mediapulse.com/author/jplodinec/.

Reading through the blog postings, it is clear that Dr. Plodinec is constantly and consistently examining and reexamining the world as he sees it through the lens of resilience.

Similarly, the paper by Dr. Plodinec provides a well-crafted explanation of the Community Resilience System (CRS) developed as a collaboration of CARRI. The CRS serves as architecture for communities to assess themselves, determine critical assets that are at risk, and as a result, how they will invest their limited resources to maintain a healthy balance between immediate and future, possibly less certain, needs.

In his paper, Dr. Plodinec draws on the language of environmental science in referring to a community as an ecosystem which is bonded together, in varying degrees depending on the community in question, by its social capital. The paper lays out an approach that allows, in theory, a single community to understand the complex relationships and interdependencies on which its continuity depends and then to understand the vulnerabilities associated with those dependencies and formulate a plan to strengthen the most critical of those elements.

The paper suggests that an effective CRS should help a community quickly stabilize and then recover after a disruptive event. Dr. Plodinec offers a community resilience cycle as a framework or model for the stabilization and recovery phases of coping with a disruptive event. He provides numerous examples, mostly from communities affected by Katrina, to substantiate the model.

The paper suggests a four-step process for communities to become more resilient based on organizing, assessment, planning, and action. Interestingly, this process, although in a different sequence, is not dissimilar to the four-step Deming Cycle—plan, do, check, and act—that is the basis of many management systems' approach-based standards for business continuity and organizational resilience.

The paper concludes with an example of a truly resilient community from the past, Charleston, South Carolina. Charleston rebuilt

itself after a devastating cyclone in 1885 in just 16 months without the benefit of either state or federal funding. This example leaves the reader to wonder how far the pendulum of dependencies has swung toward dependency on state and federal funding to help remediate after a major disruption. The paper concludes by offering 10 guiding principles for a community resilience system.

Overall the approach taken by Dr. Plodinec is easy to understand and quite intuitive. I commend this paper to anyone interested in considering a field-tested approach to improving resilience at the individual community level.

Being Vulnerable in a Resilient Community?

Ms. Corinne Bara-Zurfluh is a researcher at the Center for Security Studies, Crisis and Research Network, ETH Zurich. Ms. Bara-Zurfluh holds a master's degree in political science and public international law from the University of Zurich, where she focused on peacekeeping operations and humanitarian intervention, direct democracy, and electoral studies. She has previously worked for the Swiss Federal Department of Foreign Affairs and the International Relations and Security Network at the Center for Security Studies.

Ms. Bara begins her thesis with an examination of resilience through the lens of coping skills in communities affected by a disruptive event. In particular, her paper offers its perspective by examining the financial aspect of coping. Individual stress during or immediately following a disruption is characterized by our ability to pay for the repair and recovery of our life systems to return them to the state they were in before the disruption. The paper provides the reader with an opportunity to rethink some more conventional approaches to disasters by considering the effect on individuals rather than over-focusing on the hazard itself. Ms. Bara suggests that there are several key elements that include access to diverse financial resources, social capital, and adaptability that assist in coping with the financial impact of disruptive events.

Ms. Bara's paper goes on to consider the impact of social vulnerability as a key indicator of increased risk especially for some members of the community. Drawing extensively on the work of resilience luminary Susan Cutter, Ms. Bara revisits the Hazards-of-Place Vulnerability Model, which highlights, among other things, the impact of "age, gender, race, and socioeconomic status" on increasing social vulnerability of the population.

Ms. Bara's paper examines these constructs by carefully unfolding the disastrous floods that occurred in Switzerland in 2005. It is clear that the Swiss society was resilient in relation to the 2005 floods and that resilience was possible due to a carefully planned distribution of risk, through a combination of personal savings, insurance, reinsurance, and charitable donations to assist with unmet financial needs.

Overall, Ms. Bara's approach is easy to digest and informative to the thinking on resilience. Most notably, Ms. Bara asks us to consider the complexity of relationships that define communities, suggesting that it is not possible or desirable to separate individuals and communities when considering coping mechanisms.

Organizations—Their Role in Building Societal Resilience

Ms. Rita Parker is the Chief Executive of Innovative Solutions for Security and Resilience, Australia; a Visiting Fellow, Defence and Security Applications Research Centre, University of New South Wales at the Australian Defence Force Academy; and subject matter expert at the Center for Infrastructure Protection, George Mason University.

Ms. Parker has an established background in security and resilience issues with a particular focus on nontraditional security, crisis management, business continuity, and organizational resilience working across a range of topics including pandemics, counterterrorism, and civil-military cooperation for humanitarian relief operations. She has broad-based policy experience as a senior advisor in the former Office of Security and Intelligence Coordination in the Australian Depart-

ment of the Prime Minister and Cabinet, and as a senior manager in the Department of Defense in the Office of Transport Security and in the Attorney-General's Department. Ms. Parker was the National Strategic Manager for the largest counterterrorism exercise in Australia, Mercury 05, and advised the Australian Department of Health on its first pandemic influenza exercise, Cumpston. After gaining her MBA, Ms. Parker established the consulting organization Innovative Solutions for Security and Resilience, providing advice to organizations on developing their corporate resilience and conducting diagnostic assessments of key organizational capabilities. In 2010 she convened and led the Australian Technical Working Committee to develop the National Standard for Organisational Resilience. Ms. Parker was a contributing author for the book *Resilience and Transformation*, published by the Commonwealth Scientific and Industrial Research Organisation.[6]

I had the pleasure to first meet Ms. Parker in 2010 when she and I both shared a podium at the Security Analysis and Risk Management Association annual conference at George Mason University. Aside from our common heritage, it soon became obvious that we shared an interest in resilience, specifically organizational resilience and how it relates, almost inexorably, to other forms of resilience.

It was with that common interest in mind that I asked Ms. Parker if she would be willing to consider contributing to the symposium. Luckily, she agreed and the result of that initial collaboration follows as she offers her considerable knowledge and thinking on organizational resilience.

Rita Parker, like any true Aussie, is masterful at weaving a story to establish her point. Her metaphorical comparison of the frog and the bicycle as systems, one of which can be disassembled and reassembled and work perfectly thereafter and one which cannot, provide a perfect example of her use of stories to illustrate a key argument.

6 Australia's national science agency.

During her paper, Ms. Parker sets out the case for system of systems thinking about resilience, using examples drawn from Australia's most recent disasters, the floods of January 2011.

There can be little doubt that one of the clear value propositions that a resilience-based approach offers is the importance of holistic rather than stove-piped assessments, specifically of risk, processes, and capacities. Rita Parker's paper elaborates on some of the considerable risks for organizations that fail to consider themselves and their environment holistically, including an examination of their role in the greater community.

In her paper Ms. Parker notes that thinking about critical infrastructure in both Australia and the United States has matured from "infrastructure protection" toward "infrastructure resilience," recognizing the critical role of organizations as a part of the "resilience continuum." Moreover, Ms. Parker's paper provides an excellent argument for inclusivity of communities and all organizations, not just those who own or operate critical infrastructure, as partners in planning across the resilience continuum.

This thoughtful paper by Ms. Parker is both on point and worth the investment to read it from beginning to end.

Like all the papers presented in these proceedings, I encourage the reader to examine the thinking, in particular the combination of disciplines that have contributed to the symposium and the resultant proceedings. After reading the work of these distinguished researchers, your thinking and ideas will be changed.

Bases for a Community Resilience System

Dr. John Plodinec

Introduction

American communities are faced with a combination of threats unique in our nation's history. They are threatened by the specter of natural and human-induced disasters, while trying to recover from an historic economic disaster. Globalization has made a pandemic due to the rapid spread of highly infectious diseases ever more likely. New hazards induced by global climate change may imperil their very existence.

Many communities are successfully reinventing themselves to better withstand these threats, recognizing that they must adapt or risk becoming another failed city. In the great American tradition, these communities have recognized the importance of relying on themselves to reduce the risks they can control and of preparing to bounce back faster and better from risks they can't. This is the essence of community resilience.

While some communities have become more resilient, many more have not been able to—they simply don't know how. Communities

need a way to help them harness the talents and energy within themselves to become more resilient. There is no playbook that helps communities position themselves so that they can become more resilient. There are no comprehensive guidance documents that lead communities through the processes of critically examining themselves, of identifying critical assets at risk, of making wise investment decisions that balance present needs against contingencies for future disasters. While there have been some successes in achieving more resilient communities, there is no easily accessed source of information about how these successes were achieved. Based on its experience working with communities and an extensive body of research, the Community and Regional Resilience Institute (CARRI) believes that the time has come to develop a useful and usable community resilience system that communities will use to become more resilient.

When we talk about a community resilience system, we're talking about a set of processes, guidelines, incentives and supporting resources that communities can use to enhance their resilience—to better anticipate the risks facing them, to take actions to limit the impacts of the risks they face, to respond more effectively in the face of disaster, and to recover faster and better than before. By doing so, communities will also find ways to perform their essential functions more effectively and efficiently even when not facing disaster, which may be the ultimate reward for their efforts.

In the following sections, we describe the bases for a community resilience system. We first consider the nature of communities. We then look at the threats facing communities, both in terms of chronic stresses and sudden shocks. We then look at community resilience—what it means, and how it can be recognized. Finally, we look at process—how a process to achieve community resilience should be shaped.

Communities

The Community Resilience System (CRS) is based on the concept of a community working together to become more resilient. We think of a community as

> A group of individuals and organizations bound together by geography and perceived self-interest to efficiently carry out common functions.

A community may be thought of as an ecosystem. The community ecosystem would consist of individuals and families, economic and civic institutions, and the built and natural environment, all bound together by social capital, as depicted in Figure 1.[1] First and foremost, communities are made up of individuals and families, each with their own hopes, dreams and aspirations. The members of the community belong to the community because they believe they benefit from being a part of it. The benefits may be financial, or social, or simply an emotional sense of well-being. But individuals must see benefits, or else they are unlikely to contribute to the community.

[1] The concept of a community as an ecosystem is certainly not original, and has been used by many others. The specific representation of a community used here is nearly identical with that in the draft National Disaster Recovery Framework, with one difference: this representation explicitly recognizes "individuals and families" as a part of the community ecosystem while the NDRF's representation does not.

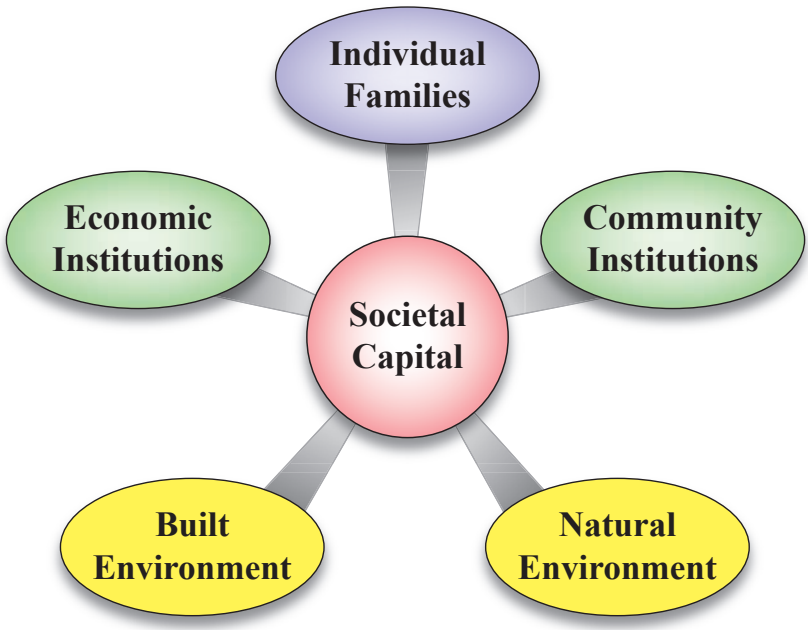

Figure 1: The Community Ecosystem

A community has both a built and a natural environment. The built environment includes all of the community's infrastructures—for example, the water, power, communications and transportation infrastructures—as well as residential housing and other facilities. The natural environment includes the rivers and streams that flow through or by the community, any undisturbed wilderness areas, and the air the community breathes.

Economic and civic institutions are the engines that provide the community with its vitality. Economic institutions include businesses and groups devoted to the economic development of the community. Civic institutions are those that are focused on the non-economic aspects of community life, e.g., faith-based and charitable institutions, organizations providing social services, school systems, museums and groups devoted to the arts.

The parts of the community ecosystem are bound together by the social capital within the community. Thus, social capital is the essential motivating force that leads to common goals and shared resources to meet those goals. Social capital is an amalgam of

- Trust—mutual respect; and a belief, born of experience, that other community members will carry out their parts in achieving a common purpose.
- Communication—sharing information, whether it is shaping the common purpose or what is to be done.
- Leadership—developing a common sense of purpose around a vision, communicating the vision, and enlisting and empowering others in the community to achieve the vision. Without leadership,[2] a community may not develop a vision of what it wants to become, and are unlikely to make progress.
- Effective governance[3]—open, transparent and inclusive decision-making processes. The effectiveness of governance thus plays a critical role in determining what a community can actually achieve.
- Strong interpersonal networks—establishing and maintaining relationships that connect each of the parts of the community with one another.

Government plays a unique role in the community ecosystem because it is a part of each of the components. It is, of course, made up of individuals, many of whom live in the community. It is also an economic institution—regulating business while at the same time working to develop the local economy. It is a civic institution, providing important civil and social services. The government in a community often is an "owner" of some parts of the built environment, and in

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[2] The CRS must recognize that leadership may reside in many parts of the community, not just government or commercial institutions. The literature on the subject suggests that communities are stronger if their leadership comes from several parts of the community, working together effectively.

[3] We do not assume that governance is the sole province of government in formulating the CRS. In fact, community norms are often better enforced through other community institutions, e.g., faith-based organizations.

most communities is the *de facto* defender of the natural environment.

The vitality of the community ecosystem depends on the richness of its social capital—even a community poor in material resources can survive a great disaster if there are sturdy bonds among its parts. The rapid recovery made by the Vietnamese Village de L'Est community after Hurricane Katrina is a shining example of the power that lies within community connections.

The importance of a community's social capital cannot be overstated. If a community has little social capital, there is a real danger that the life of the community will become a sort of Zero Sum Game, where each part of the community blocks the improvement of any other part out of fear that its own share of the community pie will get smaller. Where there is a rich store of social capital, each part of the community recognizes the value of sharing resources to make the pie bigger for all.[4] Thus, a major focus of the CRS must be to help communities enhance their social capital.

Communities across America have other common attributes that will shape the Community Resilience System.

- Communities have a common geographic location. However, they need not have a common government, nor any government at all (e.g., an unincorporated area might be a community). The CRS should be flexible enough to meet the needs of unincorporated communities, neighborhoods that are a part of a larger jurisdiction, and even regional communities that encompass several political divisions.
- Communities are heterogeneous. Communities have rich and poor members; members of different races and ethnic backgrounds; members who are there because of a job assignment, and those who are there because of a deep-rooted sense of

[4] Phil Hartman (now at Mississippi State University) has pointed out that the degree to which a community engages in "making the pie bigger," and avoids the Zero Sum Game mentality, is an excellent indicator of its success in economic development.

community and place. These heterogeneities almost inevitably mean that there will be disagreements about goals and priorities. The CRS has to recognize the potential for conflicts and should help community members find a common purpose.

- Communities have an identity. When members think about their community, they probably think of it in terms of a handful of institutions—perhaps the factory at the end of the highway, perhaps the drug store where everyone gathers to hear the latest gossip, perhaps the aquarium, sometimes the mayor who has been in office for 35 years. Beyond the institutions, however, lies a deeper cultural identity—a view of the world around them colored by the rest of their community's ecosystem. The CRS should help a community to recognize and articulate its identity, so that the community can best protect and enhance them.
- Communities have assets. Even though "assets" has an economic connotation, communities should think of assets in much broader terms—as anything that helps the community to function. An outstanding hospital, a flourishing business community, and a major league sports team are readily thought of as community assets. While strong social networks might be less obvious, in times of stress they are likely to be the most important assets the community possesses. Sometimes assets are a part of the community's identity, but they need not be, particularly in larger communities. The CRS should help communities identify their assets, particularly those essential to community functioning.
- Communities are a system of systems. Communities function through systems that include community members but may also include individuals and organizations outside the community. For example, the only community members of the food distribution system for a large city may be the consumer and the store where he or she buys their food. The entire system would include many who are not part of the community, all the way back to the farmers who grow the food. The CRS should help communities to better understand the important

systems affecting them, and the degree of control the community can exert over each of these systems.

- The parts of a community are interconnected. This leads to a complex web of *interdependencies* within and among each part of the community ecosystem—in which an action by one part of the community impacts other parts, often in unforeseen ways. As an example, while bringing a major new employer to the community can be cause for rejoicing, it is also likely to put new strains on a community's infrastructure, its social services providers and its schools. The CRS should help communities to discern interdependencies that affect their vitality.

Community Resilience

Threats, Crises, and Disasters

Every day, communities are stressed in a myriad of ways. Each part of the community experiences stresses that can impact other parts of the community—buying a new home, being laid off from work; a major employer leaving the community, a company capturing a major new customer; building a new church, losing an historic landmark; starting up a new water system, brownouts from inadequate electric generation; setting aside a new green area, pollution entering a stream from an abandoned industrial site. These stresses may reflect an underlying chronic condition—the endemic poverty of a neighborhood, for example. Or they may result from an acute event—a hurricane or an earthquake. Each stress can be thought of as a symptom indicating a threat to the community.

Some stresses are foreseen, and even sought. A community may actively entice a major employer to relocate to their community even though that will introduce new stresses on the built environment. Many stresses are "surprises," shocks that reflect the inherent uncertainty of existence (tornadoes, floods). Some communities will recognize a threat and take action to relieve the stress (e.g., spurring

economic activity in an impoverished neighborhood through micro-loans to small businesses). Others may ignore the threat, in hopes it will go away. Some others will recognize the risk, but take no action, and accept the consequences.

The interdependencies among the parts of a community, and between a community and others in its region (and perhaps even in other countries), can lead to unforeseen threats and unpleasant surprises. As depicted in Figure 2, communities "A" and "B" might experience a crisis (e.g., a hurricane) that overstresses parts of each community (for example, damaging infrastructure). Interdependencies within the community will lead to cascading consequences (e.g., damage to the transportation system can seriously impact economic institutions, reducing the resources available to community institutions, and so on). The interdependencies between "A" and "B" may lead to secondary impacts on each other (e.g., disrupting "A's" transportation system may lead to food shortages in "B"). Community "C"—though not directly impacted—may suffer secondary impacts because of these interdependencies (e.g., evacuees from "A" and "B" suddenly appear on "C's" doorstep; the economy of a suburban bedroom community is disrupted by detonation of a dirty bomb in a nearby urban center).

When a part of the community—or the entire community—is so stressed that it is at the limits of its resources, a crisis occurs. Some communities are overwhelmed. These communities change in fundamental ways so that in a real sense they are no longer the same community.[5] Other communities "fail gracefully." They may not have enough internal resources to cope with the crisis, but they have enough cohesion, vision, and leadership to eventually rebuild the community to the pre-crisis level of vitality. Other communities, through a combination of foresight, competence and richness of resources, are able to cope and rapidly recover. For those communities

[5] New Orleans is a good example of a community that was overwhelmed (by Hurricane Katrina), and that has reorganized itself into something that is not the same as it was before.

that are overwhelmed, the crisis is a disaster (As Alesch has observed,[6] we denote disasters by the triggering event—the crisis, but we define them by their impacts. Many hurricanes have struck the United States, but Katrina is known because of its consequences.).[7] For the others, the crisis is most likely a painful learning experience that helps them better prepare for the next crisis, whatever it may be.[8]

Fundamentally, the CRS should help communities weather crises and avoid disasters whenever possible. Thus, the CRS should play a central role in helping a community manage risk.

- It should help communities to identify the risks they face: the major stresses facing them, especially those that could become crises. These include important chronic problems affecting each part of the community, as well as extreme events that can threaten the community's continuity (e.g., hurricanes, pandemics, and recessions).
- The CRS should guide communities in identifying their internal networks and interdependencies, and important connections beyond the community.
- It should help communities to identify their own resources—social, institutional, physical—available for coping with stress and crisis, and especially help the community to determine where the limits of those resources are.
- It should help the community identify the likely consequences of the crises it may face.

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6 Alesch, Daniel J., Arendt, L. A., Holly, J. N. *Managing for Long-Term Community Recovery in the Aftermath of Disaster*. Fairfax, VA: Public Entity Risk Institute (2009).

7 The idea of a disaster as "overwhelming" parts or all of the community is meant to be consistent with the definition of "disaster" promulgated in the UN's International Strategy for Disaster Reduction: "*a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected communities or society to cope using its own resources*."

8 It appears that the recent devastating flood in Nashville has resulted in such a painful experience, but one that the community as a whole is, in fact, learning from.

- The CRS should help communities devise strategies for reducing stresses and dealing with crises. An important part of this is providing communities, and each of their parts, with strategies for successfully dealing with stresses and crises that have proven effective elsewhere.

Interdependencies and Cascading Consequences

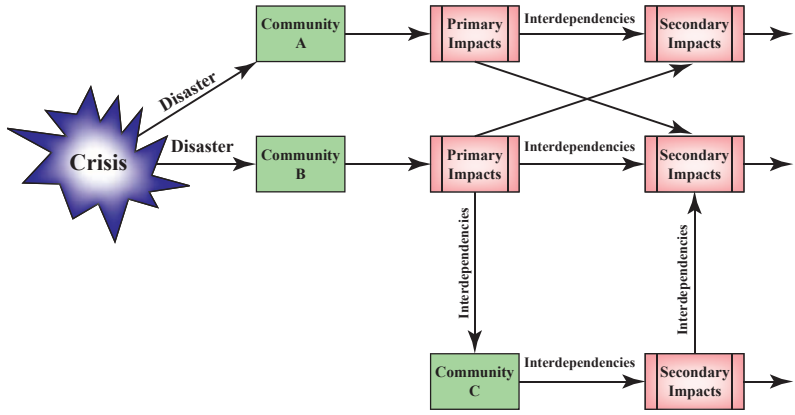

Figure 2: Extreme Events Are a Crisis for the Community, and Affect Others Linked to It

Community Resilience

The Community and Regional Resilience Institute has defined *community resilience* as

> The capability to anticipate risk, limits impact, and bounce back rapidly through adaptation, evolution, and growth in the face of turbulent change.

Resilience, like sustainability, has been defined by so many, in so many different ways, that it is in some danger of losing its meaning. But the core concept in virtually all the definitions is the idea of "bouncing back" or returning to normal functioning.

Thus, some say resilience is an emergent property—we can only judge how resilient a community is by how well it copes with a crisis and recovers from disaster. The CRS is predicated on a somewhat different view—a community manifests its resilience just as much in responding to normal stresses as it does in recovering from disasters. It follows, then, that actions communities take to improve their ability to recover rapidly and well from disasters—to improve their resilience—should also improve their vitality even in times of less stress.

Both research and practical experience indicate that, after a disaster, the speed and completeness of a community's recovery will depend on:

- *The community's vulnerabilities.* If homes, buildings or bridges in the community were constructed without thought of building codes, or—more importantly—the types of natural shocks they would experience, then the community's built environment is vulnerable to natural disasters. If the economy depends on a single employer, then the economic institutions are highly vulnerable to both national recessions and economic shocks that affect only that business. If a substantial portion of the community's populace are poor, or uneducated, or out of a job, then they will potentially be overwhelmed by almost any shock to the community.
- *The type of disaster.* Pandemics have minimal direct impact on the built and natural environments, but can devastate individuals and families, and ravage social capital.[9] Natural disasters may savage the built and natural environments, but, as shown by the examples from Hurricane Katrina below, communities can quickly recover if there is sufficient social capital.
- *The intensity of the disaster*. No matter how strong any single part of the community ecosystem is, it is likely to be overwhelmed if the disaster is intense enough.
- *The resources available for recovery.* A community needs both

[9] The recent H1N1 pandemic had little impact on any community's social capital. However, the influenza epidemic of 1918–20 clearly tore at the social fabric of communities across the US, of all types.

physical resources and the people to use them in order to recover. Disasters diminish one or both of these.

- *The ability of the community to use available resources.* This speaks directly to the social capital in the community. If there is a common vision, effective governance and competent leadership, the community is likely to rebound relatively rapidly—even if there seems to be a dearth of available material resources.

Ultimately, community resilience is a reflection of and depends upon the entire community, not just one part of the community ecosystem. While some claim that a community is only as resilient as its weakest link, experience indicates that weakness in any one part can be compensated for by strong social capital within the community. The example of Village de L'Est after Katrina has already been alluded to, but bears amplification. Prior to Katrina's landfall, Father Nguyen The Vien (the Catholic priest) spearheaded a drive to get as many of the community as possible out of harm's way. Members of the community who could leave were taken to public venues (e.g., parking lots of Vietnamese shopping areas) outside the danger zone where they were met by local Vietnamese who sheltered them. The leadership of the Vietnamese community remained behind to take care of those who could not leave. Once the storm had passed, members of the leadership group traveled the community with laptop and camera to assess and record damage. Pictures were also taken of evacuees and of survivors left behind and rapidly distributed to relieve the fears of families who were no longer together (This also helped to reinforce the sense of community.). The community, again led by Father Nguyen, moved as rapidly as possible to gather building materials and to rebuild people's homes and lives. This is a tremendous manifestation of strong social capital overcoming a lack of physical resources.

The Social Aid and Pleasure Clubs in New Orleans provide an equally striking example. Members of these clubs—primarily African-Americans from the poorer, and hardest hit, sections of New Orleans—have a historic and ongoing mission of service to their communities. The

clubs quickly reformed after Katrina and the levee breaks as well. Their members were among those who recovered most rapidly.[10]

The CRS should enable a community to assess all parts of the community—their strengths and their vulnerabilities. The CRS must also help the community to understand itself and how its constituent parts depend upon and interact with each other. Thus, the CRS has to accurately reflect the role that each part plays in achieving resilience and the need for coordination, especially before a crisis but even after the immediate response to a disaster is over.

Community Resilience Cycle

A community resilience system should be useful to communities at any time during the community resilience cycle (Figure 3). The CRS should help a community *anticipate* what may happen before a disaster occurs. This includes identification of high probability threats, their potential direct impacts, and the cascade of consequences that can be expected. Based on this anticipation, the community must *limit impacts*. A community can choose to limit impacts by preventing damage from occurring, by protecting the system, or by providing early warning systems that allow at least part of the community to "fail more gracefully," facilitating recovery. In general, this requires that the community invest in itself to try to prevent a disaster from occurring. Thus, the CRS should help the community to make optimal choices between current needs and future challenges—ones that maximize the vitality of the entire community while minimizing disproportionate impacts to any one segment of the community.

Once a crisis occurs, a CRS should help a community *respond* effectively—quickly assessing damage and impacts, and taking action to restore essential services in a way that facilitates actions to ensure the community's future vitality. Finally, once the situation is stabilized,

[10] For those interested in the recovery of New Orleans, the Brookings Institution and the Greater New Orleans Community Data Center's latest compilation, *The New Orleans Index at Five*, contains some extremely pertinent information, particularly the work of Rick Weil.

the CRS should help the community *recover* as rapidly as possible, and begin anticipating the next crisis—recognizing there is a high likelihood that the next crisis may be different.[11]

Planning is an essential part of each of these actions. As a nation, we have focused on planning to respond; however, planning to limit impacts and to recover is just as important and deserves the same level of effort. For each, planning must recognize the "connectedness" of the community—how the community is put together, how it functions, how information and goods and material move through the community, and how the community depends on other communities. Planning must also include lessons learned from previous crises—what worked and what didn't. Planning for recovery should also strive to overthrow the "tyranny of what was" to improve the community's overall vitality by building back better.

[11] As an example, New Orleans was impacted by a recession in 2001-2, hurricanes Katrina and Rita in 2005, the Great Recession in 2007, and the Deep Horizon oil spill in 2010.

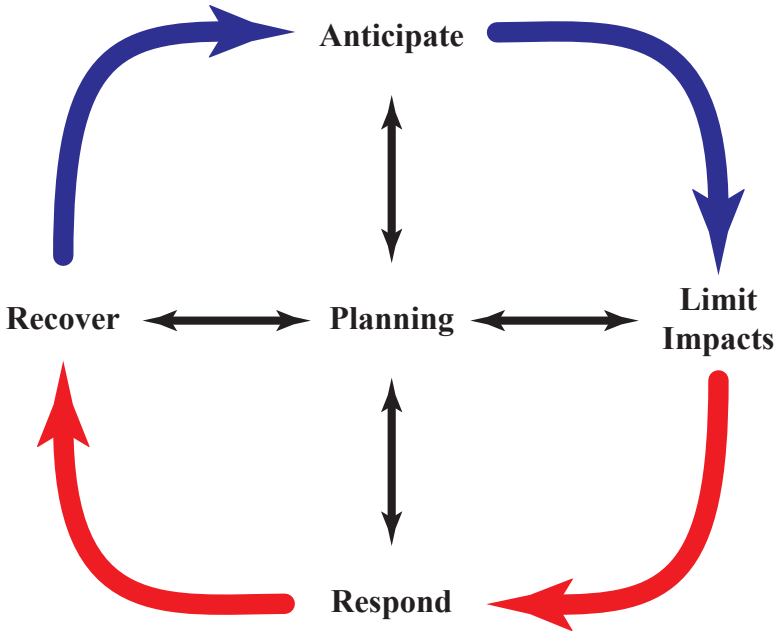

Figure 3: Community Resilience Cycle

The Village L'Est community again provides a valuable example. The community already had developed plans for community improvement prior to Katrina, and, in fact, had developed a Community Development Corporation to implement those plans. While Katrina disrupted those plans, it also imparted additional impetus in interesting ways. One of the plans in the works had been to build a retirement home, surrounded by a communal farm and a farmers' market. At the community's urging, FEMA built a temporary trailer park on the site of the retirement home, in such a way that the utility infrastructure for the trailer park could be used for the intended retirement home.

Planning must also consider the resources available to carry out each action. For each phase of the cycle, the spectrum of resources available is likely to be different. The community will have to rely almost entirely on internal resources during the anticipation phase. While

some state or federal resources may be available to limit impacts, the community will again primarily have to invest its own resources. During the response phase, extensive external support likely will be available, but the community may have lost many of its own resources due to an extreme event. During recovery, communities must expect to expend a large amount of their own resources even though significant external assistance may be available. Whatever the source of resources, the community must take charge of its own destiny—planning for recovery, obtaining resources to carry out the plan, and then using those resources to greatest effect. Thus, the CRS should aid communities in formulating and implementing plans that will actually work.

Becoming a More Resilient Community

In order to become more resilient, a community must

- ***Organize*** so that it can use the power inherent in a horizontally (citizen to citizen, organization to organization) cohesive community while leveraging the resources of existing hierarchical action mechanisms (e.g., municipal government).
- ***Assess*** its assets and liabilities, identify the potential threats it faces, its vulnerabilities to each of those threats, and the resources available to it to resolve crises.
- ***Plan*** by developing a realistic vision of what the community wants to be, and identifying the paths it will follow to convert itself from what it is now to what it wants to become.
- ***Act*** to carry out the plan, evaluate progress, and alter course as needed.

Organizing the Community

As with any journey, the first steps toward enhanced resilience are crucial. One or more leaders[12] in the community must first become convinced that the journey is worth undertaking and become a "champion" for the idea. That champion must then interest and enlist peers to develop a community-wide initiative.

Ideally, the leadership of the initiative should reflect the full fabric of the community. For less complicated communities, the "community ecosystem" (Figure 1) can be used to determine who should be part of this leadership team. Thus the team might be comprised of one or more representatives of economic institutions (e.g., President of the local bank), civic institutions (e.g., the Executive Director of the local United Way), those responsible for the built environment (e.g., President of the local electric utility), those responsible for the natural environment (possibly local government), and individuals and families (e.g., an influential member of the clergy). As indicated earlier, leader(s) of local government(s) would also be included because of the ubiquitous nature of local government in communities. If a community cannot get a leader from every part of the community ecosystem to participate, then the CRS is unlikely to produce satisfactory results.

There are several ways for more complex communities to determine who should be part of the leadership team. The CRS uses the concept of "community services" to provide a reasonably comprehensive method to ensure that the entire community is represented on the leadership team. Briefly, the community is defined in terms of a set of systems that each provides a service that sustains the community (Table 1).[13] Ideally, the leadership team should include a leader for each functional system. This approach is comprehensive and—be-

[12] For purposes of this discussion, a leader is someone who can bring resources to the table. In this context, "resources" can include funding, influence in the community, or human capital.

[13] This is a more detailed approach than that proposed by Bruneau (2003), but certainly related to it. We prefer this approach because it is both more intuitive to use, and more apt to ensure that the leadership team represents the entire community.

cause some services are provided by several organizations—is conducive to identification of community interdependencies. It also provides a convenient means to classify the large amount of information available for most communities.

Most communities are unlikely to have leaders for each service within their community. In particular, it is unlikely that any community would be able to find leaders for all of the services impacting the local economy. For those, the community should take a more regional approach, inviting regional or state leaders to participate. If there is no leader within the community for a particular service (e.g., electricity is supplied by a regional, not a local, entity), the community should invite participation from someone with responsibility for this service, even if not a member of the community. If they decline to do so, then the community's journey to heightened resilience is likely to take longer, and will be more problematic.

Table 1: Community Services

Arts, Entertainment and Recreation
Communications
Community Records
Economic
Education
Energy
Financial
Food Supply and Distribution
Housing
Individuals and Families
Local Government
Natural Environment
Public Health
Public safety and security
Solid Waste
Transportation
Water
Workforce

Once the leadership team is formed, it is responsible for

- ***Engagement of the community as a whole.*** Representatives of each part of the community should socialize the need for the initiative to their constituents and to the larger community. At significant points throughout the journey, the leadership team should pause to present its results, conclusions and "next steps" to the entire community to either verify or to change them.
- ***Assessment, planning and implementation.*** It is unlikely that every member of any community would want to be involved in each step of data gathering and interpretation, visioning and planning, or implementation. The leadership team, representing the entire community, should guide the detailed work necessary for progress. However, since the community as a whole can collectively either halt or speed the journey, significant community-wide involvement at key decision points is essential.

It has to be recognized that the journey to greater resilience may take years, or even decades.[14] Thus, it is unlikely that the entire leadership team will remain in place without change. Indeed, change is almost inevitable and should be welcomed. Champions of a resilience initiative may be useful in assessing and planning, but may add little in terms of actually carrying out a plan. Those skilled in implementation may lack the vision to discern a desired direction for the community. As one set of problems is solved, others are likely to come to the fore, requiring a different set of resources for solution, hence different leaders to guide the initiative.

Assessing the Community's Resilience

The purpose of the assessment is to tell the community where it is in its journey. At this stage, the community defines its assets, especially

[14] As an example, efforts begun in Charlotte, NC, in the 1970's did not come to fruition until at least the 1990's. Similar efforts in Cleveland, OH, started in the 1980's and are still underway (with no guarantee of success).

those that are few in number, very difficult or expensive to repair or replace, and that are essential to community functioning. These may come from any part of the community; thus, may be economic, social, as well as physical. A community should also try to determine its overall trajectory—is it becoming stronger, are assets deteriorating, is the social fabric unraveling, is its unique identity becoming blurred.

As another part of the assessment, the community identifies the actual threats it faces—considering all possible threats, whether natural or human-induced; whether economic, social or environmental. While "multi-hazard" threat assessments have focused on natural disasters or terrorist threats, we have all seen that a recession can wreak just as much havoc in people's lives as a hurricane. Thus, this part of the assessment transcends traditional emergency management considerations.

Once assets and threats are identified, the community can assess which assets are at risk, and how they might be redeveloped if damaged or lost. In particular, the community should identify the resources that are available for community redevelopment and renewal. These include both those within the community's immediate control (e.g., contingency funds, individual savings, credit and loans); and those that it can access from others (e.g., insurance, volunteers, specialized manpower from organizations outside the community, federal and state grants and loans). In many cases, the community will decide to access these resources prior to any crisis in order to strengthen the community.

Planning to Enhance Resilience

An African proverb says that a man who doesn't know where he's going doesn't need a map. Thus, planning begins with the community defining for itself where it wants to go—what it wants to be in the future. It is essential that the leadership team solicit input and feedback from the entire community throughout this part of the journey. A widely accepted vision of its future not only helps the community

to craft a plan more likely to be successful, but also—in the event of a disaster—can help to inform the decisions made by each of its members as they individually take steps to rebuild their lives.

Together, the assessment and the vision lay out a direction for the community's future. The plan is a sort of map, laying out the steps that will lead the community from where it is to where it wants to be. These steps should be tangible, and clearly tied toward achieving the vision. In developing the plan, the community should recognize that there might be oceans between its "now" and its vision of its future that the community cannot cross. In these cases, the community should go back to its vision, and turn it into a destination it can reach.

Tarboro, NC, offers an object lesson of the importance of having as realistic a vision and plan as possible. Their vision of the future was a version of the small town experience of the past—a thriving main street that would spark redevelopment of the entire community after the flooding from Hurricanes Dennis and Floyd. It hasn't quite worked out that way. In particular, the vision apparently did not consider nearby shopping malls that effectively were a barrier to realizing the vision. Although their plan may eventually come to fruition, a more realistic vision and plan would have been more likely to result in rapid redevelopment and re-growth of the community.

Taking Action to Enhance Resilience

Once the plan is developed, the leadership team organizes to work the plan. This may mean changes in membership; visionaries may give way to engineers. However, it is important that the visionaries maintain contact; they can serve as both evangelists to the community at large, and a sort of conscience and collective memory for an evolving leadership team.

As the plan is worked, it is important that progress is evaluated frequently and publicly. The entire community should have the opportunity to weigh in on what it is seeing, and changes in direction it

sees as necessary. At the same time, successful completion of key steps should be recognized and celebrated. Great progress is the result of many small steps; motivation to continue the journey requires celebration of progress along the way.

In 1885, Charleston was assailed by the Great Cyclone, which caused damage throughout the city and along the coast. Just as the community had finally begun to recover, in August, 1886, the regional community was struck by a massive earthquake (7.4 on the Richter scale), which killed at least 128 people, and left tens of thousands homeless. The quake was so powerful it was felt from Omaha to Bermuda, from Toronto to Havana. Yet, in only 16 months, the community had rebuilt itself, without federal or state funding. And in true Charlestonian fashion, they threw a party to celebrate.

More recently, Mississippi Gulf Coast residents celebrated the reopening of the Biloxi Bay Bridge after it was severely damaged by Hurricane Katrina. This was not the end of the area's recovery, but it did mark a significant milestone and re-energized community recovery efforts.

Guiding Principles for the Community Resilience System

This work leads to a set of guiding principles for development of the Community Resilience System.[15] They summarize well what the CRS must become.

- Community resilience begins with human capital (all community members, both public and private) and is the result of the daily activities of each member of the community.
- The CRS will aid the community in understanding the tangibles (resources and assets) as well as the intangibles (e.g.

[15] This set of guiding principles is the result of discussions that took place during the first Community Leaders Working Group meeting in Charleston, SC, April, 2010.

sense of place, cohesion, culture).

- The CRS will help communities develop a pre-crisis vision, outline a path to achieve a "new normal" (future baseline), address the deficiencies of the "old normal" (pre-crisis baseline), and ultimately create a more resilient community.
- The CRS will lead to "triple bottom line" outcomes involving the environment, human capital and the economy.
- The CRS will capture and reflect the needs and capabilities of the community (both vertical and horizontal); it will encourage and support community-wide, cross-sector partnerships and it will reflect the full fabric of the community.
- The CRS will help communities understand, optimize and leverage existing assets and interdependencies while simultaneously identifying and mitigating vulnerabilities in the aftermath of a crisis; ultimately aspiring for resilience.
- The CRS will help communities identify their cross-sector core leaders and networks of champions who are able to implement and manage efforts before, during and after crises.
- The CRS will be understandable to and useable by everyone in the community, whether experts or the general public.
- The CRS must be flexible and agile enough to be adapted and applied in communities of different sizes with diverse forms of government, demographics, geography and cultural identity.
- Evaluating community resilience and providing rewards for continuous, incremental improvement should lead to community vitality.

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Being Vulnerable in a Resilient Community?

Ms. Corinne Bara

Introduction

"Disasters are tracking points, in time and space, where the most unfavorable combinations of hazard occurrence, physical exposure and vulnerability conditions are revealed" (ISDR n.d.).

The statement above is the result of a remarkable evolution in the way disasters are construed. Rather than being an Act of God against which humankind is completely powerless, or an event in nature whose impacts can at best be mitigated by dams, shelters and stronger buildings, viewing disasters as a combination of hazard, exposure *and* underlying vulnerabilities acknowledges that there is something about the social fabric of a community that prohibits some natural events from becoming catastrophes. Two concepts are strongly associated with this paradigm shift in disaster studies: *resilience* and *social vulnerability*. The emergence of the two concepts in the 1970s marks a shift away from the hazard paradigm—a focus on the physical threats with a scientific and technical approach to gaining probabilistic information about them—to a focus on the people (Gaillard 2010).

The exact meaning of resilience and vulnerability is more than contested, which is due to the fact that both concepts continue to be used in a variety of academic disciplines. Even more obscure is the nature of the relationship between resilience and vulnerability. This paper aims to shed light on this relationship by reviewing some of the literature on vulnerability-resilience linkages to date and then proposing an alternative framework that puts a stronger emphasis on the appropriate level of analysis for each of the two concepts. The case of the 2005 flood event in Switzerland is used to illustrate the need for a combined resilience-vulnerability approach when analyzing the impact of natural disasters. In Switzerland—and in the global north more generally—natural disasters are often characterized by low mortality, but high economic losses (CRED n.d.). The focus of this paper is thus on financial losses from natural events and the ability of individuals and groups to cope with them, while excluding other possible disaster impacts such as human loss, people injured, damage to the natural environment, and "intangible" losses such as grief, physical and mental health impacts or the disruption of societies. In Switzerland, community resilience and social vulnerability to disaster have not received much attention in disaster studies to date. This gap reflects an understanding of disaster risk that is reminiscent of the "old" hazard paradigm in disaster research that focuses on the *hazard* side of the "disaster risk = hazard x vulnerability" equation (Garatwa and Bollin 2002). While the focus on hazards to date has gone a long way in reducing disaster mortality in Switzerland by contributing to the implementation of structural and non-structural preventative measures, there is a need for a stronger focus on the people and the factors that determine how they cope with financial losses from natural events. This paper is structured as follows: After introducing the resilience and vulnerability concepts in turn, the literature on the relationship between the two concepts is examined and further developed. The case study illustrates the factors that contributed to the resilience of Swiss society as a whole in coping with the financial losses from the 2005 flood event, as well as the factors that shaped the particular vulnerability of some individuals and groups and eventually led to unmet financial needs after the disaster. The final chapter draws

some lessons learned for further research on resilience and social vulnerability, and in particular the nature of the relationship between the two concepts.

Concepts

This section briefly introduces the two concepts of resilience and social vulnerability and discusses their usefulness in understanding how societies cope with financial losses from natural events.

Resilience and Coping with Financial Losses from Natural Events

In its most general sense, being resilient is to be able to "bounce back" after a disaster. Beyond that, however, there is no consensus on what exactly resilience means, which is due not the least to the fact that resilience has been and continues to be used in various disciplines. In a report published by the White House's National Science and Technology Council (2005), resilience is defined as "the capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure." The concept did not originate in the study of natural hazards, but has its roots in other fields such as ecology, child psychology, or engineering (Gaillard; Manyena 2006). Within disaster studies, the approaches rooted in ecological systems thinking—most famously Holling's (1973) work on the resilience and stability of ecological systems—have been dominant (Bohle 2009). The notion of a persistence of systems in the face of dramatic changes offered a compelling image, "a metaphor" (Norris et al. 2008) of how communities respond to and recover from crises. Resilience has been used for both technical systems and critical infrastructures, as well as societies. This paper only deals with the latter, often termed community or societal resilience. In emergency management, communities

are traditionally viewed in spatial terms as groups of people living in the same area or close to the same risks (Twigg 2007).

Given the popularity of the concept in academia and its adoption by security actors in several countries—among them Australia, Sweden, the US, and the UK (Brunner and Giroux 2009)—what value does the concept really add to our understanding of coping with a disaster? The resilience perspective marks an evolution in the way disasters are analyzed (Gaillard). At its core is the shift away from a focus on the hazard or threat itself to a focus on the people. As such it is closely linked to the notion of risk and uncertainty: Not all threats or disasters can be averted, and security never fully achieved, so that more effort should be spent on enhancing the flexibility and strength of a technical system or a society to deal with an event should it occur (Brunner and Giroux).

While the idea of resilience has been around for a while now, the current trend in policy and academia seems to go towards operationalizing resilience to translate the concept into practice. Such an operationalization may take the form of qualitative resilience assessments among communities or of quantitative resilience indices. A precondition for both is the identification of factors contributing to community resilience. Several factors have been suggested in the literature to date, so far however without an indication of the relative importance of each factor and on their interrelationship, e.g. whether the individual factors are cumulative or substitutable: Cutter et al. (2008) consider wealth, insurance, access to other financial resources, social networks, community engagement and participation, and a local understanding of risk to enhance social resilience. The International Federation of Red Cross and Red Crescent Societies' World Disasters Report (2004) groups resilience factors into natural capital (water, land, forests, minerals), financial assets (savings, income, credit), human capital (knowledge, skills, health etc.), social capital (reciprocity, affiliations, trust) and physical capital (shelter, buildings, lifeline infrastructure etc.). Norris et al. (2008) use a different categorization of resilience factors into economic development, social capital, community competence, and information and communication, while Brun-

ner and Giroux mention foresight and planning capacity to anticipate risks, trust and partnership throughout the community and between the public and private sectors and local communities, strength and flexibility, distribution of risk throughout society, and leadership. Moreover, the idea of adaptability/flexibility is included in several resilience definitions (Brunner and Giroux). And though resilience is usually only revealed after a disaster, resilience is more than response and/or recovery. Resilience applies to all phases of the disaster management cycle (prevention, preparedness, response, recovery), and it is exactly the strong emphasis on planning and mitigation *before* disaster strikes that distinguishes resilience from mere recovery (McCreight 2010). All these characteristics should ideally enable a society to react flexibly in the face of an extreme event yet maintain the "whole," or in other words: Bend, but not break (Brunner and Giroux).

Drawing from the characteristics of resilient societies listed above, the following resilience factors appear to be particularly relevant for coping with *financial* losses from disasters:

- A generally high level of **wealth** of a society raises the chances that individuals have the **financial assets** (savings, income, credit) to cope with unforeseen events, and that government has the resources for repair and recovery activities
- Access to a **diversity of financial resources** creates **flexibility** and **redundancy** (of financial coping instruments)
- (Financial) **risk distribution**, for example through **insurance**, makes sure that the financial impact of disasters is not disproportionately felt by certain segments of society
- **Social capital** (social networks, affiliations, reciprocity, trust and partnership throughout the community and between the public and private sectors and local communities) determines the access people have to informal risk management arrangements such as help from family, friends or community to complement private and public disaster assistance
- A strong emphasis on **planning and mitigation** as opposed to mere response and recovery enables systems of financial risk management, especially insurance and funds, to be created

before disaster strikes

- **Adaptability** enables a society to learn from previous disasters and improve its (financial) risk management strategies

The resilience factors outlined above help us analyze how people cope with financial losses from natural events. It should be noted that there is a slight difference between the "financial costs of visible physical damage" and the macroeconomic impacts of disasters (Benson and Clay 2004). The latter are more difficult to assess and quantify. Many of the risk management instruments available to individuals to repair this physical damage merely shift the financial burden from one party (the individual) to another, which facilitates coping on an individual level, but still impacts the economy. This is true for private insurance as well as financial assistance from the government authorities. High economic losses of a society at large can have important secondary impacts for the individuals living in this society, such as the postponement or abandonment of planned investments, reductions in the provision of public services, and deferment of wage and salary increases and of staff appointment (Benson and Clay). This paper is more concerned with how private individuals and communities cope with financial losses, and does not consider macroeconomic impacts of disasters. It does, however, briefly touch on the financial coping of small to medium-sized businesses and local governments.

The next section introduces the concept of social vulnerability to disasters, a concept that is closely related to community resilience.

Vulnerability and Coping with Financial Losses from Natural Events

What is social vulnerability to disasters and how does it help us understand the difficulties some individuals and groups have in coping with financial losses from natural events? As opposed to the vulnerability of built structures, social vulnerability approaches to disasters emphasize potential harm to people. Social vulnerability according to Blaikie et al. (1994) refers to "the characteristics of a person or

group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood are put at risk by a discrete and identifiable event in nature or in society." Just as in the case of resilience, the introduction of the social vulnerability concept to the research on natural hazards in the 1970s marks an evolution from a focus on the hazards (the hazard paradigm, e.g. a focus on the physical threats itself with a scientific and technical approach to gaining probabilistic information about them) to a focus on the people (the vulnerability paradigm) (Gaillard). It challenges the view that disasters are Acts of God, but instead depicts natural hazards as extreme events in nature that are made even more dangerous by either the acts or the neglect of people (Burton et al. 1993). Put very simply, a natural event can only become a disaster if it combines with social vulnerabilities, sometimes expressed in the formula "disaster risk = hazard x vulnerability" (Garatwa and Bollin). It is obvious that social vulnerabilities are always there, at least in populated areas. The added value of this approach is, however, that social vulnerability researchers have traditionally used it to highlight *differences* in disaster risk that cannot be explained by the differential exposure to hazards alone. For example, 90 per cent of the victims in the 1991 cyclone disaster that killed 140,000 in Bangladesh were women and girls, a fact that can hardly be explained by biological and physiological differences alone (Oxfam GB 2010). Social vulnerabilities hence determine the "degree to which different classes in society are differentially at risk" to suffer from an extreme event (Susman et al. 1983). This difference is rooted in physical, social, economic, and political conditions and inequalities in everyday life, which are independent of the hazard itself. The social vulnerability concept is used in disaster research as well as in research on global environmental change and development (in particular poverty and hunger), which partially explains the broad spectrum of vulnerability definitions and frameworks. In disaster research, one of the most popular vulnerability frameworks is the Hazards-of-Place model. The Hazards-of-Place model of vulnerability was promoted by geographers in particular (Hewitt and Burton 1971; Cutter and Solecki 1989;

Cutter 1996; Cutter et al. 2003) to bridge the hazard and vulnerability paradigms mentioned above. In the Hazards-of-Place perspective, vulnerability is the result of both biophysical exposure to the hazard (hazard paradigm) and social inequalities (vulnerability paradigm), but within a specific area or geographic domain (Cutter 1996). As illustrated in Figure 1, disaster risk (the probability of a hazard event happening) interacts with mitigation measures to produce the hazard potential. The hazard potential is either moderated or enhanced by the geographic context to produce biophysical vulnerability, whereas the social fabric of a place determines social vulnerability. The social and biophysical vulnerabilities interact to produce the overall place vulnerability (Cutter et al. 2003).

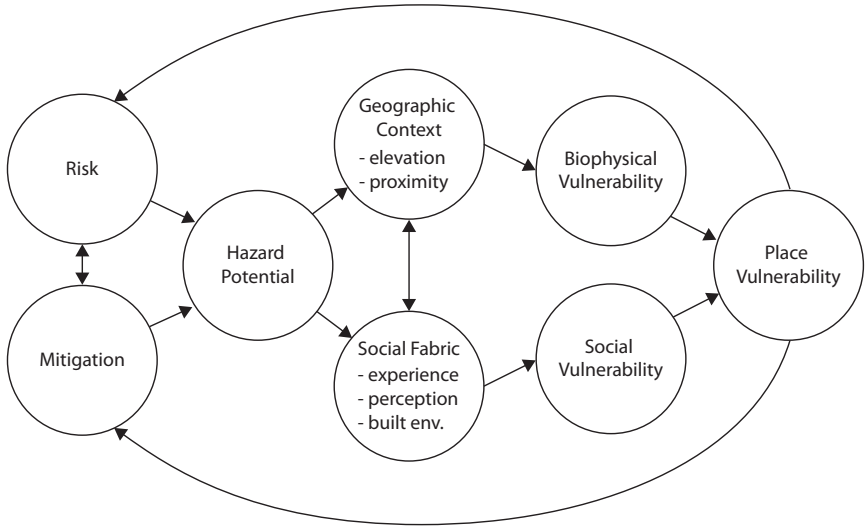

Figure 1: The Hazards-of-Place Model of Vulnerability

Source: Cutter et al. 2003, modified from Cutter 1996.

What are the key determinants of social vulnerability? Among the most widely accepted social indicators according to Cutter et al. (2008) are age, gender, race, and socioeconomic status. Vulnerable groups include special needs populations (physical or mentally challenged, homeless, transients), non–English speaking immigrants, and seasonal tourists. Other determinants mentioned in the vast literature on social vulnerability are caste (see in particular Bosher et

al. 2007; Ray-Bennett 2009), housing situation, poverty, occupation and unemployment, family size, social or physical isolation, and social capital (for social capital and vulnerability see in particular Bohle 2006; Dynes 2006; Griffin 2003; Nakagawa and Shaw 2004; Pelling 1998). With regard to individual disaster risk, social vulnerabilities may manifest themselves both in a higher likelihood of an individual to be killed, injured or suffer material damage in an event, as well as in greater difficulties in coping with consequences after an event. This paper is primarily concerned with financial disaster losses and doesn't look at mortality or injury rates. For this reason, only the coping side of vulnerability is discussed further. The concept of unmet needs becomes important in this context. Unmet needs after disasters are the result of existing social inequalities that create vulnerable populations and inadequacies in institutionalized disaster assistance (Bolin and Stanford 1998). Institutionalized disaster assistance includes both what Holzmann et al. (2003) call market-based arrangements (typically insurance) and public arrangements (e.g. government disaster assistance). It differs from informal arrangements such as savings or help from family, friends and the larger community. The most vulnerable are those who for some reason fall through this multi-layered safety net of risk management instruments. Their financial disaster losses are neither fully covered by insurances, nor by government disaster assistance. Additionally, they don't have the financial means to cover the costs by themselves, and as a result have to rely on charities to help them cope with their financial losses. In their field study after the 1994 Northridge (California) earthquake, Bolin and Stanford demonstrate how unmet needs relate to the vulnerability of particular class and ethnic groups.

The concept of social vulnerabilities thus helps us understand how some people or groups have more difficulty coping with financial losses from natural events and are likely to have unmet needs after a disaster. The next chapter aims to bring the resilience and vulnerability concepts together and examine their interrelationship.

Linking Resilience and Social Vulnerability

As was demonstrated above, the way a society copes with the financial impacts of a disaster can be looked at both through resilience or a social vulnerability lens. But what is the relationship between resilience and social vulnerability in the context of disasters? This chapter reviews the literature on the resilience-vulnerability relationship, and suggests an alternative way of linking the two concepts.

Resilience and Vulnerability: Opposites or Components of Each Other?

It is noteworthy that research on resilience and social vulnerability to disasters has developed in two largely separate strands. Janssen et al. (2006) pointed out that "major publications on the knowledge domain resilience do not cite the other two knowledge domains vulnerability and adaptation, and the other way round." They trace this observation back to the historical developments of these domains, e.g. the distinct scholarly communities from which the concepts originate. There is, however, a growing literature that links the two concepts, within which two broad groups of conceptualizations of this link can be distinguished. For one group of researchers, vulnerability and resilience are seen as opposites or two sides on a continuum. For the other group, the two concepts are related but their relationship is more complex (Galderisi et al. 2010, cited in Tapsell et al. 2010). If resilience and vulnerability are seen as two sides on a continuum, then something very vulnerable is not very resilient and the other way around (Manyena). According to Klein et al. (2003), this conceptualization "appears to be motivated by a desire to emphasise the positive side of things," to emphasize what people have or strive for (the resilience approach), rather than what they are lacking (vulnerability approach). This understanding of resilience and vulnerability as opposites is increasingly challenged in favor of an approach that posits a more complex relationship between the two terms (Tapsell et al.). Mostly, resilience is considered to be a component (or one of

several components) of vulnerability. This follows the view of Timmerman (1981), one of the first authors to link resilience and vulnerability, who posited that resilience is a much more restricted concept than vulnerability, because the opposite of vulnerability would be "invulnerability," which doesn't exist. This view is shared by Gallopín (2006, see Figure 2) who sees resilience as a component of vulnerability, or more exactly of the "capacity of response" part of vulnerability.

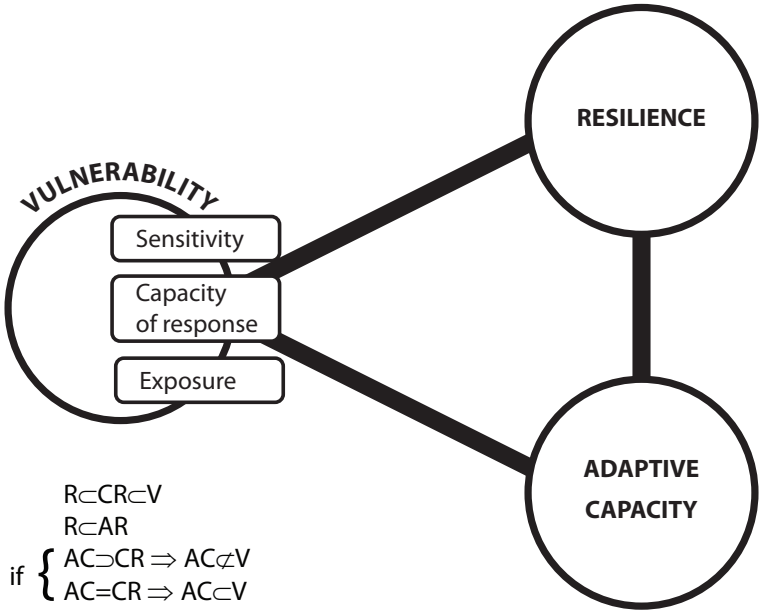

Figure 2: Resilience as a component of the "capacity of response" part of vulnerability

Source: Gallopín.

Similarly, Dow (1992) defined vulnerability as a function of the combination of exposure, resistance, and resilience. An in an attempt to integrate the numerous frameworks, Thywissen (2006, see Figure 3) proposed that risk should be understood as a function of hazard, vulnerability, exposure, and resilience, "while the mathematical relationship between the variables is unknown."

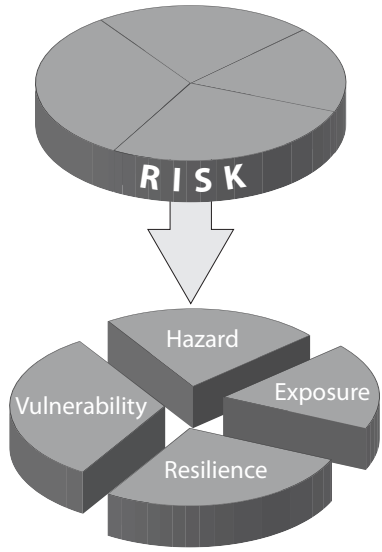

Figure 3: Risk as a function of hazard, vulnerability, exposure, and resilience

Source: Thywissen.

The two conceptualizations of the vulnerability-resilience-link as either opposites or components have a crucial thing in common: both look at vulnerability and resilience on the same level of analysis by integrating the two concepts into one single framework. This paper proposes a somewhat different conceptualization of the relationship between vulnerability and resilience that puts a stronger emphasis on the appropriate level of analysis for *each* term.

Linking Resilience and Vulnerability on Different Levels of Analysis

Following the intellectual tradition of both concepts, this paper suggests reserving the resilience term for whole systems (at whatever level of analysis chosen), and the vulnerability term to emphasize difference *within* that very system. The following three sections outline this conceptualization.

Resilience as a Property of Human Collectives

The resilience concept has been used both as a characteristic of individuals and of collectives. The notion of resilient individuals has its intellectual roots in psychology, most famously in the work of Emmy Werner (Werner et al. 1971; Werner 1992) on the resilience of children in "high risk" environments in Kauai, Hawaii. In disaster studies, however, the dominant understanding of resilience has been influenced by approaches that are rooted in either engineering or ecology, where resilience is a characteristic of a technical system or ecosystem rather than the system's individual parts (Bohle 2009). I argue in this paper that in the context of disaster studies, resilience does indeed make most sense if used for larger collectives, e.g. communities, on whatever level of analysis chosen. This is so because resilience—if it should be distinct from related notions such as capacity for coping, response capacity etc.—is built on relationships between the parts of a system (individuals, subgroups). In that sense, the resilience of a community is "more than the sum of its parts," and neither does a collection of resilient individuals guarantee a resilient community, nor the other way around (Pfefferbaum et al. 2005). Some of the key characteristics of resilient societies mentioned in Chapter 2 illustrate this. Financial risk distribution is a typical example that only works in collectives. Financial solidarity within the collective enhances resilience in a way that is not possible for individuals. Another example is social capital: social capital again builds on relationships between people of a collective. In brief, there is something about the *relationship* between the parts of a system that adds to the sum of these parts. While it is exactly this systemic aspect that makes resilience as a concept unique, there is a dark side to it. An understanding of resilience as a system property that enables a society to adapt, survive and bounce back from adversity masks differences in coping *within* that society. It becomes close to irrelevant how individuals and groups have differential abilities to cope with the event as long as the society retains the "whole." This potentially leads to a very utilitarian understanding of the resilience of a society in which "the greatest security for the greatest number" matters, and not how those at the worse end

of the spectrum cope with disaster. It follows from these thoughts that focusing on resilience exclusively is highly dangerous, also politically, especially in countries with pronounced social inequalities. To avoid an understanding of community resilience that follows a utilitarian rather than social justice logic, resilience needs to be complemented by a concept that captures difference *within* communities, and social vulnerability is the perfect candidate for that.

A Social Vulnerability Approach Highlights Difference within Human Collectives

The social vulnerability concept carries with it the connotation of difference. Everyone is vulnerable to disasters, but some more, some less. The difference here is not explained primarily by different exposures to a hazard (one person lives in a floodplain while another does not) but by social conditions and inequalities that first of all determine that some people *have* to live in floodplains while others don't, and that shape the ability to cope with a flood or any other hazardous event if it occurs. The social vulnerability literature has a tradition of emphasizing difference and inequalities, and it is this understanding of the differential vulnerability to disasters that is needed to complement the systemic resilience approach outlined above. While resilience looks at an entire system (a village, a city, a county, a country), the social vulnerability approach should highlight differential disaster risk *within* that village, city, county or country. In this sense, neither the resilience nor the social vulnerability approach is confined to any specific level of analysis, but the social vulnerability analysis is conducted on a relatively lower level of aggregation than the resilience analysis.

Resilience and Social Vulnerability as Complementary Approaches

Following from the two sections above, this paper suggests that resilience and vulnerability should neither be understood as opposites, nor components of each other on the same level of analysis, but instead as complementary approaches on different levels of analysis.

They are two different and both relevant lenses to look at how a society copes with disaster. Looking at resilience and social vulnerability on different levels of analysis follows more closely the intellectual tradition of each approach: a more systemic approach in the case of resilience, and an approach that emphasizes difference and inequality in the case of social vulnerability. A finding by Smucker and Wisner (2008) illustrates the need for a combined approach: The people of Tharaka, some of Kenya's poorest agro-pastoralists, are very resilient as a society, while the vulnerability gap within their group widens. Changes in drought coping over 30 years have enabled the society as a whole to adapt to dramatic structural and policy changes (resilience), but they have also redistributed the impacts of drought with the result that the living conditions of those with poor or insufficient land are now increasingly precarious (differential vulnerability). Neither a resilient nor a vulnerability approach alone can fully explain this double-edged process.

This paper so far has discussed some of the literature on resilience and social vulnerability to provide a framework for understanding how people cope with financial losses from natural events. It has reviewed the literature on possible linkages between resilience and vulnerability, and proposed an alternative approach to combine the two concepts. In the next section, the points made so far are illustrated using the case of the 2005 floods in Switzerland.

Case Study: The 2005 Floods in Switzerland

In August 2005 torrential rain in large parts of Switzerland caused floods and landslides that gave rise to the costliest natural event ever caused in the past hundred years in the country. Financial loss is estimated to amount to 3 billion Swiss francs (about US$2.4 billion).[1] Almost one third of all Swiss municipalities were affected (see Figure 4). Private losses of individuals and companies accounted for

[1] The exchange rate of 23 August 2005 (date of the flood event) is used throughout this paper.

three quarters of the total damage sum. One quarter of the private damage was concentrated in two important industrial and commercial zones (Hilker et al. 2007). Six people lost their life, and over 1,000 people had to be evacuated (BBC, August 23, 2005), valleys remained cut off from the world for days, and there was great damage to infrastructures such as roads and railway lines.

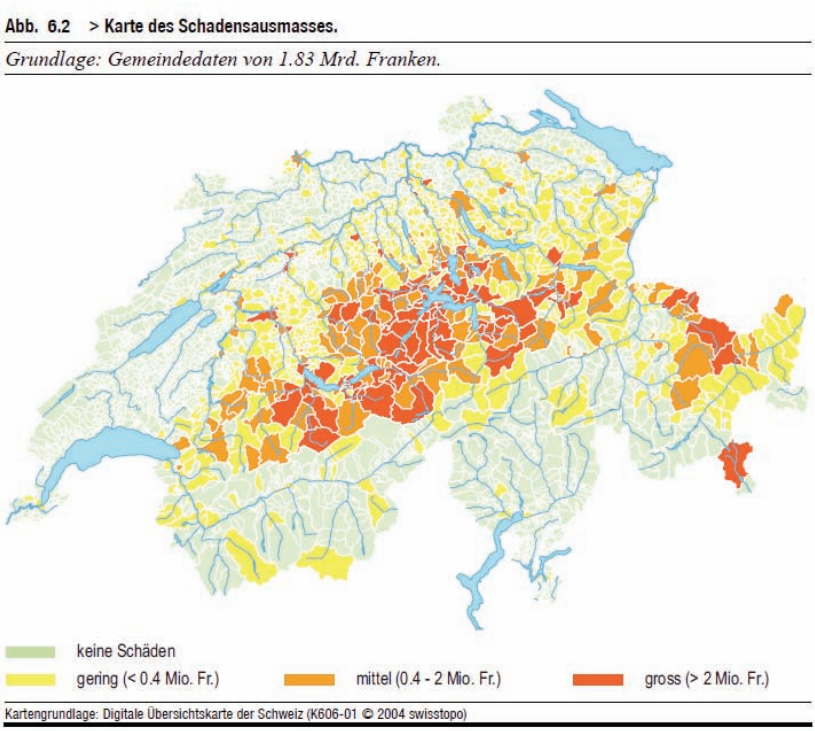

Figure 4: Flood Damage in Switzerland by Municipality

Notes: (Green: no damage; yellow: minor damage (<US$0.32 million); orange: medium damage (US$0.32 million to US$1.57 million); red: major damage (> US$1.57 million).

Source: Hilker et al.

Coping with the Flood

All in all, Switzerland coped well with this disaster. The comparatively low mortality has been attributed to structural preventative measures, progress in disaster management (warning and evacuation) and

improved equipment of emergency services in the past 100 years. On the economic side, private individuals and company owners were able to cover a large part of their financial losses by means of a compact social safety net consisting of insurances, government subsidies, funds for non-insurable natural hazards, personal savings and contributions by charities (see Figure 5).

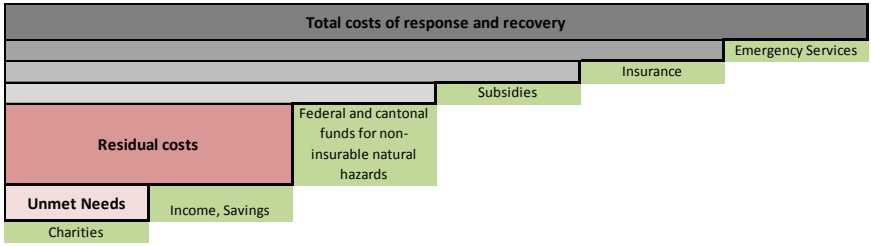

Figure 5: Institutions of the Social Safety Net to Cover Financial Losses after the 2005 Flood in Switzerland

Source: Adapted from Caritas Switzerland.

The costs of **emergency relief** operations were borne by the cantons (emergency services) and the state (assistance to the civilian actors by the armed forces) and were not incurred by individuals or companies. A number of **insurances** covered the *insurable* damage from the event: Damage to and inside of houses is covered by home insurance, which is mandatory in all but four cantons in Switzerland (Gut n.d.). On top of that, the majority of Swiss households have a contents insurance, which is not mandatory, though often enforced by landlords for rented apartments. Health insurance is mandatory. Additional insurances are available but not mandatory to cover losses from natural disasters (damage on cars, damage resulting from hail and—partially—landslides, etc.). However, a large part of the risks from natural disasters is not insurable, especially for farms and the public sector (infrastructures). **Federal subsidies** for restoration projects were available for the public sector and partially for farmers. After the 2005 flood, the federal government provided additional assistance of CHF 251 million (US$198 million) to the cantons and municipal governments to cover half of the costs incurred (DETEC 2005). Fed-

eral government subsidies are *not* available for private individuals and companies (FOWG 2005). For private individuals, the **Swiss pool for non-insurable natural hazards (ESF)**—a private aid institution founded in 1901—covered up to 60% of costs incurred by damage from natural hazards for which insurance is not available or not customary. Funds from the ESF are generally available to individuals with an annual income lower than CH 80,000. In some cantons, cantonal pools for non-insurable natural hazards complemented the assistance granted by the national fund (Gut n.d.; Elementarschädenfonds n.d.).

Any **residual costs** had to be borne by the individuals themselves. While a majority of the population was able to draw from **savings** or had a high enough **income** to cover those residual costs after the 2005 disaster, there were roughly 820 households and small to medium-sized businesses who had unmet recovery needs (Swiss Solidarity 2007). As a result, this group had to rely on **charities** to help them cover their remaining costs. The two largest charities that run programs to satisfy unmet needs after natural disasters are Caritas Switzerland and the Swiss Red Cross. The two organizations are tasked with the distribution of the donations collected by Swiss Solidarity, the humanitarian solidarity and fund-raising platform run by the Swiss Broadcasting Corporation. Swiss Solidarity raises money to provide immediate relief, interim aid or subsidiary assistance to private persons, corporations, small family businesses and, given sufficient funds, to financially weak municipalities (Swiss Solidarity n.d.). Caritas Switzerland is responsible for the distribution of the donations in the eastern, the Swiss Red Cross in the western part of Switzerland. Together, the two organizations cover the entire territory of Switzerland with their unmet needs programs, while some smaller charities (Schweizer Berghilfe, Winterhilfe Schweiz) provide additional assistance.

In total, Caritas Switzerland and the Swiss Red Cross distributed 6 million Swiss francs (US$4.7 million) raised by Swiss Solidarity to individuals, households and small to medium-sized businesses. As funds were sufficient, another 38 million Swiss francs (US$30 mil-

lion) raised by Swiss Solidarity were used to support financially weak municipal governments (Swiss Solidarity 2007).

The following two sections apply both a resilient and a vulnerability lens to fully understand the financial coping mechanisms outlined above. The resilience lens looks at the entire country and the mechanisms in place that contributed to the fact that the country as a whole coped very well with the 2005 floods. The vulnerability lens, in turn, looks at those individuals who had unmet financial needs after the disaster and could not independently cope with the financial impacts of the event.

Factors Contributing to Switzerland's Resilience in the 2005 Flood

In Section 2, the following resilience factors were identified to contribute to a society that is able to cope well with financial losses from natural events:

- A high level of wealth of a society, sufficient financial assets (savings, income, credit) of individuals
- Access to a diversity of financial resources, flexibility/redundancy of coping instruments
- (Financial) risk distribution, for example through insurance
- Social capital
- A strong emphasis on planning and mitigation as opposed to mere response and recovery
- Adaptability

Drawing from this framework, the following part answers the question why Switzerland was able to cope well with the financial impacts of the 2005 flood event.

When **financial risk is distributed** throughout society, for example through insurances or special disaster funds, the financial impacts of a disaster are not disproportionately felt by single individuals and

groups. In Switzerland, insurances functioned as the core risk distribution mechanism in the 2005 floods. It was particularly through mandatory home insurance and insurance for contents that individuals were able to cover their financial losses from the 2005 event. A multiple system of solidarity supports this sharing and transfer of risks. First of all, insurance premiums are fixed, independent of the level of exposure to natural hazards. Second, the cantonal building insurers transfer their risk to a quasi-State entity, the Intercantonal Reinsurance Union, which in turn reinsures on the international market (Moser and Lampert 2008). Another risk management mechanism was the Swiss pool for non-insurable natural hazards (ESF), a private aid institution that generates its income by management of its assets, a percentage of the annual gross takings of gaming houses, and donations (Moser and Lampert). The ESF only provides financial assistance to those individuals with an annual income lower than CHF 80,000, which is again a form of redistribution to ensure that risks are first and foremost covered for those who lack personal financial risk management instruments, such as savings or additional non-mandatory insurance. Risk distribution and financial solidarity were thus crucial elements in the building of a resilient society in Switzerland.

A resilient society puts a **strong emphasis on mitigation** as opposed to mere recovery. Systems of financial risk management are thus not created after disaster has struck, but are part of mitigation activities to reduce the effects of disasters when they occur. The resilience of Swiss society in the face of the 2005 floods was due largely to financial measures taken well in advance of the event, which include insurances, the federal and cantonal pools for non-insurable natural hazards, and personal savings. It is noteworthy that only a small part of the damage was financed with resources specifically provided *after* the event, among them the CHF 251 million of federal assistance to the cantons and municipal governments, and the donations raised by charities of course.

Gülden and Poliwoda have analyzed the historical development of these core financial flood mitigation measures in Switzerland and found that the establishment of many of these instruments is a clear

case of learning from previous disasters. Past floods have triggered **adaptation** reactions in Switzerland including the implementation of an obligation against natural disasters for home insurers, and the creation of the ESF for non-insurable damage from natural hazards.

A resilient society, moreover, is **flexible**. It has access to a diversity of financial resources and coping instruments (redundancy). As Figure 5 illustrates, Switzerland's multi-layered social safety net in the case of a natural disaster offered a multiplicity of coping instruments that complemented each other. These included all three risk management instruments (market, public and informal arrangements) mentioned by Holzmann et al.: In cases in which insurances did not cover the damage, government subsidies were available to some, and if not, funds for non-insurable natural hazards, and so on.

Informal risk management instruments to cover residual costs not taken care of by public and market arrangements include both individual measures such as savings, and help from third parties, such as friends, families and charities. A generally high level of **wealth** of the Swiss society allowed most people to independently cope with the unforeseen events by their individual financial assets. In addition, **social capital or social cohesion** in many—especially smaller—villages in Switzerland contributed to the fact that not many individuals had to rely on charities. The role of social capital has gained more attention in disaster studies recently. Social capital determines in particular the access people have to informal risk management arrangements such as help from family, friends or community. In Switzerland, market institutions and public provision were both available and worked well, but in the phase following immediately after the disaster, social capital was key. The distribution of money from insurances, funds, government subsidies or even charities is usually a longsome process, yet the two largest charities providing disaster assistance in Switzerland, Caritas Switzerland and the Swiss Red Cross, reported that they had to provide only very little immediate and interim aid after the 2005 event. This was due to the fact that most people could rely on a social network to help them out with money or housing in the time immediately after the disaster. In the few cases where immediate aid

was needed it was mostly due to a lack of social relationships of the aid recipient, or, in other words, the absence of social capital (Gut 2010; Reinhardt 2010).

To sum up, the resilience of the Swiss society as a whole in dealing with financial losses after the 2005 floods was a result of a solidarity-based distribution of financial risk, a strong emphasis on mitigation, adaptation as a result of the experience of previous catastrophes, flexibility, wealth and social capital. These factors contributed to an effective, multi-layered and multi-actor social safety net that allowed individuals to bounce back rapidly after the 2005 floods and have the financial resources to "go on" with their lives. Yet there were a number of approximately 820 households and small to medium-sized businesses that had unmet recovery needs after the floods and had to rely on **charities** to help cover their remaining costs. The following section applies a social vulnerability lens to take a closer look at these unmet needs. The aim is to understand what contributed to some individuals' difficulties in coping, and where the social safety net failed for them.

Social Vulnerabilities in Switzerland

In Chapter 2, vulnerability was described as the degree to which different individuals and classes in society are differentially at risk to suffer from an extreme event (Susman et al.). Their vulnerability is shaped by conditions of inequality based on their age, gender, race, caste, socioeconomic status, language, health/disability, housing situation, and more.

In Switzerland, social vulnerabilities to disaster that can be attributed to any of the typical vulnerability factors mentioned above are not of such an obvious and extreme dimension as witnessed in other (particularly developing) countries. The accounts by the disaster relief delegates of Caritas Switzerland (Gut 2010) and the Swiss Red Cross (Reinhardt) in fact paint a complex picture of the vulnerabilities that led individuals and households to depend on their organizations' fi-

nancial disaster assistance after the 2005 flood event. Rather than being the result of obvious disadvantage or discrimination, it was always a combination of vulnerability factors that led to those unmet disaster needs despite an effective social safety net.

With regard to coping with financial loss from disasters, an obvious vulnerability factor is the **financial situation** of the aid recipients. Caritas and the Red Cross generally do not provide assistance to those individuals with a yearly income higher than CHF 80,000, yet not all of those who had to rely on the unmet needs programs could be considered poor or financially weak by any (quantifiable) standard. For some house owners, for example, who are generally well-off financially, the residual costs resulting from the sum of insurance deductibles and non-insurable damage were just too high to be paid from savings. This is an important finding, as it reminds us that **everyone** (except maybe the very rich) is potentially vulnerable to financial loss from disasters. It is in particular the **vulnerability of the middle class** that is of interest here: Middle class citizens who might have acquired some property, which means they actually have quite a lot to lose, but have not yet secured a healthy nest-egg to cope with the unforeseeable (and uninsurable), because they are usually managing just fine.

Related to financial weakness, but more complex, are vulnerabilities resulting from **precarious working or living conditions.** Precarious work is a term used to describe non-standard employment which is poorly paid, insecure, unprotected, and cannot support a household (European Metalworkers' Federation EMF 2008). Precarity of living conditions is defined by Gallie and Paugam (2002) as a combination of the inadequacy of financial resources, enhanced by the lack of social connections to provide material and affective sources of support in times of need. Precarity is more complex than just financial weakness. Many of those in precarious living conditions often do manage in their daily life without outside financial assistance, but are—as Arthur Felts (2010) has described it on the spot in a recent blog post on resilience and vulnerability—"only an illness or broken down car or temporary job loss away from personal disaster." According to the interviewees at Caritas and the Red Cross, quite a number of those

who received small amounts of assistance belong to this group. They had been living at the margins of society, in a situation in which even small losses endanger the already precarious existences, but the reasons for their vulnerability differed greatly and are not neatly categorized. They were—in the words of the Caritas and Red Cross delegates—the socially isolated, independent artists, old people in peripheral regions, foreigners with a low income, the losers of globalizations, and many more. Their assistance needs were generally not high. It was in their cases that Caritas and the Red Cross also deviated from their general policy of not covering losses that could have been insured (or for which insurance is customary), because the fact that there was no insurance was often directly connected to the precarious living conditions (couldn't afford an insurance) or extraordinary life events (for example divorce) previous to and not connected to the flood event as such.

Another group who received a considerable share of charitable assistance was the **farmers**. Their unmet needs are explained primarily by what Bolin and Stanford call vulnerability combined with "inadequacies in institutionalized disaster assistance." Many of them live in valleys and mountainous areas and are thus exposed to natural hazards such as landslides, mudslides or avalanches. More importantly, however, a big part of their damage from natural hazards is not insurable. And though they did receive assistance from the federal and sometimes cantonal pools for non-insurable natural hazards, this assistance always only covers a part of the damage sum (60% in the case of the federal pool).

The focus of this case study was meant to be on financial disaster vulnerabilities of *individuals*, but two additional vulnerabilities became apparent that generally receive less attention in the vulnerability literature: the financial vulnerability of **small to medium-sized businesses**, and **public sector** financial vulnerability. Both small to medium-sized businesses and municipal governments and cooperatives subject to public law received a considerable share of charitable assistance. From the perspective of individual citizens, this assistance was highly relevant to avoid second-order disaster impacts such as

unemployment resulting from financial difficulties of the businesses, or reduced public service delivery resulting from financial difficulties and debt of the municipalities.

The examples above demonstrate the need to "go closer" and not just settle with a systemic resilience approach. Though the Swiss society as a whole proved extremely resilient in the 2005 flood event and most individuals were able to cope with the financial losses incurred with the help of an effective social safety net, there were some hundreds of individuals for whom the social safety net did not work equally well and who consequently needed charitable assistance. However, the examples also demonstrated that social vulnerability is a complex issue that is not always neatly categorized and assessed. This is particularly true in the global north and even more in social welfare states, where one vulnerability factor alone (e.g. poverty, unemployment) is rarely enough to account for the differential ability to cope with disaster, because some potential vulnerability determinants are already mitigated or "softened" by the provisions of the welfare state (e.g. social welfare, unemployment benefits). Steinführer and Kuhlicke (2007) come to the same conclusion after an assessment of social vulnerability in the context of the 2002 Mulde (Elbe) flood in Germany. They find that an ex-ante assumption concerning social vulnerability which is solely based on socio-economic variables is not meaningful in the case of that event. They point out that while the concept of vulnerability was developed in geographical contexts which are defined by a highly unequal distribution of resources in a general sense, the societal framework of traditional European welfare states with their efforts for at least balancing social inequalities may need a different approach to vulnerability assessment.

Implications for Research on Resilience and Vulnerability

One of the aims of this paper was to draw lessons learned for further research on resilience and social vulnerability. The section will discuss some of them in turn.

First, an understanding of resilience and social vulnerability as complementary approaches on different levels of analysis opens up a number of new questions to be explored in research. These questions center on the relationship of the society and its parts. Pfefferbaum et al. have rightly pointed out that one "cannot easily divorce the individual from his or her community for they are durably entwined—especially, it would seem, in the case of resilience." They expected positive externalities of increased "individual resilience," as they called it, so that increased individual resilience may benefit both others in the community and the community as a whole. But does a society really become more resilient as a whole when differential vulnerabilities within it are reduced? Or the other way around: How is it possible that increased community resilience can still lead to a greater gap in vulnerability *within* the community, as was demonstrated in the example on Kenya above? These questions have to be critically analyzed.

Second, the question remains whether a less systemic definition and understanding of community resilience would be able to *include* the differential vulnerability lens described in this paper. Norris et al. (2005), for example, have already pointed out that the distribution of help according to the *rule of relative need* (severity of exposure) should be an indicator of good community functioning, so that a society's capacity to distribute disaster assistance to those who most need them (the vulnerable) would become an important aspect in the definition of community resilience.

Third, if resilience and social vulnerability are indeed two separate but complementary frameworks on different levels of analysis, what are the determinants of resilience or social vulnerability, respectively? Are there factors that influence both resilience *and* vulnerability? Which

factors that strengthen the overall resilience of a community can at the same time reduce vulnerability differences within that community and vice versa? Social capital could potentially be such a factor and deserves more attention as a crucial link between society and its parts. This is so because social capital can be understood as a characteristic of both individuals and whole communities, though this view is not uncontested (Ledogar and Fleming 2008; Bohle 2006).

Fourth, what is the most appropriate level of analysis for each term? This obviously depends on the research question. In the understanding postulated above of resilience and social vulnerability as complementary approaches, the level on which social vulnerabilities are analyzed depends on the level on which resilience is analyzed. If the resilience of a country is discussed, differential social vulnerabilities *within* that country need to be assessed. If the resilience of a city quarter is analyzed, differential social vulnerabilities *within* that quarter are discussed. However, while resilience has a clear spatial dimension (because it is the characteristic of a human collective and depends on relationships within this collective), the spatial dimension of social vulnerabilities needs careful examination. Bolin and Stanford have already pointed out that the locational dimension of vulnerability is not always as clear-cut as it is observed in societies where people marginalized by class, politics or ethnicity are driven to the hazardous peripheries of a place. Because social vulnerabilities are rooted in social, political or cultural inequalities that are independent of hazardous events, social vulnerability should be expected to have the clearest spatial dimension in places where these inequalities are reflected in the residential segregation of minorities. This calls for due caution when trying to "measure" vulnerability using aggregate-level data in places with low segregation of minorities, such as Switzerland and—arguably—many other Western European social welfare states.

Conclusion

This paper aimed to throw some light on the complex relationship between community resilience and social vulnerability. It proposed a new framework to link the two concepts that follows the intellectual tradition of each concept within disaster studies and puts a strong emphasis on the appropriate level of analysis for each term. The paper suggested reserving the resilience term for whole systems, e.g. communities. This reflects the fact (that was confirmed in the case study on the 2005 floods in Switzerland) that a resilient community is "more than the sum of its parts" (Pfefferbaum et al. 2005) and that there seems to be something about the *relationship* between people of a community that adds to the sum of these parts. It was pointed out that a purely systemic understanding of resilience is dangerous as it potentially leads to an overly utilitarian understanding of successful coping with disaster. Such an understanding masks individual and group differences in coping *within* communities. The social vulnerability approach with its tradition of emphasizing differences in disaster—rooted in physical, social, economic, and political conditions and inequalities in everyday life—is needed to complement such a system approach to resilience. This first step towards an alternative conceptualization of the resilience-vulnerability link opens up a series of interesting questions to be explored in further research that center on the relationship between the community and its parts.

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Organizations—Their Role in Building Societal Resilience

Ms. Rita Parker

Societal resilience has been recognised as important in dealing with disruptive events and the focus has generally been on two aspects, community resilience and critical infrastructure resilience. But implicitly, every society is dependent on the organisations within it to contribute to building and maintaining societal resilience. Not all organisations are explicitly or fully integrated into the process of building societal resilience to deal with disruptive events. This inconsistency can be attributed to a number of different factors such as the type of the service or goods provided by the organisation or the sector in which it is located. This report examines the actual and potential roles of organisations in building and maintaining societal resilience.

The nature and meaning of resilience has been debated over many years with each discipline offering its own definition. Interpretations of resilience also vary in different communities, organisations or nations because different populations cope differently with disruptions, catastrophic or unexpected events. For any definition to be meaningful it needs to be based on a shared understanding of the

measures and systems used in determining resilience and relevant to the society, organisation or nation under review. Effective societal resilience requires a holistic, systemic approach, which includes all stakeholders, integrates all relevant elements and explicitly recognises the need to anticipate and to be adaptive and flexible. Alistair Mant's metaphor of the frog and the bicycle (Mant 1997) demonstrates the importance of connectivity and of systems thinking in the context of societal resilience. Mant cites the essential difference between the frog and the bicycle when viewed as *systems*: in the relationship of the parts to the whole. A bicycle can be disassembled, cleaned, parts replaced or modified, and put back together again and it will work. The frog is different and more representative of an entity which functions at full efficiency only when all components are integrated and working together. Remove any part of the frog (or integrated entity) and it becomes less efficient. Similarly, societal resilience has a greater likelihood of achieving success when all the stakeholders—individuals, communities, organisations and governments—are involved and connected.

There has been a growing trend by governments, communities and organisations to embrace resilience as a means to mitigate disruptions and catastrophic events. Many start with the perception that resilience means *bouncing back,* but soon come to realise that view is overly simplistic and to do so would mean returning to the same place and point of vulnerability. A disruptive event can provide the opportunity to enhance, to improve and to reinvent, that is, *to bounce forward*!

Organisational Resilience

Organisations are a fundamental part of our society whether they are large or small, private, public or not-for-profit. The importance of resilient organisations is not limited to the public sector or to those owning or operating critical infrastructure. Society and its economic well being rely wholly, or in part, on organisations for those non-essential as well as essential goods and services which contribute to daily

operations and sense of normality. Indeed, a number of critical infrastructure facilities and systems also depend on organisations which are not classed as critical but which are necessary for their operational effectiveness and reliability.

From an organisational perspective, resilience is usually expressed as a management system that is designed to assist an organisation to deal with adverse, disruptive or surprising events that cannot be prevented. As such, organisational resilience is an enabler of societal and community resilience. It is the nexus between them. From the local to the global, each is, in some way, dependent on the other because resilience demands partnerships and interdependences within and across social, corporate and national boundaries. It is part of a resilience continuum.

Each organisation has a unique level of resilience maturity. Some organisations will have a low level of *defensive* resilience maturity where they react to external events while others demonstrate well-developed attributes, which contribute to high levels of *offensive strategic* resilience where they plan for and prepare for the anticipated and the unexpected events impacting on their operations. Such a level of resilience positions them strongly to anticipate, to adapt, to manage and survive a major disruptive or unexpected event. Resilience tends to increase if an organisation has diversity, efficiency, agility and flexibility, autonomy, strength of its critical components—including its people—and strong connections with its stakeholders. This allows it to continue to function if a link is broken, if a particular resource becomes scarce or if a particular decision maker or leader is unavailable.

All organisations face degrees of uncertainty, risk and disruption. The impact of a disruption on an organisation will also, to some extent, impact the community in which it is located. Equally, a disruptive event, which affects a community, will affect the organisations that serve it.

Disruptions

Disruptions, whether they are intentional, natural or accidental are difficult to anticipate and hard to predict. Terrorism, piracy, threats to energy and supply chains, political instability, climate change and population shift are more recent challenges which add to an uncertain future. Natural disasters alone are now four times higher than in the 1970s (Oxfam 2007). Two thousand people are killed in disasters each month (Arbon 2010). That is the equivalent of six 747 aircraft crashing each month.

True catastrophes, on the scale of the 2010 floods in Pakistan, thankfully are rare. Those floods resulted in 21 million people injured or homeless, twenty percent of land submerged under water, extensive damage to infrastructure and an estimated economic impact equal to one third of GDP. The situation was further compounded in Pakistan by disease and increased activity by the Taliban. Over the past few years, there have been various emergencies of one sort or another that may not be of the magnitude of the Pakistan floods or the earthquake in Haiti in 2010, but which still have a significant impact on the ability of those affected to go about their daily lives and which test the resilience of the communities and organisations affected and, often, the nation.

In a country known for bushfires and drought, the Australian State of Queensland experienced the worst floods in 35 years in January this year. Three-quarters of the State were declared a disaster zone as the floods inundated an area equivalent in size to France and Germany combined. When the floods peaked, 28,000 homes were without power in that one State. Three weeks later, Queensland braced itself for tropical cyclone Yasi. In terms of its destructive force, Cyclone Yasi has been compared to Cyclone Katrina of 2005. Cyclones are an annual threat that are, if not uniquely Australian, so much a part of the Australian summer that it is referred to as the "cyclone season" as though it is on a par with the "cricket season" (Mortimer *et al* 2011).

The flood waters continued to flow southward through the States of New South Wales and Victoria. The latter State was affected only two summers previously by sweeping bushfires, which took 173 lives.

As noted by the Australian Prime Minister, the Hon. Julia Gillard, in her address to the Federal Parliament on 8 February 2011 (Gillard 2011):

> This summer will always be remembered for the way Queensland suffered—floods of unprecedented proportions, an inland tsunami so powerful it swept away lives and shattered communities, and the most powerful cyclone the nation has ever seen.
>
> Australia has watched in horror as day after day a new chapter in natural disaster history has been written.

Organisations have commercial, management and often altruistic interests in maintaining operations and in doing so, play a vital and valuable role at every level in assisting and supporting their employees and society as a whole in the immediate aftermath and in the days, weeks and months following a disaster. For example, the Queensland Museums and Gallery Services (M&GSQ) immediately began compiling a register of flood damage to any museums, galleries or cultural heritage organisations in flood affected parts of Queensland and provided advice about assistance. A network was established to connect workers in those institutions across regional and metropolitan Queensland to share information and advice on how to salvage collection items and personal treasures.

The economic cost of the flood damage is yet to be fully assessed but it is expected to be higher than the annual Australian expenditure average of $AU1.58 billion each year in recovering from natural disasters, including the costs of injury and death (Geoscience Australia 2007). The financial scale is unprecedented in Australian history and the preliminary cost estimate is $AU4.6 billion for Queensland alone and a further $AU1 billion in flood costs for other States affected by floods (Mortimer *et al* 2011).

Planning for Disruption

A significant aspect of disruptions is that often they begin to unfold before they are noticed and they can have unforeseen consequences on individuals, communities, organisations and nations. Nassim Taleb has given us the Black Swan theory (Taleb 2007), which refers to a high impact, hard to predict and rare event beyond the realm of normal expectations or planning. Invariably plans are created to prepare for the inevitable, to pre-empt the undesirable and to control the controllable (Weick *et al* 2007). Unfortunately, events have a habit of confounding predictions such as the example of the Queensland floods, and prudent crisis management and planning is based on consideration of a wide range of risks rather than on a forecast that any particular risk will occur (Cabinet Office UK 2008).

Setting out the risks—their likelihood and their impact—is not predicting that any particular type of emergency will materialise or that, if it were to do so, it would happen on a specific scale. Plans can be developed to address recognised vulnerabilities based on known threats. But while this sounds rational, planning for known vulnerabilities has its limitations because planners plan in stable and predictable circumstances about known events and likely threats. This style of planning runs the risk of normalising the abnormal, and of not anticipating or being alert to unforeseen threats and disruptions, which are not always known for their predictability.

Resilience implies that individuals, communities and organisations are able to reduce their exposure to risks and at the same time, enhance their ability to recover. Organisations often accept a level of risk to enable activities that give a benefit to the wider society. Adopting a resilience-based approach means focusing on capabilities and resources to anticipate, to prepare and to manage disruptive events. This approach is different from a vulnerability-based approach, which focuses on identifying weaknesses and then implementing mitigation strategies to overcome them. This latter approach depends to a large extent on risk identification and its assessment.

Andrew Hopkins states that over reliance on risk assessment within the suite of risk management tools can overshadow more important aspects such as identifying threats or hazards and putting in place effective strategies to combat them (Hopkins 2005). He cites the example where a works vehicle from a remote facility when travelling on an isolated road hit a pothole. The driver swerved to the other side of the road before regaining control of the vehicle. The geographic remoteness where this took place meant the chances of hitting another vehicle were slight but, if there had been a collision, a fatality might have occurred. A risk assessment of the pothole would take into account the statistical likelihood of hitting it or of a collision with an oncoming vehicle to arrive at a decision on dealing with the risk through, such as diverting traffic, erecting signs and other similar approaches. Hopkins argues that in this kind of situation it makes more sense to bypass the risk assessment stage. A hazard had been identified and the obvious control measure was to fill the pothole. A resilience-based approach encourages adaptability rather than a checklist or tick-the-box formula.

A society's resilience potential will not be maximised if it is developed in a segmented way, separating communities from organisations and sectors. From an early age we are taught to take problems apart and to break them down into manageable pieces. While this might make complex tasks more convenient and controllable, we run the risk of losing the intrinsic sense of connection to a larger whole and of losing sight of the consequences of our actions. When we try to see the big picture, we attempt to reassemble the pieces in our mind, but the task is futile. It is similar to trying to reassemble the fragments of a broken mirror—the image will always be distorted (Senge 1992).[1]

Similarly, organisations are potentially vulnerable when work units develop as silos or stove pipes as they become isolated from other areas and lose sight of the organisation's vision. In some instances, these units generate their own culture and vision, which may not be in the best interests of the overall organisation. Duplications and inefficien-

[1] Quoting Bohn.

cies result when the organisation does not work as an integrated system. Silos can be created around an individual, a group, a division, a function, or even a product line or service. Wherever it is found, silo mentality becomes synonymous with power struggles, lack of cooperation, and loss of productivity. And always, the customer or client is the ultimate loser. More broadly, any benefits to the overall society are diminished or lost. The foundation of a successful and resilient organisation demands that we confront workplace silos of expertise and address the issues associated with our increased global connectedness. Silos erode this foundation. A resilience framework means that business units, processes and activities are no longer operating in isolation of each other. It brings them together to sit at the very centre of an organisation's ethos and way of operating, which ultimately contributes to societal resilience.

Shared Responsibility

Resilient organisations are pivotal for a nation's security, progress and well-being especially when the future is uncertain. Today's challenges have drawn attention to vulnerabilities which were previously less evident. This means there is more than one future. There are several futures—some good, some challenging but all are unknown and unpredictable. If the future were predictable, resilience would lose its importance—nations, organisations, communities and individuals would simply need to plan for a known set of conditions, including some which may be unlikely but which could result in significant harm if they are not anticipated. To meet both these challenges and unknown future, greater flexibility and creativity are needed to make the transition from being reactive to proactive and to become adaptive, agile and flexible to changing circumstances.

Organisational resilience is the crucial connection, which binds each element of the increasingly complex, virtual and physical network of links and relationships, which make up society. The interdependencies between governments, organisations, communities and individu-

als are multidimensional and exist at several levels, which mean that building resilience must be a shared responsibility.

Figure 1: Organizational interdependencies

Public-private partnerships are integral to developing resilience for a nation's security, its well-being and its future as a trading nation. Since the widely acclaimed management of the 2000 Olympic Games in Sydney over a decade ago, there have been some notable successful major public private partnerships in Australia such as the Commonwealth Games in 2006 and the APEC (Asia Pacific Economic Cooperation) Forum in 2007. But a full account has not been taken of the legacy of lessons from past collaboration and partnership between the public and private sectors—not just those deemed critical—which could be used to build greater resilience. Indeed, these are lost opportunities to leverage and build on skills, capabilities and networks. The Commonwealth Heads of Government meeting to be held in Western Australia in October 2011 is an opportunity to inculcate resilience strategies and reap the subsequent benefits for organisations and communities.

The Private Sector Preparedness (PS-Prep) Program of the United States Department of Homeland Security has as its goal a resilient and recoverable private sector and the Program is an example of engaging private sector organisations. The PS-Prep Program has adopted the ANSI [American National Standards Institute]/ASIS [American Society for Industrial Security] SPC [Security, Preparedness, and Continuity].1-2009 Organizational Resilience Standard as part of a program designed to voluntarily bolster the resilience of private organisations during man-made and natural disasters and emergencies and goes some way to include organisations including those which are not responsible for operating critical infrastructure and encourages them to develop resilience.

It can be argued, however, that simply adopting a Standard, while important, is not the only factor necessary to create resilience or build key capabilities and the qualitative elements of resilience for an organisation. Indeed, a comparative study shows that the three common factors for successful public-private partnerships irrespective of geographic location are "Commitment and responsibility of public and private sectors"; "Strong and good private consortium"; and "Appropriate risk allocation and risk sharing" (Cheung *et al* 2012).

Critical Infrastructure

The resilience of critical infrastructure is an important element in support of societal resilience—it is part of the resilience continuum and organisations are pivotal. Increasingly, elements of critical infrastructure are in the hands of corporations and organisations and in recognition of its importance, many governments have taken steps to engage critical infrastructure owners and operators. This is an attempt to mitigate the potential for critical infrastructure to be a nation's *Achilles Heel* through its vulnerabilities. It is not always recognised that strategies and plans to deal with the unexpected need regular testing, modification and updating. Over-reliance on untested and outdated plans compounds vulnerability.

The potential for vulnerability has led to a shift in thinking from infrastructure *protection* to critical infrastructure *resilience*. Infrastructure *protection* and infrastructure *resilience* represent complementary but distinct elements of a comprehensive risk management strategy. In Australia, the term critical infrastructure *protection* is used to describe actions or measures undertaken to mitigate the specific threat of terrorism even though the threat of terrorism is part of the all hazards approach to critical infrastructure encapsulated in the Critical Infrastructure *Resilience* paradigm (Attorney-General's Department 2010).

Protection of national assets such as transportation hubs, bridges, water and power supplies, communications facilities and supply chains are critical for a nation's security, its economy and its future as a trading nation. Commercial organisations, whether managing infrastructure, providing transport systems or supplying communications networks, have become key determinants of the level of a nation's resilience. Critical infrastructure *resilience* demands a holistic and integrated approach across boundaries of private and government sectors leading to a more effective response to all hazards. Critical infrastructure resilience moves nations and communities away from the danger of a fragmented, isolated silo or stove pipe approach, to one, which is integrated.

Like the term resilience, each country defines critical infrastructure slightly differently and the concept of critical infrastructure has been evolving over time. In the 1980's, the emphasis was generally on the public sector with a strong focus on transportation such as highways, air and seaports, bridges, and public transport. In 2001, the US, in the USA Patriot Act, defined critical infrastructure as *physical or virtual systems and assets*. Their destruction or incapacity would have a debilitating impact on security, national economic security, public health or safety, or any combination of those matters and by 2006 the United States had identified 17 critical sectors with over 77,000 individual assets listed in the Department of Homeland Security National Asset Database (Moteff 2007).

In its 2008 report on protection of critical infrastructure, the OECD [Organisation for Economic Co-operation and Development] provided the following table of definitions from six countries (OECD 2008).

Table 1: Critical infrastructure definitions by country

Country	Critical Infrastructure Definition
Australia	"Critical infrastructure is defined as those physical facilities, supply chains, information technologies and communication networks which, if destroyed, degraded or rendered unavailable for an extended period, would significantly impact on the social or economic well-being of the nation, or affect Australia's ability to conduct national defence and ensure national security."
Canada	"Canada's critical infrastructure consists of those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of Canadians or the effective functioning of governments in Canada."
Germany	"Critical infrastructures are organisations and facilities of major importance to the community whose failure or impairment would cause a sustained shortage of supplies, significant disruptions to public order or other dramatic consequences."
Netherlands	"Critical infrastructure refers to products, services and the accompanying processes that, in the event of disruption or failure, could cause major social disturbance. This could be in the form of tremendous casualties and severe economic damage… "
United Kingdom	"The [Critical National Infrastructure] comprises those assets, services and systems that support the economic, political and social life of the UK whose importance is such that loss could: 1) cause large-scale loss of life; 2) have a serious impact on the national economy; 3) have other grave social consequences for the community; or [4)] be of immediate concern to the national government."

United States	The general definition of critical infrastructure in the overall US critical infrastructure plan is: "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." For investment policy purposes, this definition is narrower: "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on national security."

The common theme throughout the definitions listed by the OECD is that critical Infrastructure refers to the *essential services* we all rely on in our daily lives, such as power, water, health, communications systems, financial services and transportation. Some elements of critical infrastructure are not physical assets, but are in fact networks or supply chains. Critical infrastructure networks include—electric power, gas and liquid fuels, telecommunications, transportation, financial services, wastewater facilities and water supply. A significant amount of critical infrastructure is inter-linked. The degree and complexity of these linkages is increasing as we become more reliant on shared information systems and on convergent communication technologies, such as the Internet.

Highly interconnected and mutually dependent entities, particularly critical infrastructures, can create their own vulnerabilities. This was demonstrated over a decade ago in 1998 by the failure of the telecommunications satellite, *Galaxy 4*. The loss of that single telecommunications satellite led to an outage of nearly ninety percent of all pagers nationwide across the United States (Rosenbush 1998). Owners and operators of critical infrastructure are, in some instances, dependent on the effective and continuous operation of organisations, which are not deemed to be critical. This is a potential vulnerability and weakness of critical infrastructure planning if those organisations are not resilient when faced with disruptions. For example, bringing food from the paddock to the plate is dependent not only on particular key facilities, but also on a complex network of producers, processors,

manufacturers, distributors and retailers and the infrastructure supporting them.

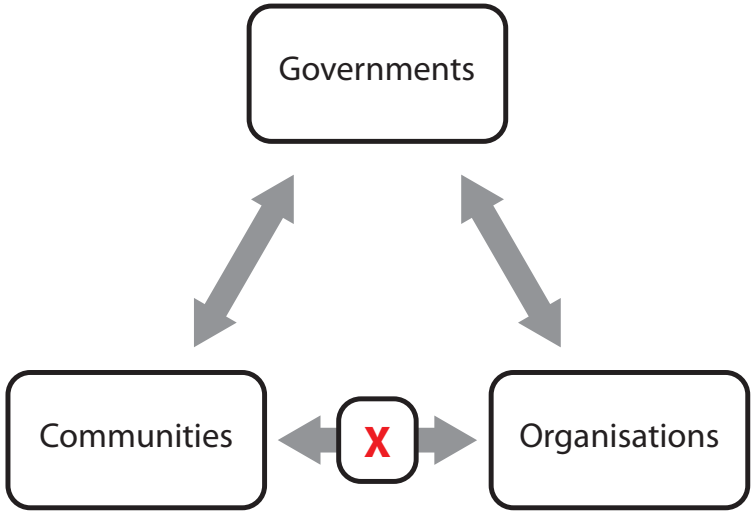

Figure 2

While essential services are given priority by governments, it is important to recognise that national infrastructure also contributes to a nation's resilience and equally can represent a point of vulnerability. But there is a disconnect between how infrastructure in general is ranked as a measure of a nation's overall competitiveness. According to the World Economic Forum in its Global Competitiveness report (World Economic Forum 2010) there was generally an inconsistency between a nation's overall competitiveness ranking and that of its infrastructure which was one of twelve measures of competeiveness. One hundred and thirty nine countries were assessed and ranked for the report. Of the countries ranked among the top ten across all measures, only one, Canada, which ranked 10th overall, achieved a higher ranking for its infrastructure at ninth. In that same top group, Germany alone maintained the same ranking overall (5th) and for its infrastructure. The country with the biggest disparity among the top ten was the United States, which was ranked 4th overall, yet was placed 15th for its infrastructure. Australia ranked 16th overall out of the one hundred

and thirty-nine countries in global competitiveness and was ranked 34th for the quality of its infrastructure.

This disparity between a country's overall ranking and that of its infrastructure raises several questions relating to engagement of owners and operators or critical infrastructure and how organisations in non-critical and support sector areas are, or should be, engaged so that they too contribute to societal resilience as part of the resilience continuum.

Resilience Continuum

In Australia the resilience is a shared responsibility recognising the interdependencies between individuals, communities and organisations. But there are gaps and the partnership potential has yet to be fully realised on an ongoing basis. Organisations have the potential to provide an existing systemic contribution to a holistic resilience continuum but this requires the integration of organisations into the resilience planning of both nations and communities. Without this integration, the entire system fails.

A relatively unacknowledged potential point of failure is that of partnership arrangements between organisations and communities. What is often missing in this arrangement is involvement of those organisations which deliver services to communities *or* which own and operate facilities which are *not* identified as critical infrastructure but upon which communities rely and governments implicitly include in their planning, such as dairies, bakers, local media outlets, mortuaries, waste disposal operators, etc.

As we develop and implement the concept of resilience across national, corporate and social boundaries, inherent interdependencies become clearer and the gaps more obvious. Ideally, each sector or element should be connected to, and contributing towards, the resilience of the other. It *should* be a seamless continuum for the delivery of essential services, to drive economic growth, to support social needs and

to support the economic performance and well-being of each nation and its people.

If resilient communities are the foundation of a resilient and strong nation (Plodinec 2010), then organisations *must* be included in the mix of stakeholders—including through partnership arrangements between and within organisations and communities, similar to existing and emerging public-private partnerships. During times of adversity, whether caused by an intentional act such as terrorism or an act of nature like the unusual flooding in Australia, resilient traits are evident to varying degrees within the communities affected. But in such situations, resilience is not a steady state, especially if many organisations deemed to be non-critical are excluded from planning and response strategies.

Organisations have the potential to be *shapers* of resilience, but with a single point of failure or failed integration as above the entire resilience system can be compromised. The weakest point at this time is the disconnect through the exclusion of many so called non-critical organisations from the resilience continuum. This single point of failure can impact the entire resilience continuum if not remedied.

Conclusion

A high level of societal resilience requires the adoption of a systems approach, whereby all stakeholders are connected and interrelated.

While it is easy to perceive some organisations as detached entities, of relevance only to the stock market and shareholders, or to remote boards of directors, many are not commercially or profit based. Organisations are *not* passive inert entities. They are made up of people; they are part of a wider system, that is, society. Alistair Mant's metaphor of the frog and the bicycle (Mant 1997) demonstrates the importance of systems thinking in the context of societal resilience. Similarly, organisations are at their most effective when operating as part of a system, in this case the wider society *and* they work best

when all the parts are interconnected. This means connections within the organisation *and* with the community in which it is located and which, more broadly, it serves—because an organisation operates as part of a society's system.

The people who work in organisations live in communities. Logically, therefore, there *should* be no disconnection in the resilience continuum. Organisations are made up of the same people critically affected by the level of, or absence of, community resilience. They depend on a workforce at home or abroad, which is sufficiently resilient to provide the means of production or the services that in turn determine their contributions to resilience as part of the continuum to achieve national resilience.

For organisations, resilience provides a conceptual and practical overarching framework for activities and plans such as risk, business continuity and security. For the resilience continuum to be truly effective there needs to be a holistic, integrated and inclusive process which recognises and benefits from the interrelationship between *all* stakeholders—including between organisations and communities. That is, a shared responsibility *and* mutual obligation between governments, organisations, communities and individuals.

Direct collaboration between government and critical infrastructure owners and operators, communities *and* organisations—including those in the wider business and non-corporate sectors, is a cornerstone of building societal resilience and one which has yet to be fully realised. Exclusion of any organisation on the basis that it is not deemed to provide critical services is a recipe for failure in the development of societal resilience. Organisations in all sectors of society are integral to the social fabric of a nation, its sense of wellbeing and normalcy. The ability to recover and the speed of recovery from any disruption, whether it is intentional or an act of nature, depends on the resilience strategies and processes in place before the disruption and on the level of engagement of organisational and community stakeholders.

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Societal Resilience—Looking Ahead

Brigadier General Meir Elran (Ret.)

For too long, analysts, researchers, and practitioners of resilience in general and of societal resilience in particular, focused on the specific variations of the definition and contents of the term. It is agreed by most of those that work or study in the field of resilience that irrespective of the fine tuning of the precise definition, it holds three major components: (1) capacity to absorb major disruption; (2) capability to react to it in accordance with its magnitude; and (3) ability to quickly bounce back and resume normal—if not improved—adaptive functionality. In order to make the most effective use of this understanding, there is now an opportunity to direct our attention to the ways and means available to enhance the capabilities of our societies to stand up to the challenges and consequences of natural and man-made catastrophes. We must use our understanding of resilience as a theoretical basis and a platform for action to enhance the prospects to mitigate the results of disasters and to facilitate a rapid, complete, and well-constructed recovery following emergencies.

Even though these proceedings center on the issue of societal resilience, it is clear that in order for each community to be resilient, it has to prepare itself and enrich its resilient assets, particularly in relation to its infrastructure and economy. Indeed, building a resilient in-

frastructure has become a common practice in modern projects. It is more complicated and less prevalent in the economic sphere, mostly because of the significant interrelationships with social and political issues. It is even less apparent in the societal arena. Even though the vision of societal resilience is commonly hailed by politicians the world over, the real picture is far from being satisfactory when examined in actual terms of investments in, and successes of, community resilience programs. In most countries the "hard" preventive and protective measures, designed to thwart disasters, still have the clear upper hand. They sell better, despite their much higher price, and they seem to be more attractive to the decision makers, who can seemingly point at concrete progress in a relatively short time. This is usually not the case with social resilience programs, which are "soft" in nature, difficult to measure, intangible in nature, and with results that can be seen in the long run, mostly after disasters actually happen.

The key message from the first International Symposium on Societal Resilience and these proceedings is that there is an urgent need to promote the understanding of the educated public and the decision makers around the world, on the national and local level, that it is time to focus more on specific programs of societal resilience. The ideas gathered in this document represent just a fraction of the body of knowledge that has been developed in recent years on societal resilience. They clearly demonstrate that it is not only worthwhile to improve the societal resilience of the communities as a vital part of the preparedness for possible disasters, but that it is also cost-effective for the non-crisis environment.

Societal resilience is by no means a static attribute. It can be promoted by the communities and the society as a whole if people understand its significance, its contribution to the public prosperity and standard of living, and its potential contribution to the recovery from catastrophes which constantly happen and cause growing damage to life and property, whatever precautionary measures are taken to prevent them. All ideas that have been presented in this volume are part of the effort to foster societal resilience, as has been the case in many communities in the United States and elsewhere. Wherever practical

and comprehensive resilience action plans have been implemented, they proved to pay off lavishly, and indicated that their social yield stretches well beyond the scope of preparedness for disasters.

Several practical components are worthy of highlight and should serve as a base for constructing societal resilience guidelines:

- **Leadership is a critical asset.** Given the understanding that national/federal levels have an important role in defining the desired standards for resilience and in providing for those communities less able to help themselves, the most salient instrument is the local leadership, both formal and informal. Only the recruitment of the local leadership and its unconditional commitment to the promotion of the community's resilience can ensure success. It takes an inclusive type of leadership, dedicated to the cause, and continuously involved with the practicalities, to reach the required level of societal resilience.
- **Public participation is a key factor.** Here the role of non-governmental organizations (NGOs) and the private sector is of special significance, bringing with them not only their unique professional assets, but also the breadth of the society at large. It has been evident in the experiences of different communities all over the world that this is a cross-cultural critical component which should be utilized to its fullest.
- **Grass roots involvement is essential.** If possible, the best way to engage a community with resilience-oriented projects is through a bottom-up approach. At the same time, resilience programs must be meticulously planned and carefully implemented, supervised, and assessed. This calls for a well-structured interdisciplinary framework to deal with and lead those projects, to facilitate the essential but difficult to achieve cooperation with the variety of formal and informal entities and agencies which should be integrated in such a complicated venture.
- **Current beliefs and practices need to be reexamined.** As societal resilience is closely associated with the cultural value

system of each community, it often necessitates a transformation of beliefs and practices. In this context, there is a special place for the educational system and younger generations as the best leverage for change toward building a future resilient community.

- **Constructing resilient communities is a long and agonizing process.** There are no shortcuts in the implementation of the vision for resilience. The effort must be continuous and relentless. It can never stop, even after the establishment of the foundations. There must be an ongoing maintenance effort to sustain the resilient systems that have been created.
- **Do not reinvent the wheel.** In many cases, communities which enter into a systemic process of prompting societal resilience tend to "reinvent the wheel." This is often an expensive and unnecessary mode of action. Societal resilience is a universal concept and should be perceived as both generic in concept and in practical terms. There is a lot to learn from other communities and other countries, where successful resilience projects have been implemented and documented. However, we must keep in mind that there is no "template approach"—each community has its own special features, which must be taken into consideration.

The proceedings and the vision behind them are dedicated to those communities which decide to embark upon the long but worthwhile path toward societal resilience. They are designed to provide them with basic thoughts as to how it can best be achieved, and to encourage them to learn from emergent and best practices of others and from the know-how of the scholars and practitioners involved in this project. The contributors to this document are committed to expanding our understanding through research and learning of societal resilience and to share our findings with the public at large and stakeholders. Their success in building resilient communities is our reward.

Appendices

Appendix A: Symposium 2010 Program

RESILIENCE
International Symposium on Societal Resilience

International Symposium on Societal Resilience

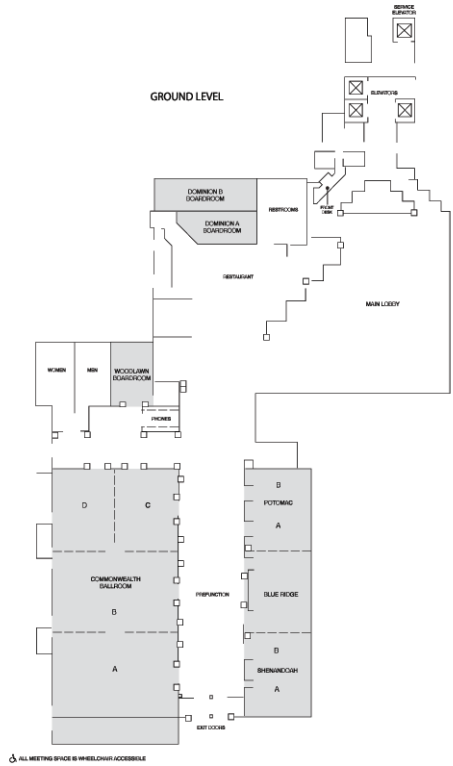
Program Book

Hyatt Fair Lakes • Fairfax, Virginia
November 30 - December 2, 2010

Hyatt Fairlakes

DIRECTIONS

From Washington Dulles Airport: Follow signs to Dulles Access Toll Road and exit onto Route 28 South. Go 4 miles to Route 50 East (Fairfax) then proceed 3 miles to Fairfax County Parkway (Rte 7100 South). At second traffic light, turn left onto Fair Lakes Parkway. At next traffic light, turn right onto Fair Lakes Circle. Hotel is located on left side.From I-66, take Exit 55B (Fairfax County Parkway, 7100 North) towards Reston. Turn right at first traffic light ont Fair Lakes Parkway. Turn right at next Traffic light onto Fair Lakes Circle. Hotel is 1/4 mile on left.



RESILIENCE
International Symposium on Societal Resilience

International Symposium on Societal Resilience Program

November 30 - December 2, 2010
Hyatt Fair Lakes (Fairfax, Virginia)

Welcome to the International Symposium on Societal Resilience!

The Symposium is hosted by the Homeland Security Institute, in coordination with the U.S. Department of Homeland Security, United States Army War College's Center for Strategic Leadership, and the Institute for National Security Studies, Tel Aviv University.

Day 1: Tuesday, 30 November 2010

5:00pm - 6:00pm	**Conference Registration**
6:00pm - 9:00pm	**Welcome Reception** ..... Commonwealth Ballroom
6:15pm - 6:25pm	Welcome and Introductions: Phil Anderson, Director, Homeland Security Institute
6:25pm - 7:00pm	Keynote Speaker 1: **Brian Kamoie,** Senior Director for Preparedness Policy, Resilience Directorate, National Security Staff, The White House
7:00pm - 7:30pm	Dinner
7:30pm - 8:00pm	Keynote Speaker 2: **Christine Wormuth**, Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs, Department of Defense
8:00pm - 8:30pm	Keynote Speaker 3: **Major General** (Retired) **Matan Vilnai**, Israeli Deputy Defense Minister
8:30pm - 8:40 pm	Closing Remarks: Phil Anderson
9:00pm	Adjourn

Day 2: Wednesday, 1 December 2010

8:30am - 10:15am	**Day 2 Opening Plenary:** ***International Perspectives on the Need for Resilience*** ..... Commonwealth Ballroom
8:30am - 8:40am	Opening and Welcome: Phil Anderson, HSI
8:40am - 8:45am	Panel Introduction: Alex McLellan, Principal Analyst, Homeland Security Institute
8:45am -10:15am	Opening Plenary

Moderator: Dan Kaniewski, Assistant Vice President and Deputy Director, The George Washington University Homeland Security Policy Institute (HSPI)

Distinguished Panel:

- **Dr. Gamini Keerawella**- Head and Professor, Department of History, University of Peradeniya, Sri Lanka
- **Lieutenant Colonel Rami Peltz**- Head of the Behavioral Sciences Branch, Home Front Command, Israel
- **Dr. Matt Qvortrup**- Senior Lecturer of International Relations, Resilience Centre, Cranfield University, United Kingdom
- **Christian Sommade**- Délégué Général, Haut Comité Français pour la Défense Civile (Executive Director, French High Committee for Civil Defense)
- **Brigadier** (Retired) **K. Srinivasan**- Establishment Director, Centre for Security Analysis, India
- **Dr. Norman Vasu**- Assistant Professor, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore

10:15am - 11:30am	**Day 2 Opening Session** ..... Commonwealth Ballroom
10:15am - 10:20am	Introduction of Day 2 Keynote Speaker 1: Alex McLellan
10:20am -10:55am	Day 2 Keynote Speaker 1: **Todd Keil**, Assistant Secretary for Office of Infrastructure Protection, DHS
10:55am -11:00am	Introduction of Day 2 Keynote Speakers: Phil Anderson
11:00am -11:15am	Day 2 Keynote Speaker 2: **Alex McLellan**, Principal Analyst, HSI
11:15am -11:30am	Day 2 Keynote Speaker 3: **Dr. Ruth David**, Executive Director and President, Analytic Services, Inc.
11:30am	Adjourn for Lunch
11:30am - 1:00pm	Lunch ..... Virginia Suites
11:30am - 11:45am	Lunch Buffet
11:45am	Introduction of Lunch Keynote Speaker 1: Alex McLellan
11:45am - 12:15pm	Lunch Keynote Speaker 1: **Tim Manning**, Deputy Administrator for Protection and National Preparedness, FEMA, DHS
12:15pm	Introduction of Lunch Keynote Speaker 2: Alex McLellan
12:15pm - 12:50pm	Lunch Keynote Speaker 2: **Dr. Leonard Marcus**, Lecturer on Public Health Practice, Department of Health Policy and Management, Harvard University; Director, Program for Health Care Negotiation and Conflict Resolution, Harvard School of Public Health
12:50pm - 1:05pm	Adjourn to Ballroom for Concurrent Sessions/ Presentations
1:00pm - 3:00pm	**Concurrent Sessions I: The History and Philosophy of Resilience** ..... Commonwealth Ballroom
1:05pm - 1:10pm	Introduction of Concurrent Sessions I: Presenter: **Dr. Benjamin Nickels**- Faculty Researcher, START Center, University of Maryland College Park
1:10pm - 1:25pm	**Presentation A:** ***Is the Blame Game Making Us Less Resilient? A Re-examination of Blame Allocation in Systems with High Uncertainty*** This project will look at the implications of what has been called The New Normal: a time of higher uncertainty for many businesses and governments, with fast and strong disruptions in many systems. We cannot manage systems with high uncertainty unless we receive accurate feedback. If surprises are concealed because they are seen as "failures" of the system or the person in charge, the system cannot adapt. In some cases, the energy it takes to fix and apportion blame is diverted from the adaptation process with little pay-back and often results in attempts to resist (stop from happening) similar surprises by creating new constraints on the system that will rob it of resilience. This is a significant problem in many countries and in many organizational cultures including the military, NGO's, corporations large and small, and the media. It deserves a broad and open debate. The resilience of our organizations may depend on it. **Dr. Patricia Longstaff**- James Martin Senior Visiting Fellow, Oxford Martin School, University of Oxford; David Levidow Professor of Communication Law and Policy, Newhouse School of Public Communication, Syracuse University

1:25pm - 1:40pm

Presentation B:
Multiple Dimensions of Societal Resilience: Developing a Resilience Index

The focus of the proposed paper is to: a) identify and analyze the multiple dimensions of community resilience, including their conflicting and complimentary relationships and understand the factors that adversely impact the ability and capacity of a society to bounce back and rebound from an event; b) develop an index of resilience and policy indicators and metrics based on these dimensions; c) based on the Resilience Policy Index (RPI) identify how societal resilience can be strengthened through policy interventions and development of policy measures; and c) understand how resilience is tied to both the speed and quality of long-term recovery initiatives. The proposed paper will address these objectives by measuring the various dimensions of community resilience and their relationships. The study area for this study will be the state of Florida. Florida was chosen as it represents an area that is highly vulnerable to natural hazards like tropical storms and hurricanes, as well as ecological damage from urban sprawl and sea-level rise.

Dr. Alka Sapat- Associate Professor, School of Public Administration, Florida Atlantic University

1:40pm - 1:55pm

Presentation C:
Measuring Societal Resilience In a Terrorist - Threat Context

The focus of the proposed paper is to: a) identify and analyze the multiple dimensions of community resilience, including their conflicting and complimentary relationships and understand the factors that adversely impact the ability and capacity of a society to bounce back and rebound from an event; b) develop an index of resilience and policy indicators and metrics based on these dimensions; c) based on the Resilience Policy Index (RPI) identify how societal resilience can be strengthened through policy interventions and development of policy measures; and c) understand how resilience is tied to both the speed and quality of long-term recovery initiatives. The proposed paper will address these objectives by measuring the various dimensions of community resilience and their relationships. The study area for this study will be the state of Florida. Florida was chosen as it represents an area that is highly vulnerable to natural hazards like tropical storms and hurricanes, as well as ecological damage from urban sprawl and sea-level rise.

Brigadier-General (Retired) **Meir Elran** - Senior Fellow and Director, Homeland Security Program, Institute for National Security Studies (INSS), Tel Aviv University, Israel

1:55pm - 2:10pm

Adjourn to Break-Out Sessions- All participants should attend the break-out session to which you have been assigned *(see name tag color)*

2:10pm - 2:55pm

Concurrent Session A: Is the Blame Game Making Us Less Resilient? ..... Commonwealth A
A Re-examination of Blame Allocation in Systems with High Uncertainty.
Dr. Patricia Longstaff
Correlating Name Tag Color: Red

Concurrent Session B: ***Multiple Dimensions of Societal Resilience: Developing a Resilience Index.*** ..... Commonwealth B
Dr. Alka Sapat
Correlating Name Tag Color: Yellow

Concurrent Session C: ***Measuring Societal Resilience In a Terrorist - Threat Context.*** ..... Commonwealth C/D
Brig. Gen. (ret) Meir Elran
Correlating Name Tag Color: Green

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2:55pm - 3:10pm Adjourn to Main Auditorium for Concurrent Sessions II Presentations

3:00pm - 5:00pm **Concurrent Sessions II: Ecological and Biological Perspectives of Resilience** ..... Commonwealth Ballroom

3:10pm - 3:15pm Introduction of Concurrent Sessions II

3:15pm - 3:30pm **Presentation D:**
Developing Bio-Event Resilient Communities and Societies: A Holistic Approach

This paper describes a holistic approach for determining needed actions to improve community and broader societal capabilities to withstand bio-events that impact community health and safety, and to rapidly recover to normal or new normal conditions. This approach uses a multi-step process that builds upon various regional interdependencies initiatives to develop a comprehensive resilience Action Plan - a risk mitigation and regional continuity strategy—by a broad stakeholder group of relevant government agencies, utilities, businesses, and non-profit organizations. This Action Plan is the initial foundation for a sustainable, ongoing process centered on a public-private partnership to move a communityor society incrementally toward resilience to address any adverse significant event. This process has been under development for nearly a decade by the Pacific Northwest Center for Regional Disaster Resilience, a component of the Pacific Northwest Economic Region (PNWER), and has been customized for other regions in the United States and Canada.

Dr. Paula Scalingi - Director, Pacific Northwest Center for Regional Disaster Resilience

3:30pm - 3:45pm **Presentation E:**
Foundations of Ecological Resilience

For almost four decades, ecologists have developed and refined the idea of resilience to explain abrupt, unpredictable and deeply systemic ecological changes. Two definitions are used: engineering resilience is the amount of time for a system to recover after a perturbation and ecological resilience is defined as the amount of a disturbance that can create a new system configuration. Such system changes have been observed in lakes, where algal blooms have turned clear water green after a heat wave, coral reefs have become slimy, algal reefs after a hurricane, and grasslands or wetlands that suddenly shift dominant plants after a drought or fire. This concept has important considerations for managers; as past approaches that seek to optimize natural resource production have led to a loss of ecological resilience and subsequent state change.

Dr. Lance Gunderson - Professor, Department of Environmental Studies, Emory University

3:45pm - 4:00pm **Presentation F:**
Indicators of Ecological Resilience: Building and Sustaining Resilient Communities

This presentation examines approaches to measuring the contribution of natural ecological systems and how these measures contribute to our understanding of resilience and sustainable communities. This presentation will suggest that "Resilient communities are the product of their natural, social and economic systems; measuring these systems is critical for the long-term sustainability of a community, especially in the recovery of a community following a disaster". Indicators of ecological resilience may be selected to complement social and economic indicators and form a basis for policy decisions. Communities should be engaged in selecting and using indicators in order to ensure their long-term sustainability.

Dr. John Pine - Director, Research Institute for Environment, Energy and Economics, Appalachian State University

4:00pm - 4:15pm	Adjourn to Break-Out Sessions. All participants should attend the break-out session to which you have been assigned. *(see name tag color)*
4:15pm - 5:00pm	**Concurrent Session D**: ***Developing Bio-Event Resilient Communities and Societies: A Holistic Approach.*** ..... Commonwealth A Dr. Paula Scalingi Correlating Name Tag Color: Red
	Concurrent Session E: ***Foundations of Ecological Resilience.*** ..... Commonwealth B Dr. Lance Gunderson Correlating Name Tag Color: Yellow
	Concurrent Session F: ***Indicators of Ecological Resilience: Building and Sustaining Resilien Communities.*** ..... Commonwealth C/D Dr. John Pine Correlating Name Tag Color: Green
5:00pm	Adjourn for Day

Day 3: Thursday, 2 December 2010

8:00am - 8:30am	**Continental Breakfast**
8:30am - 9:30am	**Day 3 Opening Session** ..... Commonwealth Ballroom
8:30am - 8:35am	Welcome: Phil Anderson, HSI
8:35am	Introduction of Day 3 Keynote Speaker 1: Alex McLellan
8:35am - 9:05am	Day 3 Keynote Speaker 1: **Arif Alikhan**- Department of Homeland Security Distinguished Visiting Professor and Scholar-In-Residence, National Defense University College of International Security Affairs; Former Assistant Secretary for Policy Development, DHS
9:05am	Introduction of Day 3 Keynote Speaker 2: Alex McLellan
9:05am - 9:30am	Day 3 Keynote Speaker 2: **Charles Ng**- Executive, National Security Coordination Centre, Prime Minister's Office, Singapore
9:30am - 11:30am	**Concurrent Sessions III: Social, Organizational, and Cultural Perspectives of Resilience** ..... Commonwealth Ballroom
9:30am - 9:35am	Introduction of Concurrent Sessions III Presenters: **Dr. Warren Fishbein**- Coordinator, Global Futures Forum, Bureau of Intelligence and Research, US Department of State
9:35am - 9:50am	**Presentation G:** ***Bases for a Community Resilience System*** The Community and Regional Resilience Institute (CARRI) is developing the Community Resilience System (CRS) to help communities become more resilient. The CRS is a set of processes, guidelines, incentives and other supporting resources that together comprise a practical approach for communities to follow. In this document, we describe the bases for the CRS. Fundamentally, the CRS must be compatible with the complex characters of America's communities. The CRS must help communities to understand community

9:35am - 9:50am

Presentation G continued...

America's communities. The CRS must help communities to understand community resilience in the context of their own communities – what are the perils they face, what can they do to avoid or limit the impacts of those perils, and where will the resources come from for those actions. Finally, the CRS must embody an outcome-driven approach that is usable, useful and will be used by communities to become more resilient.

Dr. John Plodinec- Science Advisor, Savannah River National Laboratory; Community and Regional Resilience Institute (CARRI)

9:50am - 10:05am

Presentation H:
Being vulnerable in a resilient community? Some lessons learnt from coping with financial loss after the 2005 floods in Switzerland

In August 2005 torrential rain in large parts of Switzerland caused floods and landslides that gave rise to the costliest natural event ever caused in the past hundred years in the country. By means of a compact social safety net, private individuals and company owners were able to cover a large part of their financial losses. Yet there were several hundreds of individuals who had unmet recovery needs after the floods and had to rely on charities to help them cover their remaining costs. This paper links the findings from the Swiss case to research on resilience and vulnerability, and combines the two concepts to demonstrate the need to take a closer look at the differential ability of individuals and groups to cope with a natural event – even in very resilient societies. The aim is to draw lessons learnt for further research on resilience and vulnerability.

Ms. Corinne Bara- Researcher, Center for Security Studies (CSS), Crisis and Research Network (CRN), ETH Zurich

10:05am - 10:20am

Presentation I:
Dimensions of Organisational Resilience

In an unpredictable future, resilient organisations are pivotal for a nation's security, progress and well-being. Resilience is now being embraced by governments, corporations, individuals and social groupings, having moved beyond the disciplines of ecology and engineering. This changing application has engendered different perspectives on, and interpretations of, the concept of resilience and approaches to it in widely divergent milieus. These range from protection of critical infrastructure, national security, and response to addressing international piracy and supply chain security. Partnerships and interdependencies within and across organisations and sectors inevitably impact on levels of resilience and the weakest link, even if unforeseen or discounted, may have an impact out of proportion to its supposed relevance. Organisations have the potential to provide an existing systemic contribution to a holistic resilience continuum. If the fundamental attributes of resilience, based as they are on a holistic systemic integrated approach, are adopted by organisations then communities and, ultimately, nations will benefit. This paper investigates the core aspects of organisational resilience, its relevance for a nation's security and examines the role of partnerships, synergy and shared responsibility.

Ms. Rita Parker- Chief Executive, Innovative Solutions for Security and Resilience (ISSR), Australia; Visiting Fellow, DSARC, UNSW at Australian Defence Force Academy; Subject Matter Expert, Center for Infrastructure Protection, George Mason University

10:20am - 10:30am

Adjourn to Break-Out Sessions. All participants should attend the break-out session to which you have been assigned *(see name tag color)*

10:30am - 11:15am	**Concurrent Session G:** ***Bases for a Community Resilience System.*** ..... Commonwealth A Dr. John Plodinec Correlating Name Tag Color: Red
	Concurrent Session H: ***Being vulnerable in a resilient community? Some lessons learnt from coping with financial loss after the 2005 floods in Switzerland.*** ..... Commonwealth B Ms. Corinne Bara Correlating Name Tag Color: Yellow
	Concurrent Session I: ***Dimensions of Organisational Resilience*** ..... Commonwealth C/D Ms. Rita Parker Correlating Name Tag Color: Green
11:15am - 11:30am	Adjourn to Ballroom for Closing Plenary
11:30am - 12:30pm	**Closing Plenary: Symposium Lessons Learned** ..... Commonwealth Ballroom
11:30am - 11:35am	Panel Introduction: Phil Anderson
11:35am - 12:20pm	Closing Plenary **Moderator: Bert B. Tussing**- Director, Homeland Defense and Security Issues, Center for Strategic Leadership, U.S. Army War College **Distinguished Panel:** • **Dr. Benjamin Nickels**- Faculty Researcher, START Center, University of Maryland College Park (Representing Concurrent Sessions I: The History and Philosophy of Resilience) • **Dr. Warren Fishbein**- Coordinator, Global Futures Forum, Bureau of Intelligence and Research, US Department of State (Representing Concurrent Sessions III: Social, Organizational, and Cultural Perspectives of Resilience)
12:20am - 12:30pm	Closing Remarks: Phil Anderson
12:30pm	Adjourn
1:30pm - 5:30pm	**INVITATION ONLY: Resilience Research Network- Strategic Planning Session** Agenda: Provided in Email Invitation Facilitator: Bert Tussing

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 1: Tuesday, 30 November 2010

Welcome Reception Keynote Speaker

Brian Kamoie
Senior Director for Preparedness Policy, Resilience Directorate, National Security Staff The White House

Brian Kamoie is Senior Director for Preparedness Policy, Resilience Directorate, on the White House National Security Staff. In this role he leads the development of national policy related to all-hazards preparedness, individual and community resilience, domestic critical infrastructure protection and resilience, preparedness grants and national security professional development.

Before joining the White House National Security Staff, Mr. Kamoie served as Deputy Assistant Secretary for Preparedness and Response and Director of the Office of Policy, Strategic Planning & Communications at the U.S. Department of Health and Human Services (HHS). In this role, he led efforts in policy development, strategic planning and communications related to preparedness for and response to bioterrorism and other public health emergencies.

Prior to his work at HHS, Kamoie was Associate Professor of Health Policy and Health Services Management and Leadership at The George Washington University School of Public Health and Health Services, where he taught classes in public health law, health services law, and homeland security and public health policy. is a 2009 senior fellow of The George Washington University's Homeland Security Policy Institute, and continues to serve on the adjunct faculty as Professorial Lecturer in the School of Public Health and Health Services.

Mr. Kamoie received his bachelor's degree in policy studies and political science from Dickinson College in Carlisle, Pa. and his law degree and master's degree in public health from The George Washington University in Washington, D.C.

Welcome Reception Keynote Speaker

Christine Wormuth
Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs, U.S. Department of Defense

Christine E. Wormuth is the Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs. As Principal Deputy, she advises the Assistant Secretary of Defense on the homeland defense activities of the Department and regional security matters for the countries of the Western Hemisphere. In addition, she is responsible for management of the Department's participation in interagency activities concerning homeland security and relations with the Department of Homeland Security.

Before returning to the Department of Defense, Ms Wormuth was a Senior Fellow in the International Security Program with the Center for Strategic and International Studies (CSIS). Ms. Wormuth worked on defense and homeland security issues, including emergency response and preparedness matters, homeland security policy development, defense strategy and resources, and the capabilities and readiness of the U.S. military.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 1: Tuesday, 30 November 2010

Welcome Reception Keynote Speaker

Christine Wormuth
Principal Deputy Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs, U.S. Department of Defense

Continued...
Additionally, Ms Wormuth's long public service career has included: Principal at DFI Government Services; French desk officer at the Policy Office of the Office of the Secretary of Defense during and after the September 11 attacks; and Special Assistant to the Under Secretary for Policy. She holds a Masters of Public Policy from the University of Maryland. She holds a Bachelor of Arts in political science and fine art from Williams College and is a member of Women in International Security.

Welcome Reception Keynote Speaker

Major General (ret.) **Matan Vilnai**
Deputy Minister of Defense, Israel (Labor)

Matan Vilnai has served as the Deputy Minister of Defense for Israel since 2007. Prior, he has served as the Minister in the Prime Minister's Office; Acting Minister of Science and Technology; and Minister of Science and Technology.

Elected to the Knesset in 1999, Matan Vilnai was appointed Minister of Science, Culture and Sport in 1999, and served as Chairman of the Ministerial Committee for Israeli Arab Affairs. Vilnai was reappointed Minister of Science, Culture and Sport in March 2001, serving until until October 2002.

His distinguished military career serving in the IDF spanned 35 years. From 1978-1982 he was Chief Paratroop and Infantry Officer. In 1989 he was appointed OC Southern Command. From 1994-1997 Major General Matan Vilnai was Deputy Chief of the General Staff.

He has a B.A. in History from Tel Aviv University. In 1984, he became a fellow at the Center for International Affairs, at Harvard University, Boston; and in 1998 he became a fellow at Johns Hopkins University, Washington D.C.

Day 2: Wednesday, 1 December 2010

Opening Plenary Moderator

Dan Kaniewski
Assistant Vice President for Homeland Security and Deputy Director, Homeland Security Policy Institute (HSPI) The George Washington University

Daniel J. Kaniewski is Assistant Vice President and Deputy Director of The George Washington University Homeland Security Policy Institute (HSPI). Mr. Kaniewski re-joined HSPI in August 2008 after spending three years on the White House staff, most recently as Special Assistant to the President for Homeland Security and Senior Director for Response Policy.

Mr. Kaniewski's current research interests include incident management, emergency management, and the homeland security policymaking process.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Opening Plenary Moderator

Dan Kaniewski
Assistant Vice President for Homeland Security and Deputy Director, Homeland Security Policy Institute (HSPI) The George Washington University

Continued...
He co-chairs the HSPI Preparedness, Response, and Resilience Task Force with former FEMA Administrator David Paulison and former New York official Michael Balboni. Prior to his White House service, he co-founded HSPI and served as its first Deputy Director from October 2002 to July 2005. Earlier in his career he was a Congressional Liaison for Terrorism Preparedness and Consequence Management at the Federal Emergency Management Agency.

Prior to 9/11, Mr. Kaniewski served as a Homeland Security Fellow to members of the U.S. House of Representatives where he conducted research on congressional coordination for homeland security. From 1996-2000 he utilized his experience as a firefighter and paramedic to assist policymakers as Emergency Medical Services Advisor to the Congressional Fire Services Institute (CFSI).

Mr. Kaniewski holds a Bachelor of Science degree in Emergency Medical Services from The George Washington University School of Medicine and Health Sciences, a Master of Arts degree in National Security Studies from the Georgetown University School of Foreign Service, and is a Ph.D. candidate in Public Policy and Administration at The George Washington University.

Opening Plenary Panelist 1

Dr. Gamini Keerawella
Head and Professor, Department of History, University of Peradeniya, Sri Lanka

Dr. Gamini Keerawella is a Senior Professor of History at the University of Peradeniya in Sri Lanka. He was the recipient of the IOCPS Senior Visiting Fellowship at the University of Western Australia, Senior Fulbright Fellowship at the University of California, Berkeley, Japan Foundation Fellowship and Visiting Research Fellowship at the Institute of Developing Economies, Tokyo Japan, and Scholar-in-Residence at the Center for Theory, Baroda, India.

He was the Founder Director of the National Integration Programme Unit (NIPU), and has served as Secretary, Ministry of Ethnic Affairs National Integration and Mineral Resources Development and Adviser to the President of Sri Lanka.

His publications include From National Security to Human Security: Evolving Security Discourse in Sri Lanka, Japan in South Asia in the Context of the New Discourse on Peace and Security, Sri Lanka Navy: Enhanced Role and New Challenges, and over 12 book-chapters and articles in *Asian Survey, Canadian Journal of Communication, dialogue and Social Science Review.*

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Opening Plenary Panelist 2

Lieutenant Colonel Rami Peltz
Behavioral Sciences Branch,
Israel Defense Forces

LTC Rami Peltz is the Head of the Behavioral Sciences Branch, Home Front Command, Israel Defense Forces. He is responsible for the population behavior officers functioning in the HFC headquarters and field units. His branch is engaged in research of population behavior during emergency situations, promoting resilience, assisting in preparing the psycho-social setting the local authorities, as well as preparing people with special needs.

During emergencies LTC Peltz is responsible for assessing the national psychological status, and evaluating the capacities and knowledge of the civilians, as a basis for recommendations how to best meet their needs.

LTC Peltz participated in the Search and Rescue IDF team to Haiti, and took part in a research delegation to Thailand after the Tsunami. He was actively involved in the HFC efforts during the missile attacks on the Northern (2006) and Southern (2008/09) regions of Israel; and participated in Search and Rescue efforts in the aftermath of the terror attack in Hilton Tabba.

Opening Plenary Panelist

Christian Sommade
Délégué Général, Haut Comité Français pour la Défense Civile (Executive Director, French High Committee for Civil Defense)

Christian Sommade has been the Executive Director of the French High Committee for Civil Defence for 10 years.

As executive director for the French high committee for civil defence, Mr. Sommade has re-launch 10 years ago the activity of the High committee, as one of the major think tank in France on the issues of Resilience, emergency and crisis management against catastrophic threats with a focus on CBRN issues, critical infrastructure protection and societal resilience.

In the Framework of HCFDC activities, Mr. Sommade has also been a trainer on crisis management for the French Ministry of Interior and many private companies, as well as consultant on different resilience and security matters.

Before that, Christian Sommade has spent 3 years in Washington DC to develop and promote the French NBC defense industry on the US market of Homeland security. Before this appointment, he has worked for 8 years in Giat Industries as Manager of the CBRN defense division. He has worked as project manager for 2 years on a large audit of the French civil defence for the Prime Minister Dept (SGDN)

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Opening Plenary Panelist

Christian Sommade
Délégué Général, Haut Comité Français pour la Défense Civile (Executive Director, French High Committee for Civil Defense)

Continued...
Between 1985 and 1990, Mr. Sommade has been working as export manager for SP Company, engineering and industrial firm specialized in CBRN collective protection and Air Raid shelters. Between 1983-1985, Mr. Sommade was junior consultant for a large engineering firm in the field of civil defense planning and audit.

Mr. Sommade graduated from University Paris Sorbonne – Law & Human Science University - with a Master in Public Law and an Advanced Diploma in Defence; from University Paris 13 with a Master in Marketing and Communication. He as been graduated of the 7th session of the High Studies Institute for Internal Security (IHESI) of the French Ministry of Interior.

Opening Plenary Panelist 4

Dr. Matt Qvortrup
Research Director, Resilience Centre at Cranfield University, UK Defense Academy

Dr. Matt Qvortrup is Research Director and acting head at the Resilience Centre at Cranfield University, at the UK Defense Academy.

Having earned his doctorate in Politics from Brasenose College, University of Oxford, Dr. Qvortrup has taught at the London School of Economics (2000-2003) and has previously been a visiting Professor at University of Sydney and at the University of New South Wales (2005). Dr Qvortrup served as Head of the Gun Crime Section in the British Home Office (2003-2004), where he was responsible for the most successful gun amnesty in British history.

Described by the BBC as "the World's leading authority on referendums", Dr Qvortrup has worked as a consultant for the US State Department, Elections Canada, the UK Electoral Commission and is currently affiliated to Chatham House, The Royal Institute of International Affairs. During 2009 he was an adviser to the Barack Obama's Special Envoy to the Sudan.

Dr. Qvortrup has written several books, including: Balloting to Stop Bullets. Referendums on Nationalism and Ethnic Issues, A Comparative Study of Referendums. Government by the People, as well as he has written numerous reports and refereed papers in academic journals.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Opening Plenary Panelist 5

Brigadier K. Srinivasan (Retired)
Establishment Director, Centre for Security Analysis, India

Brigadier Srinivasan is the Establishment Director for the Centre for Security Analysis (CSA) in India. In this capacity, he guides and supervises the work of research fellows. His area of work includes, conflict resolution & peace building, terrorism, disaster management and role of civil society in conflict situations.

During his active army career of 35 years, he participated in 1965 and 1971 wars and in counter insurgency operations in Jammu & Kashmir and has held several important commands, instructional and planning assignments.

He is a graduate of Defence Services Staff College and College of Defence Management. Brigadier Srinivasan is an active member of the working group on non-traditional security of Regional Network of Strategic Studies Centres set-up by NESA Centre, National Defence University, Washington.

Opening Plenary Panelist 6

Dr. Norman Vasu
Assistant Professor, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore

Dr. Norman Vasu is an Assistant Professor at the Centre of Excellence for National Security (CENS), S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore. He is Deputy Head of CENS and the coordinator of the Social Resilience Programme.

Prior to his current role at CENS, he was a tutor at the Department of International Politics at the University of Wales, Aberystwyth from 2000-2002. At the same University he was a lecturer on International Relations for the Centre for Widening Participation and Social Inclusion from 2002-2004. Dr Vasu was also a Post-Doctoral Fellow with the Institute of Defence and Strategic Studies, Nanyang Technological University, Singapore from April 2005 – March 06.

Dr Vasu has authored How Diasporic Peoples Maintain their Identity in Multicultural Societies: Chinese, Africans, and Jews (2008) and edited Social Resilience in Singapore: Reflections from the London Bombings (2007). He has published widely in journals such as Asian Ethnicity , The Kantian Review and Jane's Homeland and Security Monitor as well as writing for several newspapers on topics surrounding multiculturalism, national security and social resilience. His current research interests include the theories and practise of multiculturalism, transnational communities and nationalism.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Opening Plenary Panelist 6

Dr. Norman Vasu
Assistant Professor, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore

Coninued...
He obtained a MA from the University of Glasgow in 1998 and a MSc in International Relations from the London School of Economics in 1999. In 2004, Dr Vasu received his doctorate in International Politics from the University of Wales at Aberystwyth.

Day 2 Opening Session Keynote Speaker 1

Todd M. Keil
Assistant Secretary for Infrastructure Protection, U.S. Department of Homeland Security

Todd M. Keil was appointed in December 2009 by President Obama to serve as the Assistant Secretary for Infrastructure Protection at the U.S. Department of Homeland Security. His office is responsible for protecting the assets of the United States essential to the nation's security, public health and safety, economic vitality, and way of life. These assets, referred to as critical infrastructure and key resources, are divided into 18 separate sectors, as diverse as agriculture and food, emergency services, and critical manufacturing.

He brings to the national infrastructure protection mission more than 22 years of experience in global security operations and management, intelligence and law enforcement, and threat assessment and risk mitigation. His recent experience in private industry includes senior consulting in risk mitigation, executive and facility security, and worldwide threat management.

Prior to entering private industry in 2007, Mr. Keil held several key positions at the U.S. Department of State's Diplomatic Security Service, including Regional Director for Western Hemisphere Affairs, where he championed protection of U.S. government facilities, personnel, and national security information. In Foreign Service positions in Indonesia, Ireland, and Austria, he provided a broad range of security and law enforcement management and risk mitigation expertise, while advising U.S. ambassadors and in primary liaison roles with a wide network of global law enforcement, intelligence, and counter-intelligence agencies. From 1994 to 2000, he held a leadership position on the protective detail that provided personal protection for two Secretaries of State.

Mr. Keil holds a Bachelor of Arts in Political Science and Criminal Justice from Ripon College in Ripon, Wisconsin. He has also studied at the University of Bonn in Germany and the American University in Washington, D.C.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Day 2 Opening Session Keynote Speaker 2

Dr. Ruth David
President and Chief Executive Officer,
Analytic Services, Inc.

In October 1998, Dr. David became president and chief executive officer of ANSER, an independent, not-for-profit, public service research institution that provides research and analytic support on national and transnational issues. In November 1999, Dr. David initiated Analytic Services' Homeland Defense Strategic Thrust to address the growing national concern of multidimensional, asymmetric threats from rogue nations, substate terrorist groups, and domestic terrorists. In May 2001, the ANSER Institute for Homeland Security was established to enhance public awareness and education and contribute to the dialog on the national, state, and local levels. In April 2004, the corporation was selected by the Department of Homeland Security to establish and operate a new federally funded research and development center, the Homeland Security Institute (HSI).

From September 1995 to September 1998, Dr. David was Deputy Director for Science and Technology at the Central Intelligence Agency. As Technical Advisor to the Director of Central Intelligence, she was responsible for research, development, and deployment of technologies in support of all phases of the intelligence process. Previously, Dr. David served in several leadership positions at the Sandia National Laboratories, where she began her professional career in 1975. Most recently, she was Director of Advanced Information Technologies.

Dr. David is a member of the Department of Homeland Security Advisory Council, the National Academy of Engineering (NAE), and the Corporation for the Charles Stark Draper Laboratory, Inc. She is Chair of the National Research Council (NRC) Committee on Technology Insight–Gauge, Evaluate, and Review and Vice Chair of the HSAC Senior Advisory Committee of Academia and Policy Research.

Dr. David received a B.S. degree in electrical engineering from Wichita State University (1975), an M.S. degree in electrical engineering from Stanford University (1976), and a Ph.D. in electrical engineering from Stanford University (1981).

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Day 2 Opening Session Keynote Speaker 3

Alex McLellan
Principal Analyst, HSI

Alex McLellan is a Principal Analyst with the Homeland Security Studies and Analysis Institute. He is leading HSI's support for the Private Sector Preparedness Program and Standards, specifically focused on best practices and the development of governance systems and evaluation criteria; and developing high level requirements for First Responder Personal Protective Equipment, specifically the Advanced First Responder Locator System.

His prior expertise, obtained during a 25 year career involving military service and private sector consulting, includes strategic planning, systems engineering, systems analysis, requirements analysis, performance metrics and measures of performance, operational analysis, program analysis, and training, education and professional development.

Mr. McLellan holds a BS in Applied Science (Computing Science) and is near completion of a MS in Systems Engineering. He is also enrolled in a doctorate program in systems engineering with Stevens Institute.

Lunch Keynote Speaker 1

Timothy W. Manning
Deputy Administrator for Protection and National Preparedness

Timothy W. Manning was confirmed as Deputy Administrator for Protection and National Preparedness at the Federal Emergency Management Agency (FEMA) in May 2009. In this capacity, he is responsible for preparing the nation to protect against, prevent, respond to, and recover from acts of terrorism and natural disasters.

Through the coordination of the National Preparedness Directorate, Grant Programs Directorate, Office of National Capital Region Coordination and National Continuity Programs Directorate, Mr. Manning oversees the Agency's preparedness initiatives including national training, education, exercises, assessment, and community preparedness programs.

As a former firefighter, emergency medical technician (EMT), rescue mountaineer, hazardous materials specialist and hydrologist, he brings almost two decades of diverse, frontline emergency management experience to the Agency. Prior to joining FEMA, Mr. Manning served as the Secretary of the New Mexico Department of Homeland Security and Emergency Management and Homeland Security Advisor to Governor Richardson.

Mr. Manning entered the New Mexico state government in 2001 as the hazardous materials response program coordinator for the Department

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 2: Wednesday, 1 December 2010

Lunch Keynote Speaker 1

Timothy W. Manning
Deputy Administrator for Protection and National Preparedness

Continued...
of Public Safety. He rose through the ranks, serving as the Chief of Emergency Operations Bureau and then as the Department's Director. In 2007, Mr. Manning was named the state's first Secretary of Homeland Security and Emergency Management.

Deputy Administrator Manning earned a BS in Geology from Eastern Illinois University, and is a graduate of the Executive Leaders Program (ELP) at the Center for Homeland Defense and Security at the Naval Postgraduate School.

Lunch Keynote Speaker 2

Leonard Marcus
Lecturer on Public Health Practice, Department of Health Policy and Management, Harvard University; Director, Program for Health Care Negotiation and Conflict Resolution, Harvard School of Public Health

Dr. Leonard Marcus is founding Director of the Program for Health Care Negotiation and Conflict Resolution at the Harvard School of Public Health (HSPH). Dr. Marcus is also founding Co-Director of the National Preparedness Leadership Initiative, a collaborative effort of HSPH and the Kennedy School of Government, developed in collaboration with the Centers for Disease Control and Prevention, the White House, and the Department of Homeland Security, and the Department of Defense.

In recent years, Dr. Marcus has played a leading national and international role in terrorism preparedness and emergency response, developing the conceptual and pragmatic basis for "connectivity" — the coordination of "people, organizations, resources, and information to best catch, contain, and control a terrorist or other public health threat," and "meta-leadership"- "overarching leadership that strategically links the work of different agencies and levels of government."

Dr. Marcus teaches HSPH courses on negotiation and conflict resolution and leadership. His research interests include: factors associated with the coordination of effort for national and international terrorism response strategies; implications of conflict in health care services; the uses of mediation for resolving health disputes; the contributions of conflict resolution to error prevention in health care; as well as on the role health can play in resolving larger social conflict.

Dr. Marcus completed his doctoral studies at The Heller School of Brandeis University. He was selected as a Fellow for the Kellogg National Leadership Program from 1986-1989.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 3: Thursday, 2 December 2010

Day 3 Opening Session Keynote Speaker 1

Arif Alikhan
Distinguished Visiting Professor and DHS Scholar-in-Residence, National Defense University, College of International Security Affairs

Arif Alikhan is the Department of Homeland Security Distinguished Visiting Professor and Scholar-In-Residence at the National Defense University's College of International Security Affairs in Washington, D.C. Professor Alikhan was most recently the Assistant Secretary for Policy Development at DHS where he led a team of policy analysts, scientists, and other experts responsible for the development, analysis, and coordination of department-wide policy initiatives. His areas of responsibility included the vast array of homeland and national security missions of DHS including efforts to protect the United States against terrorism, enhance transportation and border security, enforce federal immigration, financial crimes, and customs laws, and ensure the Nation's preparedness and response to disasters.

Prior to his appointment as Assistant Secretary, Professor Alikhan was the Deputy Mayor for Homeland Security and Public Safety for the City of Los Angeles where he served as a senior advisor to Mayor Antonio R. Villaraigosa and had oversight, operational, budgetary, and policy coordination responsibilities for the Los Angeles Police, Fire, and Emergency Management Departments.

For nearly a decade, Professor Alikhan served as a federal prosecutor and was appointed as the first Chief of the Cyber and Intellectual Property Crimes Section for the Central District of California based in Los Angeles. In addition, he served as a senior advisor to two U.S. Attorneys General on intellectual property and cyber crime issues at the U.S. Department of Justice in Washington D.C.

Professor Alikhan graduated with honors from Loyola Law School in Los Angeles where he was Chief Articles Editor of the Loyola of Los Angeles Law Review. He also attended the University of California at Irvine where he received a degree in criminal justice, criminology, and legal studies.

Day 3 Opening Session Keynote Speaker 2

Charles Ng
Executive, National Security Coordination Centre, Prime Minister's Office, Singapore

Mr. Charles Ng is currently serving in the Singapore Government as an Executive in the National Security Coordination Secretariat (NSCS), a department in the Prime Minister's Office. Having joined the organisation in 2010, he was first deployed in the Horizons Scanning Unit to experiment and infuse Futures thinking in government policy. Subsequently, he was moved to the Policy and International Relations Unit to review and coordinate the government's efforts on Resilience.

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 3: Thursday, 2 December 2010

Day 3 Opening Session Keynote Speaker 2

Charles Ng
Executive, National Security Coordination Centre, Prime Minister's Office, Singapore

Continued...
He is also the recipient of the National Youth Achievement Award (Gold), from his involvement with disenfranchised youth and has a passion for volunteer work. At Oxford University, he started the inaugural Oxford Singapore Forum, bringing together academics and policymakers alike to discuss the Singaporean Identity.

Mr. Ng graduated with a B.A. and an M.A. from Oxford University in Modern History. He also earned a Masters in Public Policy (MPP) from the Lee Kuan Yew School of Public Policy in 2008.

Closing Plenary Moderator

Bert B. Tussing
Director, Homeland Defense and Security Issues, Center for Strategic Leadership, U.S. Army War College

Bert Tussing is the Director of the Homeland Defense and Security Issues Group at the U.S. Army War College's Center for Strategic Leadership, and holds the Elihu Root Chair of Military Studies. He joined the Center in October 1999 following nearly 25 years in the United States Marine Corps.

He is a Distinguished Graduate of both the Marine Corps Command and Staff College and the Naval War College, and holds Masters Degrees in National Security Strategy and Military Strategic Studies. He has served as a consultant on three Defense Science Boards; the Center for Strategic and International Studies' Beyond Goldwater-Nichols Study; and as a member of the Senior Advisory Group for DoD's "Strategy for Homeland Defense and Civil Support."

He is a senior fellow on George Washington University's Homeland Security Policy Institute; a member of the Board of Experts for the University of California-Irvines' Center for Unconventional Security Affairs; a member of the Pennsylvania State University's Homeland Defense and Security Council; and on the Steering Committee of the Homeland Security/ Defense Education Consortium Association. In December 2009 he completed an appointment to the Department of Homeland Security's Homeland Security Advisory Council, assisting in the development and execution of the Department's Congressionally-mandated *Quadrennial Homeland Security Review.*

Closing Plenary Panelist 1

Dr. Benjamin Nickels
Faculty Researcher, National Consortium for the Study of Terrorism and Responses to Terrorism (START Center), University of Maryland, College Park

Dr. Benjamin P. Nickels is a faculty researcher at the National Consortium for the Study of Terrorism and Responses to Terrorism (START), a Department of Homeland Security (DHS) Center of Excellence at the University of Maryland College Park, where he is conducting research on the effectiveness and impacts of counterterrorism policies. His current work includes case studies on counterterrorism measures taken against Al-Qaeda in the Islamic Maghreb (AQIM) and the threat of homegrown Islamist terrorism

Distinguished Researchers, Presenter's Bios & Contact Information

Short Bios: Symposium Speakers and Panelists
Day 3: Thursday, 2 December 2010

Closing Plenary Panelist 1

Dr. Benjamin Nickels
Faculty Researcher, National Consortium for the Study of Terrorism and Responses to Terrorism (START Center), University of Maryland, College Park

Continued...
in the United Kingdom. His research interests include radicalization, counterterrorism, and resilience.

Dr. Nickels holds a doctorate from the University of Chicago. He has served as a Chateaubriand fellow and Centre national de la recherche scientifique(CNRS) researcher in France, and a Fulbright scholar in Morocco. He has taught courses on counterterrorism, political violence, Muslim intellectual history, and the Arabic language. Prior to joining START, Dr. Nickels worked as an analyst and supervisor for a defense contractor in the United States Department of the Army.

Closing Plenary Panelist 2

Warren Fishbein
Coordinator, Global Futures Forum, Bureau of Intelligence and Research, US Department of State

Dr. Warren H. Fishbein serves as Coordinator of the Global Futures Forum (GFF) within the U.S. State Department's Bureau of Intelligence and Research. In previous phases of his twenty-seven year career within the U.S. Intelligence Community, he served as an analyst and analytic manager, and as a leader of projects applying strategic foresight techniques and academic outreach to better understand complex security issues.

He is the author of Wage Restraint by Consensus: Britain's Search for an Incomes Policy Agreement, 1964-79 (London, 1984), and, with Gregory Treverton, the Sherman Kent Center Occasional Paper, Making Sense of Transnational Threats (2004). Dr. Fishbein holds a B.A. degree from the City College of the City University of New York and a Ph.D. degree in Political Science from the Massachusetts Institute of Technology.

Distinguished Researchers, Presenter's Bios & Contact Information

Concurrent Sessions 1: The Philosophy of Resilience

Dr. Patricia Longstaff- James Martin Senior Visiting Fellow, Oxford Martin School, University of Oxford; David Levidow Professor of Communication Law and Policy, Newhouse School of Public Communication, Syracuse University

Is the Blame Game Making Us Less Resilient? A Re-examination of Blame Allocation in Systems with High Uncertainty

Email: phlongst@syr.edu or patricia.longstaff@oxfordmartin.ox.ac.uk
(until May 5, 2011)

Patricia Longstaff came to the study of resilience as part of her ongoing search for ways to manage and regulate systems with high uncertainty. She has published several papers in this area, including a multidisciplinary analysis of the concept of resilience and its implications for public policy and planning for "surprises" such as terrorism and natural disasters. She received funding from the National Science Foundation to lead a cross-disciplinary investigation of resilience and has presented her ideas at conferences around the world. She is currently a James Martin Senior Visiting Fellow at the Oxford Martin School and Visiting Scholar at Trinity College, Oxford. Back home, she is the David Levidow Professor of Communication Law and Policy and a faculty member of the Institute for National Security and Counterterrorism (INSCT) at Syracuse University. She is also a Research Affiliate at the Harvard University Program for Information Policy Research (PIRP). She is a member of the U.S. State Department's Advisory Committee on International Communications and Information Policy (ACICIP) and a member of the Board of Directors of the International Telecommunications Society (ITS).

Dr. Alka Sapat- Associate Professor, School of Public Administration, Florida Atlantic University

Multiple Dimensions of Societal Resilience: Developing a Resilience Index

Email: asapat@fau.edu

Alka Sapat is Associate Professor of Public Administration at the School of Public Administration, Florida Atlantic University. She is currently working on two National Science Foundation funded projects; the first involved research on resilience, vulnerability, and long-term displacement and housing issues following hurricanes and the second focuses on the role of the Haitian-American community in long-term recovery and resilience issues following the Haiti earthquake. Her research interests include disaster and crisis management, environmental policy innovations, climate change policies, environmental justice, federalism and technology policy. Dr. Sapat's teaching interests include environmental and public policy, research methods, and disaster management. Dr. Sapat's work is published in Public Administration Review, Policy Studies Review, International Journal of Public Administration, and other scholarly venue.

Distinguished Researchers, Presenter's Bios & Contact Information

Concurrent Sessions 1: The Philosophy of Resilience

Brigadier-General (Retired) **Meir Elran**- Senior Fellow and Director, Homeland Security Program, Institute for National Security Studies (INSS), Tel Aviv University, Israel

Measuring Societal Resilience In a Terrorist - Threat Context

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Meir Elran joined the Jaffee Center, now incorporated into the Institute for National Security Studies, in 2003 after a long career in the IDF Military Intelligence directorate. His most senior post in the IDF was Deputy Director of Military Intelligence (1987-1989). Other positions that Brig. Gen. (ret.) Elran held in the IDF included Assistant Director of the Research Division for Evaluation and Deputy Commander of the IDF's National Defense College. Elran's main areas of research are the inter-relations between the social domestic aspects of Israel and its defense doctrine and practice. He has published several articles on the subject of national resilience in Israel, especially as it was manifested during the second intifada and the Second Lebanon War. He is co-editor (together with Shlomo Brom) of The Second Lebanon War, published by INSS and Yediot Ahronot. In 2009 he was an international fellow with the US NDU's Near East and South Asia Strategic Studies Center, where he edited a comparative research study on chaos management.

Concurrent Sessions 2: Ecological and Psychological Perspectives of Resilience

Dr. Paula Scalingi- Director, Pacific Northwest Center for Regional Disaster Resilience

Developing Bio-Event Resilient Communities and Societies: A Holistic Approach

Phone: 206 601-9301; Cell phone: 925 858-5101
Email: scalingigroup@comcast.net or paula@pnwer.org

Paula Scalingi is Director of the Pacific Northwest Center for Regional Disaster Resilience for the Pacific NorthWest Economic Region (PNWER), a statutory consortium comprised of Alaska, Idaho, Montana, Oregon, Washington, the provinces of Alberta, British Columbia, and Saskatchewan, and Yukon and Northwest Territories. Since October 2001, she has assisted private/public sector and non-profit organizations across the nation to develop and implement activities to improve preparedness and resilience. As vice chair of The Infrastructure Security Partnership, a national coalition of engineering and built environment associations, Dr. Scalingi was the principal architect of the Guide to Develop an Action Plan for Regional Disaster Resilience (RDR Guide). She is currently chairing a follow-on task force to develop the 2011 edition of the RDR Guide. In addition, she serves on the Steering Group of the national Community Resilience System Initiative sponsored by the Community and Regional Resilience Institute (CARRI). Dr. Scalingi previously founded and directed U.S. DOE's Office of Critical Infrastructure Protection and served as director of the Decision and Information Sciences Division at Argonne National Laboratory. She also served in the U.S. Arms Control and Disarmament Agency, on the staff of the U.S. House of Representatives Permanent Select Committee on Intelligence, and in the Central Intelligence Agency.

Distinguished Researchers, Presenter's Bios & Contact Information

Concurrent Sessions 2: Ecological and Psychological Perspectives of Resilience

Dr. Lance Gunderson- Professor, Department of Environmental Studies, Emory University

Foundations of Ecological Resilience

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Lance Gunderson is a systems ecologist who studies how people understand, assess, and manage large ecosystems. He holds BS, MS and PhD degrees from the University of Florida. He worked as a research botanist for the US National Park Service in south Florida (1979-89), and as a research scientist at the University of Florida (1992-98). Dr. Gunderson was the founding chair (1999-2005) of the Department of Environmental Studies at Emory University and is currently a Professor in that department. He has been involved in the in environmental assessment and management of large-scale ecosystems, including the Everglades, Florida Bay, Upper Mississippi River Basin, and the Grand Canyon. He has co-edited five books, including Panarchy: Understanding Transformations in Systems of Humans and Nature, Resilience and the Behavior of Large Scale Ecosystems, and Foundations of Ecological Resilience.

Dr. John Pine- Director, Research Institute for Environment, Energy and Economics, Appalachian State University

Indicators of Ecological Resilience: Building and Sustaining Resilient Communities

Email: pinejc@appstate.edu

John C. Pine is Director of the Research Institute for Environment, Energy and Economics at Appalachian State University in Boone, N.C. He joined the faculty at Appalachian in January 2009 from Louisiana State University. His book, Natural Hazards Analysis, published by CRC Press / Taylor Francis in 2009, reflects his research associated with hazards, disasters, risk assessment and risk management. Dr. Pine's presentation is based on a research project funded by NOAA's Coastal Services Center through MCEER, University of Buffalo and is focused on the resilience of coastal communities following Hurricanes Katrina and Rita in 2005.

Dr. John Plodinec- Science Advisor, Savannah River National Laboratory, Community and Regional Resilience Initiative (CARRI)

Bases for a Community Resilience System

Phone: 803-725-1134
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John Plodinec is the Science Advisor at the Savannah River National Laboratory. His current responsibilities include representing the laboratory in a variety of technical forums aligned with the laboratory's primary thrust areas. Most importantly today, this includes heading up SRNL's involvement in the Community and Regional Resilience Initiative (CARRI). An internationally recognized expert in nuclear and chemical waste management, Dr. Plodinec has been involved in several initiatives aimed at helping communities recover more quickly from catastrophic events.

Distinguished Researchers, Presenter's Bios & Contact Information

Concurrent Sessions 3: Societal, Organizational, and Cultural Perspectives of Resilience

Dr. John Plodinec- Science Advisor, Savannah River National Laboratory, Community and Regional Resilience Initiative (CARRI)

Bases for a Community Resilience System

Continued...
He has led CARRI's Charleston, SC, team, trying to understand how Charleston has successfully recovered from a variety of catastrophes, and then transferring its successful practices to the rest of the nation. He is currently deeply immersed in developing CARRI's Community Resilience System that will help communities assess their strengths and weaknesses, and then take positive action to enhance their resilience.

Ms. Corinne Bara- Researcher, Center for Security Studies (CSS), Crisis and Research Network (CRN), ETH Zurich

Being vulnerable in a resilient community? Some lessons learnt from coping with financial loss after the 2005 floods in Switzerland

Phone: +41 44 633 91 47
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Corinne Bara is a researcher at the Center for Security Studies (CSS) of the Swiss Federal Institute of Technology Zurich. As member of the Crisis and Risk Network (CRN), she specializes in research on security risks and social vulnerabilities and does consultancy work for the Swiss Federal Administration in the fields of risk analysis and management. Ms. Bara holds a Masters degree in political science and public international law from the University of Zurich. She has previously worked for the Swiss Federal Department of Foreign Affairs and the International Relations and Security Network (ISN) at the Center for Security Studies.

Ms. Rita Parker- Chief Executive, Innovative Solutions for Security and Resilience (ISSR), Australia; Visiting Fellow, DSARC, UNSW at Australian Defence Force Academy; Subject Matter Expert, Center for Infrastructure Protection, George Mason University

Dimensions of Resilience

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Rita Parker has wide ranging experience as an advisor to corporations and government agencies on resilience, and in providing high level policy advice and management related to security issues including counter terrorism. In collaboration with other professionals, Ms. Parker also designs and manages exercises across topics including crisis management, business continuity, pandemics, counter-terrorism and civil-military cooperation for humanitarian relief operations. As a thought leader in the area of organisational resilience, Ms. Parker chaired the 2010 Committee to develop an Australian national standard for organisational resilience. She is a Visiting Fellow at the Australian Defence Force Academy at the University of New South Wales and is associated as a Subject Matter Expert with the Center for Infrastructure Protection at George Mason University, Virginia USA.

Appendix B: Overview Report

HOMELAND SECURITY STUDIES & ANALYSIS INSTITUTE
An FFRDC operated by Analytic Services Inc. on behalf of DHS

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RESILIENCE INITIATIVE REPORT

13 June 2011

Prepared for
Department of Homeland Security
Science & Technology Directorate

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BACKGROUND

Resilience is now widely recognized as a critical component of effective homeland security. Yet government officials, business managers, and scholars are still wrestling with the concept of resilience, including its definition and how to achieve it. The concept has changed throughout history. Resilience was once recognized as having full control over systems and attempting to prohibit any natural, accidental, or catastrophic events from influencing the functionality of the systems. The focus of resilience has now shifted to the idea of adapting to unpredictable changes and resuming functionality through other means after an event.[1]

To address the issue of resilience, the Homeland Security Studies and Analysis Institute founded the International Resilience Research Network (IRRN) in August 2009 as a research-based, policy-oriented group of international professionals aspiring to provide other countries with sound tools to enhance resilience. The IRRN's main purpose is to stimulate and share scholarly work on resilience. This approach is consistent with HSI's mission to facilitate the sharing of ideas and information to produce innovative solutions to domestic security problems.

The Department of Homeland Security sponsored and organized, through the Homeland Security Studies and Analysis Institute, the first International Symposium on Societal Resilience, held at the Hyatt Fair Lakes in Fairfax, Virginia, from 30 November to 2 December 2010. Convened under the auspices of the IRRN, the symposium was executed in collaboration with the U.S. Army War College and the Institute for National Security Studies of Tel Aviv University.

The first IRRN meeting was held on 24 August 2009 to discuss the capability of an international research network focused on societal resilience. At the second IRRN meeting, on 29 April 2010, the first phase of the strategic plan for the research network was drafted and socialized. The third and most recent meeting, held on 2 December 2010—at the conclusion of the symposium—was an opportunity for members to discuss the next steps of and future research for the network.

FINDINGS OF THE IRRN

The presentations given at the symposium will be included in the formal proceedings to be published by the Homeland Security Studies and Analysis Institute. These presentations reflect the diversity of issues and conceptual differences that continue to characterize discussions of resilience. A few of these issues are summarized below.

Defining Resilience

> Academics and policy makers alike have made efforts to define the term *resilience* or various subsets of resilience. Although governments, corporations, communities, and individuals are now embracing the concept, the definitions of resilience currently in use vary greatly, which contributes to the analytical difficulties in discussing the subject.

[1] Carl Folke, "Freshwater for Resilience: A Shift in Thinking," *Philosophical Transactions: Biological Sciences* 358, no. 1440 (December 29, 2003): 2027-2036.

Characteristics of Community Resilience

There are numerous characteristics of a resilient community, including the foresight and planning to anticipate risks; trust and partnership throughout the community and between the public and private sectors; the distribution of risk throughout society; able leadership; social cohesion; community involvement; communication; financial resources; insurance; access to other financial resources; and local understanding of risk mitigation.

- **Measuring Societal Resilience**

  To increase resilience, it is important to understand the factors that contribute to it, and be able to measure levels of resilience and the effect of actions taken to increase it. Thus, meaningful metrics to measure resilience are essential to building a resilient community. Several proposals for measuring resilience emerged from the symposium.

- **Organizational Resilience**

  Resilient organizations are essential for a nation's security, progress, and well-being. Partnerships and interdependencies within individual organizations and across entire sectors inevitably affect levels of resilience. The weakest link, especially if unforeseen or discounted, may have a disruptive impact—an impact that basic preparedness could have prevented. If *organizational* resilience contributes to *communal* and *national* resilience, then communities and, ultimately whole nations will benefit.

- **Ecological Resilience**

  Although there appeared to be some differences in how participants understood the concept of ecological resilience, which was the topic of several presentations, most viewed it as a major component of community resilience. The issues of climate change and natural disasters in particular, as well as environmental contamination, illustrate this.

FUTURE IRRN RESEARCH

At the December 2010 IRRN meeting, members discussed and identified a number of areas for future collaborative research. In addition, participants from several countries agreed to collaborate on an initiative for comparative resilience research.

As might be expected given the diversity of approaches, experiences, and opinions, the IRRN discussion was wide ranging and spirited. The following overview of research topics represent a starting point for further discussion and refinement:

Benchmark and measure community resilience on a comparative basis

Define elements of collaborative leadership

Identify characteristics of resilience that are common to or unique among cultures

Decide which definition of resilience researchers should use

Conduct historical analyses of community preparation, response, and recovery

Identify the incentives for creating community resilience

Consider strategic communications as an element of resilience

Consider risk communications as an element of resilience

Consider the other-than-critical infrastructure (e.g., small and medium-sized businesses)

Identify what makes an individual more or less resilient

Identify what makes communities more resilient

Identify what efficiencies can be drawn from resilience efforts, whether they are low cost, and what are the ways—as opposed to the means—to resilience

Consider whether shared experience spurs individuals toward action for the greater good

Understand how to motivate people to think about resilience organically, rather than relying completely on assistance from private or government entities

NEXT STEPS

Based on the outcomes of the symposium and the December IRRN meeting, the following projects are currently in planning or development:

A publication to include the research completed by the distinguished presenters at the symposium

Cooperative efforts will lead to additional analytic products that will serve as resources to strengthen international resilience, empowering each country to face its own challenges of natural disasters, transnational terrorism, or any other disruptive event

A strategic plan for the IRRN

A governance structure for the IRRN

A more robust and active IRRN that includes sub working groups focused on historical, sociological, psychological, cultural, organizational, and political aspects of resilient societies

A list of additional researchers, policy makers, or others who should be included in the IRRN

The second International Symposium on Societal Resilience

CONCLUSION

The IRRN is still in the early stages of development. The concept of an international network of resilience researchers has been widely discussed among members of both the academic and policy communities, but the development of the actual network will take time. A variety of international researchers have expressed a willingness to join and participate. As the IRRN develops and grows, broadening participation to as many countries as possible is a priority. The

Homeland Security Studies and Analysis Institute also hopes to expand the IRRN to include representatives from the private sector who may be involved in research or implementation of resilience.

The International Symposium on Societal Resilience marked the beginning of a strong international resilience network—an important first step toward establishing a regular forum for sharing current research and exchanging information and ideas on resilience. Questions raised at the symposium and the December IRRN meeting will form the basis for new and continuing research. Additional symposia will provide a basis for continued growth through international collaboration. The goal is to conduct and promote applied research that will assist policymakers and ultimately produce more resilient individuals, communities, governments, and societies.

Appendix: IRRN Goals and Objectives: Draft Three-Year Plan (2010-2012)

APPENDIX
IRRN GOALS AND OBJECTIVES: DRAFT THREE-YEAR PLAN (2010-2012)

Background

In August 2009 a group of researchers from a wide spectrum of domestic and international research organizations assembled in Washington, D.C., and agreed to develop an international network of resilience researchers. This network will examine how to build societal resilience in the face of catastrophic disaster, stimulate scholarly work on societal resilience, and increase information sharing between resilience research activities. This network was formalized at the first International Symposium on Societal Resilience in November 2010. The following goals and objectives comprise a three-year plan for the IRRN. For the purposes of this plan, the IRRN is in the beginning of year two.

Goal 1 – To enhance global collaboration in resilience research and best practices

Objective 1 – Host annual resilience symposia with a targeted attendance of

- 15 countries in 2012, and
- 30 countries in 2013.

Objective 2 – Create an operational international network for resilience research by the end of 2011

Objective 3 – Create an information-sharing platform on societal resilience with the targeted participation of

20 countries in 2012, and

- 40 countries in 2013.

Goal 2 – To increase awareness of the impact of resilience

Objective 1 – Publish one analytic product (article, book, op-ed, etc.) per year on resilient communities

Objective 2 – Publish collaborative research from individuals within the network in

- one peer-reviewed journal article in 2011, and
- three peer-reviewed journal articles in 2012.

Objective 3 – Establish multinational resilience partnerships

Appendix C: IRRN Mission, Vision, Values, and Strategy

Mission, Vision, Values, and Strategy

This document provides the basis for the development and sustainment of the international community of researchers and policy makers known as the International Resilience Research Network (IRRN).

Mission

Assist individual communities—worldwide—to improve their resilience in the face of catastrophic events.

Vision

Create an international research network to provide information and assistance to communities seeking to build improved resilience.

Values

Members of the IRRN agree to the following values:

- **Leadership**. Provide innovative leadership in thinking about resilient societies—our own and others.
- **Collaboration**. Engage the thinking of any and all colleagues and disciplines so that we may learn from the work of others.
- **Respect**. Respect the work and interests of all members of the network and those they serve.
- **Excellence**. Strive to excel in all our research and dealings with each other and others.

Strategy

1. Examine how to improve and sustain societal resilience in the face of catastrophic disruptions, and to facilitate information sharing between existing resilience research activities within the United States and abroad.
2. Establish and maintain collaboration arrangements to understand and promote the concept of resilience—nationally and internationally.

3. Develop opportunities to educate and inform others in regards to developing and operationalizing sustainable resilience.
4. Encourage scholarly study and collaboration among researchers and policy makers to share ideas, experiences, and research.
5. Host regular symposia, conferences, and workshops on societal resilience, providing an opportunity for individuals to come together from around the world to establish contacts, share findings and ideas, develop a network that can be utilized for further research, and offer guidance to policy makers.
6. Maintain a network of individuals committed to the issue of resilience.
7. Develop publications that highlight the work of the network members, to include proceedings from symposia, conferences, and workshops.

***

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