University of Delaware

DRC

Disaster Research Center





2009 ANNUAL REPORT

DISASTER RESEARCH CENTER

OFFICE OF RESEARCH

UNIVERSITY OF DELAWARE

2009 ANNUAL REPORT

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The editorial staff gratefully acknowledges the staff at the University of Delaware's Office of Communications and Marketing for their assistance with the format and layout of this report.

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Disaster Research Center (DRC)

Established at Ohio State University in 1963 by Professors E. L. Quarantelli, Russell Dynes, and Eugene Haas, and moved to its current location at the University of Delaware (UD) in 1985, DRC was the first research center in the world devoted to the social scientific study of disasters. Historically, the Center has conducted field interviews and extended research projects on group, organizational, and community preparation for, response to, and recovery from natural and technological disasters and other community-wide crises for both academic and practical development of the field of disaster research and mitigation.

Recognizing the broader research interests in disasters across the campus and the interdisciplinary nature of the research, the Center moved from the Department of Sociology and Criminal Justice to the College of Arts and Sciences in the summer of 2006 and in June 2007 the Center moved again to come under the oversight of the UD Research Office. While much of the research at DRC has been interdisciplinary, UD researchers from disciplines other than Sociology are now actively engaged with the Center. Research at the Center continues to build on the foundation in the social sciences while broadening activities to more explicitly embrace interdisciplinary, multidisciplinary and cross-disciplinary research.

Graduate and undergraduate training has been an integral component of DRC's mission. Faculty members from the University of Delaware's Department of Sociology and Criminal Justice and the Department of Civil and Environmental Engineering oversee DRC projects. Classes are taught in the Department of Sociology and Criminal Justice's graduate concentration in Collective Behavior, Social Movements, and Disasters as well as the undergraduate concentration in Emergency and Environmental Management. Classes on Risk Analysis, Civil Infrastructure Systems, and Modeling Systems are also taught in the graduate program in Civil and Environmental Engineering in the concentration on Infrastructure Systems. In Fall 2009, Professor Trainor piloted DISA 650 Introduction to Disasters as part of the new graduate program in Disaster Science and Management that is administered through the School of Urban Affairs and Public Policy. The program offers Masters of Science and Doctor of Philosophy degrees. Graduate researchers from DRC have gone on to careers at leading universities, prominent research centers, key disaster-oriented government agencies, and private sector organizations that deal with disaster and risk issues.

Researchers at DRC have conducted over 685 field studies since the Center's inception, traveling to communities throughout the United States and to a number of foreign countries. DRC researchers have carried out systematic studies on a broad range of disaster types, including but not limited to hurricanes, floods, earthquakes, tornadoes, hazardous chemical incidents, plane crashes, and civil disturbances. Past DRC studies have focused on such topics as emergency medical and mental health service delivery in disasters, community responses to acute chemical hazards, mass evacuation and sheltering, preparations for and responses to major community disasters by lifeline organizations, community earthquake mitigation and emergency preparedness in the Central U.S. and the San Francisco Bay Area, disaster recovery in Charleston, South Carolina and Santa Cruz, California, a large-scale multiyear study on the implementation of FEMA's Project Impact initiative, and the utilization of earth science information in earthquake risk decision making.

Since its founding over four decades ago, DRC's activities have been supported by diverse sources, including the National Institute of Mental Health, the Federal Emergency Management Agency (FEMA) and its preceding agencies, the NOAA Sea Grant Program, and the U.S. Geological Survey. Major research funding is currently provided by grants from the National Science Foundation (NSF), FEMA, the National Institute of Standards and Technology (NIST), and the United State Department of Transportation through the UD University Transportation Center.

In addition to maintaining its own databases, DRC serves as a repository for materials collected by other agencies and researchers. DRC's specialized library, the E. L. Quarantelli Resource Collection, contains the world's most complete collection on the social and behavioral aspects of disasters — now numbering more than 56,000 items. It is open to both interested scholars and agencies involved in emergency management.

The Center has its own book, monograph, and report series with over 1,200 publications including preliminary papers and published articles. The DRC maintains ongoing contact with scholars from throughout the United States, Asia, Europe, and Mexico, some of whom have been visiting research associates at the Center for periods of up to a year. In 2009 we hosted several visitors from Sweden and these visits have served as a foundation for ongoing collaboration.

For more information, consult DRC's home page at www.udel.edu/DRC

Director's Message

The Disaster Research Center (DRC) at the University of Delaware is pleased to present our 2009 Annual Report. This report documents our ongoing activities and achievements, both individually and collectively. Important milestones achieved in 2009 include the Faculty Senate and Board of Trustees approval of the new graduate program in Disaster Science and Management (administered through the School of Urban Affairs and Public Policy), the signing of a Memorandum of Understanding with Argonne National Laboratory, formalization of a research network (Netherlands United States Water Crisis Research Network — NUWCReN) with partners in the U.S. and Netherlands to explore water issues, and the successful completion of another year of the Research Experience for Undergraduates program.

The first part of the year was characterized as the "Swedish Invasion of DRC." We had a brief visit from colleagues from Lund University, followed by an extended visit by Misse Wester from Royal Institute of Technology, then Erna Danielsson from Mid Sweden University, and finally, Linda Eliasson, a PhD student at Mid-Sweden University joined the REU program for the summer. We have enjoyed learning about crisis management in Sweden. This in-depth experience has been complemented by our on-going collaborations with the Netherlands and our continued interaction with colleagues from around the world.

In the spirit of international collaboration, I began the fall semester by joining some of our NUWCReN colleagues to celebrate the 150th Anniversary of Henry Hudson's founding of New York. We closed out the year by hosting a NUWCReN meeting involving our partners from the University of Colorado, Boulder; George Washington University; Virginia Polytechnic University; TNO; COT; Wageningen; and the Dutch Ministry of Transport, Public Works, and Water Management.

This 2009 Annual Report documents the accomplishments of our faculty, staff, graduate students and undergraduate students this past year. Highlights include continued active engagement of our students in our research. The publications listed reflect this involvement. Specifically:

- 20 graduate and 19 undergraduate students worked at DRC throughout 2009 as research assistants. The graduate students are enrolled in degree programs in four different colleges. These students contribute to both the research and outreach activities supported by the Center. Financial support for these students has been possible through a number of externally funded research projects.

- The Research Experience for Undergraduates (REU) Program funded by the National Science Foundation continued. Once again the 10 undergraduate social science researchers were joined by two civil engineers, one sophomore and one junior, two Masters degree students from the Tata Institute in India, and one Ph.D. student from Mid-Sweden University. The diversity of disciplines and cultures added to the richness of the experience. The individual projects are documented in this report. It was a pleasure to work with these 15 talented, motivated and energetic young researchers.

We continue with our Salon Series, implementing and updating our 2007 strategic plan, moving the proposed new interdisciplinary graduate program in Disaster Science and Management forward, and educating our students. Please come and visit, use the Collection, or attend one of our Salon Series seminars.

We look forward to a productive 2010 and welcome your comments and suggestions.

Sue McNeil, Ph.D., P.E.
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Visitors from Lund University in Sweden and Carleton University in Canada gather with DRC personnel to discuss crisis management.

(photo by DRC staff)

Feature Article: Interdisciplinary Graduate Program in Disaster Science and Management

In September 2010, the School of Urban Affairs and Public Policy in partnership with the Disaster Research Center will launch a new graduate program in Disaster Science and Management. This interdisciplinary program will award M.S. (both thesis and non thesis) and Ph.D. degrees. The program builds on the strengths and experience of the Disaster Research Center to offer a program that includes both field experiences and international experiences, has an interdisciplinary focus, and is centered around strong advising and committed faculty. The new program (www.udel.edu/DRC/Education/) complements the existing graduate programs in Sociology (www.udel.edu/soc/grad.html) and Energy and Environmental Policy (ceep.udel.edu/academics/applying/index.html).

The research oriented Masters and Ph.D. programs and a non-thesis Masters program will train the next generation of leaders in the field who will work in academia, government, NGOs and consulting. The program builds on our strengths and experience to offer field and international experiences, and an interdisciplinary focus. Drawing faculty from across the campus and recruiting students from many different disciplines, the interdisciplinary program includes courses, a regular seminar and research or internship experience. The team-taught core courses will focus on the interdisciplinary field of disaster science addressing theories, research methodologies, and policies related to emergency preparedness, mitigation, management and response.

The 30-credit, non-thesis Masters includes three core courses, one analysis course, one public policy and organizational decision making course, a seminar, an internship and electives. The 30-credit Masters follows the same core curriculum but with 6 credits of thesis, one additional analysis course and fewer electives.

The Ph.D. program focuses on six thematic areas:

- Organization, management and leadership
- Built and natural environment and society
- Vulnerability and resilience
- Policy and planning including continuity of operations
- Simulation and modeling
- Health sciences and services

The Ph.D. requires 36 credits of coursework (beyond M.S.). This includes two research methods courses (6 credits), three courses in a thematic area (9 credits), nine credits of dissertation, and a one credit seminar. In practice, the focus of the Ph.D. will depend on the student's background and interests, and available funding.

Limited funding will be available in the form of graduate research assistantships for students entering the research track (both M.S. and Ph.D.).

One of the core classes, DISA 650 Introduction to Disasters, was piloted during the fall, 2009 semester. This course provides an overview of disaster science and management at the graduate level including an historical overview of disasters. Topics include the anatomy of a disaster; government, non-government and private sector actors; and policy and regulation. Students explored case studies and wrote a short paper. In the spring semester (2010), another core class DISA 651 International Aspects of Disasters will be piloted. This course provides an overview of international disasters, including impacts on development and a comparative analysis of how disasters are dealt with in different countries. Both classes are taught by Professor Trainor. Professor McNeil serves as the Interim Program Director and Ms. Gail Kracyla serves as the Program Assistant.

FEMA Administrator Craig Fugate speaks at a press conference in Rehoboth Beach, Delaware. He is accompanied by Senator Tom Carper, Senator Ted Kaufman, Representative Mike Castle, Governor Jack Markell, and Delaware Emergency Management Agency Director Richard Turner.
(photo by FEMA staff)

Research

DRC has a well-established research tradition built on its foundations in the social sciences, a proven capacity for quick response field research, and a culture of collaboration between faculty, staff, graduate students, and undergraduate students. In particular, the increase in focus on issues related to disasters, the multidisciplinary funding climate, emerging collaborations between DRC and external agencies, the many unfunded mandates related to disaster planning that have been imposed on governmental agencies, and DRC's University-level administrative location under the Research Office have created not only an increased demand for DRC's traditional expertise, but have also provided motivation to go beyond multidisciplinary work to develop a sustainable interdisciplinary program. In developing such an environment, DRC plans to draw on the core research areas current DRC faculty engage in, all of which are prime for interdisciplinary collaboration, including:

- The identification of the social, physical and environmental factors/conditions that influence vulnerability and resiliency of social and physical systems
- Individual and collective threat perception and behavior
- Organizational and inter-organizational dynamics
- Development and disasters
- Social and political dynamics that enhance the development of public policy for disaster reduction
- Analysis and management of infrastructure systems

In developing and conducting research projects, DRC aims to act as a catalyst for and serve as the intellectual home for interdisciplinary disaster related research. Our integrated project teams leverage the interests and capacities of other disciplines on campus, that balance quantitative and qualitative approaches to research, that demonstrate systems-level thinking, that employ the broadest possible set of methodologies and analytic techniques, and that nurture a culture which values the integration of disciplinary insights and thinking.

Project Descriptions

This section provides short descriptions of active and recently completely projects involving faculty from the Disaster Research Center at the University of Delaware. Although by no means an exhaustive list of capabilities, these projects demonstrate the Center's expertise and our current agenda.

Active Projects

Collaborative Research Proposal on Improvisation and Sensemaking in Sudden Crisis

Principal Investigators: Tricia Wachtendorf, Disaster Research Center, and James M. Kendra, University of North Texas
Senior Personnel: Jasmin Ruback, Ruback & Associates
Graduate Research Assistants: Lynn Letukas, Disaster Research Center, and Brandi Lea, University of North Texas
Undergraduate Research Assistants: Chris Colindres, Jeff Engle, Brittany Scott
Funding Agencies: National Science Foundation, University of Delaware Research Foundation

The waterborne evacuation project focuses on the unplanned waterborne evacuation of more than 500,000 commuters from Lower Manhattan by an ad hoc flotilla of ferries, tugs, workboats, dinner cruise boats and other assorted harbor craft after the 9/11 attacks on the World Trade Center, and the subsequent improvised boat-lift of supplies and equipment into the city. The goal of this project is to examine organizational improvisation and distributed sensemaking under conditions of rapid change and urgent needs for decision making and action. The focus of this research is on geographically dispersed organizations that are able to coordinate actions and responses by "making sense" of their surroundings and environment during a crisis.

The study works to ascertain:

- The cues upon which participants relied in assessing shifting environmental information;
- The existing and developing networks that were significant in coordinating action;
- The processes of gathering, assessing, and disseminating information to support distributed learning; and
- The significance of prior experience and the process by which it was employed in changing circumstances, including the emergence of new norms.

Principal analytical methods include an inductive qualitative approach, a social network analysis of pre- and post-attack relationships among participants and GIS mapping of vessel activity. The study will provide an explanatory framework for how organizations understand rapid change, communicate with others in turbulent and complex environments and develop new strategies and procedures for emergent needs under crisis conditions.

DRU: Contending with Materiel Convergence: Optimal Control, Coordination, and Delivery of Critical Supplies to the Site of Extreme Events

Principal Investigators: Jose Holguin-Veras, Rensselaer Polytechnic Institute, Tricia Wachtendorf, Disaster Research Center, Havidán Rodríguez, Disaster Research Center, Satish V. Ukkusuri, Rensselaer Polytechnic Institute, and Didier M. Valdes, University of Puerto Rico-Mayagüez
Graduate Research Assistants: Lauren Barsky, Bethany Brown, Lynn Letukas
Funding Agency: National Science Foundation

The overall goal of this project is to develop methodologies and tools to foster an accelerated convergence between the dynamic needs and supplies of critical resources (e.g., blood, water) to the site of an extreme event. Achieving the overall goal of this project requires a modeling framework that integrates concepts from the social sciences, control theory, and robust and stochastic optimization of supply chains to bridge the gap between dynamic demand and supply of critical resources (i.e., resources available on site, private donations, resources provided by emergency agencies) after an extreme event, as a system, and in consistency with social science principles.These mathematical procedures would help proactively advise the general public about donation priorities; thus reducing the probability of a repeat of previous extreme events in which a massive influx of non-priority donations hampered the flow of critical resources.

The project seeks to develop novel analytical formulations to:

- Forecast what is needed, providing robust estimates of the dynamic resource requirements following an extreme event (e.g., demand for water or food);
- Estimate what is available, i.e., critical resources available on site and in adjacent areas;
- Estimate the dynamic pattern of unmet needs, i.e., what needs to be transported to the site;
- Establish an optimal strategy of priority allocation among the donations from the general public and emergency agencies;
- Design the most effective ways to deliver, store and distribute critical supplies to the impacted area;
- Identify institutional impediments to coordinating an effective response to extreme events, and formulate mechanisms to overcome these obstacles; and,
- Identify ways in which tighter integration of the information technology systems can be achieved among the pertinent stakeholders.

The work will lead to scientific contributions in the social sciences, control theory, robust and stochastic optimization, dynamic modeling of supply chains; and to improved National emergency response capabilities. As a part of the effort to promote learning education at all levels, the research team will engage both undergraduates and middle school students in research activities with specific emphasis on members of underrepresented groups.

Infrastructure Security and Emergency Preparedness

Principal Investigators: Sue McNeil, Tricia Wachtendorf, Earl Lee, Rachel Davidson, and Joseph Trainor
Graduate Research Assistants: Laura Black, Sekine Rahimian and Gabriela Wasileski
Undergraduate Research Assistants: Charles Mitchell III, Sarah Dalton
Funding Agencies: Delaware Department of Transportation and University Transportation Center

The first part of this project (funded by Delaware Department of Transportation) considers the protection of our national infrastructure systems. Of special relevance to this project is the joint responsibility of the Department of Transportation and the Department of Homeland Security to collaborate on all matters pertaining to transportation security and transportation infrastructural protection. Given the many pressing needs for transportation resources in Delaware, assessing the vulnerability and risk of Delaware's critical transportation infrastructure, identifying possible countermeasures, and estimating the capital and operating costs of these improvements is challenging.

The objectives of this research are:

- To provide background and context for addressing risks and vulnerabilities as outlined above, and
- To explore the applicability of one tool, CAPTA, for costing asset protection.

The tool requires knowledge of the hazards faced, the events of concern, the assets of high consequence, and appropriate counter measures, and preparations. Armed with this information, CAPTA iteratively assists the agency to understand when and where to commit resources.

The research involves a literature review, review of CAPTA and development of a case study.

A second part of this project (funded by the University of Delaware University Transportation Center) recognizes that transportation infrastructure security and emergency preparedness present an enormous challenge for both the State of Delaware and for the major transportation corridors that run through the state. The objective of this part of the project is to review the current state of practice for Delaware, review external research and apply insights from state-of-the-art social science and engineering, and develop a plan for integrating research insights into practice.

Integrated Optimization of Evacuation and Sheltering for Hurricanes

Principal Investigators: Rachel Davidson, Disaster Research Center, Tricia Wachtendorf, Disaster Research Center and Linda Nozick, Cornell University
Post-doctoral Research Associate: Pruttipong Apivatanagul
Graduate Research Assistants: Rochelle Brittingham and Bethany Brown
Funding Agency: National Science Foundation-HSD

This project seeks to improve understanding of and decision support for evacuation and mass case sheltering in hurricanes. In the past, math modeling in this application has been limited to estimating the time required to clear a region, assuming many characteristics of the problem are uncontrollable input (e.g., where shelters are located). Instead, we will expand the decision frame and use optimization models to support the full range of strategic and operational evacuation and sheltering decisions, with higher-level objectives such as minimizing life loss, cost, and inequity. These models will be developed through a tight interaction between sociologists and engineers to ensure that they are firmly grounded in the reality of people's behavior. For the first time, the models will be based on individual hurricane scenarios instead of conservative aggregations of many events, and they will be dynamic, accounting for the fact that officials can update their decisions as an event unfolds and information about the situation changes. The project has 5 main steps: (1) determine a suite of hurricane scenarios for use in evacuation and shelter models such that they probabilistically represent the full range of possible events, but are limited in number enough to allow detailed analysis with each; (2) conduct focus groups of key decision makers and stakeholders to identify and characterize key decision making elements; (3) using the focus group input, develop long-term strategic mathematical optimization models for evacuation and sheltering decisions; (4) conduct surveys of affected citizens to test the validity of the optimization model assumptions and results; and (5) demonstrate the models with case study applications in North Carolina.

Interaction between Building and Occupant Responses during Collapse (IBORC)

Principal Investigators: Benigno E. Aguirre, Disaster Research Center and Sherif El-Tawil, University of Michigan
Graduate Research Assistant: Kimberly Gill
Funding Agency: National Science Foundation

The primary goals of this project are to contribute to the state-of-the-art of urban search and rescue (USAR) preparedness by developing a better understanding of how buildings partially or fully collapse, to examine factors (social, structural and ecological) which impact human survival when formal emergency response occurs to structural collapse, as well as to understand survival of civilians in structural fires where search and rescue occur. Building collapse is a pressing concern in structural fire; this project analyzes how the presence of formal emergency responders impacts the survival of civilians in such a context. Using a sociological approach, this project seeks to understand the social components which influence civilian death and injury in structural fires where collapse may occur.

Recent Developments:

- Finished reviewing witness statements, grand jury testimony and newspaper articles from *The Providence Journal* of individuals impacted by the Station (Rhode Island) nightclub fire (February 20, 2003) for developing a quantitative database for statistical analyses that will inform researchers regarding social bonds during the event.

Investment Planning for Regional Natural Disaster Mitigation

Principal Investigators: Rachel Davidson, Disaster Research Center and Linda Nozick, Cornell University
Graduate Research Assistants: Meredith Legg and Pantea Vaziri, Cornell University
Funding Agency: National Science Foundation

In this project, we are developing a set of mathematical models to help guide an optimal expenditure of regional natural disaster mitigation funds and to provide insight into the many factors that interact to determine the best mix of mitigation strategies. Focusing on earthquakes and hurricanes, the regional natural disaster mitigation analysis models will help an at-risk region with a limited budget decide how much to spend on pre-event mitigation that aims to reduce future losses versus post-event recovery, and which of the many possible pre-event mitigation activities to fund so as to meet the region's objectives. The proposed set of models will advance knowledge about natural disaster risk management and the simultaneous planning for multiple hazards. While it is widely thought that pre-disaster mitigation is desirable, and much has been done to develop structural and other techniques for disaster mitigation, the circumstances in which it is desirable to implement different mitigation measures are not well understood. This project will merge optimization and loss estimation modeling to provide new insights into resource allocation decisions for mitigation. The findings may be generalizable to other hazards and may prove useful to risk managers in other contexts.

International Research Network

Principle Investigators: Joseph Trainor, Disaster Research Center, Erna Danielsson, Mid Sweden University, Anna Olofsson, Mid Sweden University, Kurt Petersen, Lund University, and Ann Enander, Karlstad University
Graduate Research Assistants: Rochelle Brittingham and Susan Brink
Funding Agency: Swedish Central Bank Tricentenary Fund

The goal of this project is the development of a national and international description of a "knowledge network" with the requisite skills necessary to support the growing interest in risk, crisis, and disaster research. New technologies and new approaches to research have made it possible to create 21st century solutions to coordinating and integrating researchers. These activities will create synergy among participants, will aid in the production of innovative activities, and will have great potential to produce ideas, solutions, and approaches that would not come into being without this grant's assistance. The level of sustained research interaction this funding can provide will help us to overcome the barriers that distance and disciplinary training have created. By continuing to work together, our interactions will facilitate the creations of permanent relationships that can serve as the basis for future projects which will expand our proposed work in directions that other groups will simply not be equipped to handle.

Modeling Post-earthquake Fire Spread

Principal Investigator: Rachel Davidson
Graduate Research Assistants: Sizheng Li, University of Delaware, and Selina Lee, Cornell University

In the aftermath of an earthquake, many fires may ignite simultaneously and at the same time that a region's suppression capabilities are severely diminished due to damaged water supply, transportation, communication systems, and increased demands on fire service personnel. The result can be conflagrations that cause losses exceeding those caused by ground shaking. In this project, we are developing a new simulation model of post-earthquake fire spread and applying it to a case study area in Los Angeles. The model is designed to have several desirable features: (1) to be physics-based, representing the various modes of fire spread separately (e.g., radiation, branding); (2) to be computationally tractable so that it can be applied to an entire urban area; (3) to provide many types of detailed results, including for example, total area burned, spatial description of spread, and relative importance of different modes of spread, so that it can provide insight into the relative importance of different contributors to fire spread; (4) to quantify uncertainty in the results, and (5) to be flexible to allow easy modification. The new post-earthquake fire spread model is designed to be used to: (1) improve estimation of fire damage for a specified earthquake scenario, (2) provide new insight into the relative importance of factors that contribute to post-earthquake fire spread, and (3) help future evaluation of potential long- and short-term post-earthquake fire risk reduction strategies.

Multi-Organizational Collaborative Leadership and Interaction

Principal Investigators: Tricia Wachtendorf, Disaster Research Center, and William Waugh, Georgia State University
Funding Agency: Department of Homeland Security: Center of Excellence for the Study of Natural Disasters, Coastal Infrastructure, and Emergency Management

The goal of this project is to help officials do a better job of coordinating incidents that are multi-organizational and/or multi-jurisdictional. Consideration is given to traditional formal responders as well as other community-based involvement and the integration of public and private sector efforts, social and human factor elements, and political and cultural facilitators/barriers to response participation. This project will: (1) assess the effectiveness of current organizational structures and incident management systems in building and maintaining collaboration among stakeholders involved in managing hazards and disasters; (2) identify best practices, major issues, and the skill-set (individual and organizational) necessary to build and maintain collaborative relationships; (3) identify skills, cultural features, and social relationships that can foster effective improvised action when a multi-organizational response is necessary; and (4) design and test a training program in collaborative management and leadership for community and state officials involved in managing hazards and disasters. Research methodology includes focus groups, in-depth interviews, and test-bed application.

NEES-SG. NEESWood: Development of a Performance-Based Seismic Design Philosophy for Mid-Rise Woodframe Construction

Principal Investigators: John van de Lindt, Colorado State University, Rachel Davidson, Disaster Research Center, Andre Filiatrault, University of Buffalo, David Rosowsky, Texas A & M University, and Michael Symans, Rensselaer Polytechnic Institute
Graduate Research Assistant: Greg Black
Funding Agency: National Science Foundation, Network for Earthquake Engineering Simulation (NEES) Program

The objective of this project is to develop and experimentally validate a performance-based seismic design (PBSD) procedure that would make construction of mid-rise wood-frame construction possible in regions of moderate to high seismicity in the U.S. While wood-frame structures have historically performed well in earthquakes with regard to life safety, they have sustained significant structural and non-structural damage in recent events. Further, the height of wood-frame construction has been limited to approximately four stories, and current building code requirements for engineered wood construction are not based on a global seismic design philosophy but rather wood elements are designed independently of each other. In this project, we seek to provide the necessary mechanisms to take advantage of the engineering characteristics that make wood-frame construction perform well with regard to life safety, while safely increasing the height of wood-frame structures in seismically active areas and mitigating damage to low-rise wood-frame structures. The UD portion of the project is to develop a regional earthquake loss model for wood frame buildings to help guide the specification of appropriate performance objectives.

Netherlands US Water Crisis Research Network (NEUWCRN)

Principle Investigators: Joseph Trainor, Disaster Research Center, Sue McNeil, Disaster Research Center, Karen Engle, COT, Jack Harald, Virginia Tech, Liesel Ritchie, Natural Hazards Center, University of Colorado, Boulder, Harold Bousche (TNO), and Georg Frerks, Wageningen University
Graduate Research Assistants: Manuel Torres and Lucia Velotti
Undergraduate Research Assistant: Brittany Scott
Funding Agency: The Ministry of Public Works, Transport, and Water Management, The Netherlands

The purpose of NUWCREN is to develop a sustainable network of Dutch and U.S. knowledge institutes that can facilitate the advancement of the Netherlands' preparedness with respect to possible floods. In addition to distributing existing knowledge, we also aim to develop scientific knowledge and assess operational practices for flood disaster management. The ultimate goal is to institutionalize a collaborative international network that can generate approaches to policy in the Netherlands and/or the United States.

New Methods for Measuring, Monitoring, and Evaluating Post-Disaster Recovery

Principal Investigators: Ronald Eguchi, University of Buffalo, Rachel Davidson, Stephanie Chang, University of British Columbia, Arleen Hill, University of Memphis, and Beverley Adams, Imagecat, Inc.
Graduate Research Assistant: Dana Rathfon
Funding Agency: National Science Foundation

Post-disaster recovery—one of the phases of the disaster management cycle—is a complex physical, social, economic, environmental, and political process. It lasts years, requires enormous financial and other resources, and can define the character of the affected communities for years to come. The literature includes theoretical frameworks of recovery and empirical case studies of historic events. The empirical studies have often focused on a single dimension of recovery, such as housing, and have typically relied on interviews, focus groups, and one-time surveys for data gathering. This literature offers rich cross-sectional insights into recovery at a point in time, but limited systematic, quantitative empirical descriptions of regional recovery over time. Using newly available high-resolution satellite imagery, previously underutilized statistical data, and advanced field survey techniques that capture a detailed geographically referenced record of recovery through photographs, video, and observations, this study will develop innovative methods for systematically and quantitatively measuring and monitoring post-disaster recovery. Using a single recent hurricane as a case study, in this project we are: (1) developing methods to process and interpret remote-sensing data to describe the physical and socio-economic manifestations of post-disaster recovery; (2) obtaining and compiling quantitative and qualitative recovery data from remote-sensing, field reconnaissance surveys, secondary statistical sources, interviews, and surveys; (3) developing methods to analyze and synthesize the recovery data to comprehensively measure and monitor recovery; and (4) demonstrating application of the new methods within the case study area. Improved tracking of recovery will serve as a critical first step for future efforts to better explain and evaluate recovery by addressing questions such as: (1) For a disaster that has just occurred, over what timeframes and in what ways is recovery likely to unfold?; (2) Why is recovery proceeding in a particular way?; and (3) How are recovery speed and character correlated with various pre- and post-disaster decisions and actions?

Post-Earthquake Fire Spread and Suppression Modeling

Principal Investigator: Rachel Davidson
Graduate Research Assistant: Sizheng Li

Under the right conditions, post-earthquake fires can dominate losses in an earthquake. Fires following the 1906 San Francisco earthquake killed 3,000 people and destroyed 492 city blocks. After the 1995 Kobe earthquake, fire killed 500 people and damaged 6,900 buildings. Since the 1980s, little research has focused on post-earthquake fires. Recent advances in computation, GIS and compartment fire modeling provide great opportunities for developing the next generation of post-earthquake fire model. Although urban conflagrations are not thought to be a problem anymore due to improved fire codes and fast suppression response (and therefore, they are not studied much), the threat still exists in a post-earthquake situation in which there are many simultaneous ignitions at the same time that the water supply system is damaged, transportation corridors are blocked, and communications are impaired.

Current regional post-earthquake fire models, such as the one in FEMA's national standardized risk model, HAZUS-MH, are based on a macro, completely empirical, deterministic approach developed by Hamada in the 1950s and updated in the 1980s by Scawthorn. While it provides reasonable overall results, it does not represent the large uncertainty in fire spread, and it cannot be used to understand the relative importance of different modes of spread, the effect of different factors on the speed and location of spread, or the effectiveness of different suppression activities. The overall project goal is to develop the next generation urban post-earthquake fire ignition-spread-suppression simulation model for use in (1) estimating likelihood, location and rate of fire spread, and (2) understanding how fire spreads in detail.

The next generation model will: (1) be physics-based, which means it will be generally applicable and incorporate the latest fire science, (2) be modular, (3) use real building footprint information from remote sensing data, (4) explicitly represent risk reduction strategies (e.g., fire suppression efforts, fire resistant walls, fire breaks) so their effectiveness can be evaluated, and (5) be applicable in the U.S. In fact, the model will be usable for any urban fire spread.

Post-earthquake Water Supply Restoration

Principal Investigator: Rachel Davidson
Graduate Research Assistant: Susan Brink

In this project, we are developing a discrete event simulation model of post-earthquake restoration for the Los Angeles Department of Water and Power water supply system, and using it to provide insight into the factors that govern restoration efficiency and ways to improve the process. The model mimics the real-life process in detail, simulating the movement of different types of crews as they inspect, reroute around, isolate, and repair system damage. For any given earthquake, it provides restoration curves with uncertainty bounds, maps showing the spatial distribution of outages over time, and crew and repair material usage information. Results for the 1994 Northridge earthquake suggest the model is capable of accurately estimating the time and spatial sequence of the restoration. This is the first application of discrete event simulation to post-disaster water supply restoration, and one of the first for any infrastructure system.

Research Experience for Undergraduates (REU) Program: Training the New Generation of Disaster Researchers

Principal Investigators: Havidán Rodríguez and Joanne Nigg
Faculty Mentors: Tricia Wachtendorf, Benigno Aguirre, Sue McNeil, Joseph Trainor, Rachel Davidson, and Earl Lee II, Disaster Research Center, and Walter Díaz, University of Puerto Rico-Mayagüez (UPRM)
Graduate Research Assistant: Lauren Barsky
Undergraduate Research Assistants: Brittany Scott and Kathleen Shea
Funding Agencies: The National Science Foundation, The U.S. Department of Defense and the University of Delaware

The National Science Foundation originally funded the University of Delaware's Disaster Research Center (DRC) to establish a Research Experience for Undergraduates (REU) site to engage ten (10) undergraduate students in hands-on research training to enhance their understanding of the social science aspects of disasters for three years beginning in the summer of 2005. A renewal of this funding was received in 2008 to continue the program for an additional three years through 2011. Each summer during the funding period, a nine (9) week research training institute is held at DRC to provide students with the necessary academic background, training, and relevant research experiences to prepare them to function as relatively independent research scholars. Course models focus on research methodology, social science approaches to understanding the causes and consequences of disasters, and ethical implications of the research process. Students work with leading scholars and researchers on state-of-the-art research projects that focus on issues such as disaster mitigation, preparedness, response, recovery, vulnerability, and resilience. A multi-disciplinary group of leading disaster researchers and practitioners participates in the Invited Speaker Series in order to emphasize the contributions that other disciplines bring to this field. A series of professional development and social-cultural activities complement the trainees' overall education and training. Recently, the REU added students from engineering, as well as from India and Sweden, making the REU an interdisciplinary program with an international component.

Resiliency of Transportation Corridors Before, During, and After Catastrophic Natural Hazards

Principal Investigators: Sue McNeil, Disaster Research Center, Joanne Nigg, Disaster Research Center, and Tracy DeLiberty, Geography Department, University of Delaware
Graduate Research Assistant: Silvana Croope
Funding Agency: University of Delaware University Transportation Center with funding from U.S. Department of Transportation

The objective of this project is to develop a framework to evaluate the resiliency of transportation corridors before, during, and after a catastrophic event. The project addresses the challenge of working with diverse sets of data that present several problems such as incomplete data, lack of data, data that is too dense for real-time analysis, and data not made available due to homeland security policies. Given these data challenges, we are developing the framework using a specific example and then attempt to generalize our findings. We are using U.S. 13 in Sussex County, Delaware as the example. U.S. 13 is subject to flooding, and we have access to much of the data DELDOT has available. The evaluation will use real-time emergency event management utilizing data generated from the Transportation Management Center integrated with data from other DELDOT sections and other institutions.

The research serves to develop a preliminary framework for a suite of tools to assist agencies to be better prepared for, better able to respond to and better able to recover from catastrophic events due to natural hazards. The research uses existing data, GIS tools and concepts of resiliency to assist in this important area. A technical report and presentation will document the research results and provide direction for further research, development and implementation.

Resilience of Transportation Corridors During Disaster

Principal Investigator: Tricia Wachtendorf, Disaster Research Center
Graduate Research Assistant: Ben Johnson
Undergraduate Research Assistants: Joshua Kelly and Samantha Penta
Funding Agency: University Transportation Center, University of Delaware

Transportation corridors are vital in allowing for public and commercial mobility. When these corridors are compromised during a disaster, the way in which emergency response networks function is critical to ensuring continuity or resumption of the transportation flow. Inter-organizational coordination is central to an effective disaster response and may require interaction across jurisdiction, timely exchange of information, and provision of personnel or material resources. This study examines how multi-organizational actors/agencies expect and are expected to interact during a transportation corridor disaster. Using social network analysis, researchers will examine the codified and actor-anticipated interaction in maintaining the continuity of transportation flows along the I-95 corridor in Delaware.

The study works to:

- Provide information to facilitate planning and management of response in Delaware and the surrounding states
- Increase our understanding of social response networks in place during corridor disasters, which may have applicability in other geographic areas
- Generate results useful in the development of socio-technical systems to improve communication and coordination during corridor disasters

Technology, Weather Forecasts, and Warnings: Integrating the End-User Community

Principal Investigators: Joseph Trainor, Disaster Research Center, Havidán Rodríguez, Disaster Research Center, and Walter Díaz, University of Puerto Rico-Mayagüez (UPRM)
Graduate Research Assistants: Melody Cotterill, Jenniffer Santos-Hernández, and Laura Monico
Undergraduate Research Assistants: Claudia Flores, Yesenia Rodríguez, Stephen Shinn, Jasmine Wynne, Kathleen Shea, Spencer Schargorodski, and Paige Mikstas
Funding Agencies: National Science Foundation (NSF), Engineering Research Center for the Collaborative Adaptive Sensing of the Atmosphere (ERC-CASA)

Scientists at the Disaster Research Center are contributing through research to the end user integration efforts of the Center for Collaborative Adaptive Sensing of the Atmosphere (CASA) by exploring the social and human dimensions of severe weather forecasts and warnings. CASA is an Engineering Research Center (ERC) within NSF's Directorate for Engineering that focuses on the development of revolutionary sensing technology that will enable earlier and more accurate forecasts of severe weather events. The aim of CASA is to design the necessary infrastructure to sense, analyze, and predict lower atmospheric events and to respond to potentially hazardous phenomena in order to significantly reduce their impact on society. More accurate and reliable weather forecasts and warning systems (based on the technology proposed by CASA researchers) may lead to improved disaster mitigation, preparedness, and response initiatives. Social Scientists in the CASA project are focusing their research efforts on examining how improved forecasting can reduce the exposure and vulnerability of individuals and property to everyday and extreme weather events. Specifically, through the use of survey methodology, focus groups, face-to-face in-depth interviews, and phone interviews using the recently acquired CATI system (Computer Assisted Telephone Interviewing) we are examining how the end-user community members access, utilize, and respond to weather forecasts. We also seek to explore their knowledge and interests concerning weather forecasting issues, attitudes towards climatological information, and their needs and interests in relation to the use of meteorological information. We aim to answer a variety of questions, including: What are the primary sources of weather information used by emergency management agencies?; How much confidence do these end-users have in this type of information?; According to the end-users, how reliable are weather forecasts and warnings?; How does climatological information affect the decision-making processes of this community of end-users?; and finally, How does the public respond to and interpret warnings? To collect data on the public, we launched a CATI survey in June 2008 and continued collecting data during the 2009 tornado season.

Recently Completed Projects

Learning from a Large Scale Flood Exercise in the Netherlands

Principal Investigators: Sue McNeil and Joseph Trainor
Undergraduate Research Assistant: Kathleen Shea
Funding Agencies: COT Institute for Safety, Security and Crisis Management

In response to a request from the Directorate General of the Ministry of Public Works, Transport and Water Management in the Netherlands COT assembled a network of institutions with expertise in emergency management, risk and disasters. The project is focused around Dutch flood-exercise week, organized by the Flood Management Taskforce (TMO, Taskforce Management Overstromingen) in November 2008. COT, along with researchers from the University of Delaware, and George Washington University, documented background information, participated as observers in the exercise, and developed lessons learned. The objectives of this project were to:

- Exchange information regarding key processes, best practices, and complexities of flood disaster management identified from the literature and U.S. experience that were validated (or refuted) during the exercise with emergency management. Such information is particularly valuable for emergency planning and future exercises.
- Identify areas throughout which additional research is necessary, particularly those areas in which results of the literature study were not validated by the case study.

A final report was completed early in 2009 and a new project—NUWCReN—was launched to continue and expand the collaboration.

Population Composition, Geographic Distribution, and Natural Hazards: Vulnerability in the Coastal Regions of Puerto Rico

Principal Investigators: Havidán Rodríguez, Disaster Research Center, Walter Díaz and Aurelio Mercado, University of Puerto Rico-Mayagüez (UPRM)
Graduate Research Assistant: Jenniffer Santos-Hernández
Undergraduate Research Assistant: Chris Colindres
Funding Agency: University of Puerto Rico Sea Grant College Program

Given its geographic location and climatological characteristics, Puerto Rico is highly susceptible to natural hazards (e.g., hurricanes, floods, tsunamis, and earthquakes). Coastal or riverine flood areas and steep mountains characterize much of Puerto Rico. Hurricanes San Ciriaco (1899), San Felipe (1928), San Ciprián (1932), Santa Clara (1956), Hugo (1989), and Georges (1998) have had a significant social and economic impact on the Island's population and economy. As a result of changing social and demographic patterns in Puerto Rico, there has been a significant increase in population density, in the proportion of the elderly and physically disabled population, and an increasing concentration of residents in flood and/or landslide prone areas and especially along the coastline. According to the Insurance Commissioner's Office, as of June, 2003, 160,000 families were living in flood prone areas in Puerto Rico, of which 43,568 (27.2%) did not have flood insurance. These factors have contributed to the increasing vulnerability to natural hazards on the Island. The primary goal of this project was to understand how these and other factors contribute to the vulnerability of the Puerto Rican population living in coastal regions, how they have changed from 1990 to 2000, and how risk and vulnerability vary according to different social, economic, and demographic variables. To accomplish the aforementioned goal, we developed geographical maps, in both paper and GIS format, of the coastal areas of Puerto Rico that included detailed demographic and socioeconomic data of the resident population. Using 1990 and 2000 Census data, Graduate Research Assistant Santos-Hernández completed her M.A. thesis which presented the estimation of the social vulnerability to storm surge flooding index for Puerto Rico. This research project allowed us to develop a better understanding regarding the demographic and socio-economic factors that contribute to the vulnerability, perception of risk, disaster mitigation, and preparedness among communities in the Island's coastal regions. Further, it also provided government agencies and emergency management organizations with detailed information that will allow them to play a critical role in mitigating the effects of natural hazards in Puerto Rico. The Disaster Research Center (DRC) purchased the software necessary to publish on the Internet, in an interactive format, the vulnerability maps that we developed. This research project was a collaborative and interdisciplinary effort between the Disaster Research Center at the University of Delaware, the Center for Applied Social Research (CISA) in the Department of Social Sciences and the Physical Oceanography Laboratory in the Department of Marine Sciences, both at the University of Puerto Rico-Mayagüez.

REU participants attend the Disasters Roundtable, "Children and Youth in Disasters: Closing Gaps among Research, Practice, and Policy," held in Washington D.C.

(photo by DRC staff)

DRC Field Studies

In addition to our regular projects, researchers at DRC have conducted over 685 field studies since the Center's inception, traveling to communities throughout the United States and to a number of foreign countries in the immediate aftermath of disaster events. Our work has encompassed a broad range of disaster types. Recent field studies have focused on a number of topics including organization, multi-organizational coordination, social behavioral response to disasters, warning and evacuation, and vulnerability.

This section offers a brief list of the field research conducted by DRC faculty and graduate students during the past calendar year.

Location:	New Hanover County and Raleigh, North Carolina
Dates:	July 6–10, 2009
Researchers:	Tricia Wachtendorf and Rochelle Brittingham
Funding Agency:	National Science Foundation
Title:	DRU: Integrated Optimization of Evacuation and Mass Care Sheltering for Hurricanes
Purpose:	Focus groups were conducted to better understand community stakeholder opinions on increasing safety during hurricane evacuations.

Location:	Punta Gorda, Florida
Dates:	August 12–16, 2009
Researchers:	Dana Rathfon, University of Delaware, Arleen Hill, University of Memphis
Funding Agency:	National Science Foundation
Title:	Project #0926142
Purpose:	This field research was part of an initiative to develop innovative methods for systematically and quantitatively measuring, monitoring, and evaluating post-disaster recovery using Hurricane Charley as a case study. The methods developed will then be applied to Hurricane Katrina. The field work consisted of two team members visiting Punta Gorda, Florida to collect data and attend the event marking the 5-year anniversary of Hurricane Charley. Team members collected data from survivors attending the anniversary event who were willing to share information regarding their experience of the hurricane. Researchers also met with local officials and collected data related to the Hurricane Charley recovery. Finally team members also retraced the VIEWS tracks in Punta Gorda and neighboring Port Charlotte that were previously traveled by the ImageCat team in order to take pictures and document changes that occurred since the earlier visit.

Education/Mentoring

Students, staff, and faculty affiliated with DRC all play an important role in graduate and undergraduate education at the University. Faculty offer related classes, advise students (as academic advisors and advisors for independent studies and research), and serve on comprehensive exam and dissertation committees; faculty and staff offer professional training sessions for graduate and undergraduate students; and graduate students mentor undergraduates, serve as teaching assistants, and in some cases, such as in the REU program, teach classes. The Disaster Research Center has a history of engaging graduate and undergraduate students in research. Although DRC does not admit students, offer classes, or award degrees, faculty teach classes as part of their responsibilities in their home departments and influence academic programs. DRC faculty members served on the University-wide committee to develop the interdisciplinary M.S. and Ph.D. program in Disaster Science and Management. The program was approved by the Faculty Senate in April 2009.

This section provides information and examples regarding DRC's efforts to manifest its vision of education and mentoring in a concrete way.

Doctoral Dissertation

Bethany L. Brown

"Organizational Response and Recovery of Domestic Violence Shelters in the Aftermath of Disaster." Department of Sociology and Criminal Justice and Disaster Research Center, University of Delaware, Newark, Delaware.

Master's Theses

Greg Black

"Development and Application of an Empirical Loss Analysis for Woodframe Buildings Subject to Seismic Events." Department of Civil and Environmental Engineering, University of Delaware, Newark, Delaware.

Susan Brink

"Simulation of Post-Earthquake Water Supply Restoration: Calibration and Application." Department of Civil and Environmental Engineering, University of Delaware, Newark, Delaware.

DRC Salon Series

The Disaster Research Center Salon Series differs slightly from a traditional lecture in that we encourage presenters to raise substantive issues which might contend with the existing literature, offer new possibilities, or raise issues that require additional study, or offer potential areas for collaboration between DRC and invited Salon presenters. All Salon Series presentations took place on the University of Delaware campus.

"Crisis and Multiorganizational Response Management: From Research to Practice." Presented by Kurt Petersen, Director, Lars Fredholm, Adjunct Professor, Per Becker, visiting Professor, PhD Candidate Kerstin Eriksson, and PhD Candidate Christian Uhr, Lund University Centre for Risk Analysis and Management, Lund, Sweden, February 17, 2009.

"Fight or Flight? Assumed Reactions of the Public during Crisis." Presented by Misse Wester, PhD, Department of Philosophy, The Royal Institute of Technology, Sweden, March 11, 2009.

"Interaction during Emergency Response Operations: Situational Awareness and Collaboration among Different Rescue Units." Presented by Erna Danielsson, Professor, Department of Social Sciences, Mid-Sweden University, May 13, 2009.

"Cognitive Foundations of Improvisation in Response to Disaster: The Cases of the Murrah Building and the World Trade Center." Presented by David Mendonca, Associate Professor, New Jersey Institute of Technology, September 24, 2009.

"'Do You Just Teach?' Closing the 'Gap' Between Scholarship and Practice in Emergency Management." Presented by James Kendra, Associate Professor, University of North Texas, October 22, 2009.

Other DRC Sponsored Events

"Costing Asset Protection: An All Hazards Guide for Transportation Agencies." Webinar presented by the Transportation Research Board, November 4, 2009.

"Infrastructure Security and Emergency Preparedness." UD-UTC Brown Bag Discussion presented by Sue McNeil, Rusty Lee, Joe Trainor, Rachel Davidson, Tricia Wachtendorf, Laura Black, Gabriela Wasileski, Charlie Mitchell, and Sarah Dalton, September 16, 2009.

"Resiliency of Transportation Corridors." UD-UTC Brown Bag Discussion presented by Tricia Wachtendorf and Ben Johnson, November 6, 2009.

Graduate Student Achievements

DRC graduate students are typically among the more outstanding graduate students at the University of Delaware and frequently excel within their major discipline. The following graduate students were recognized by the University for their academic achievements with the awards cited.

John Barnshaw was awarded a University Dissertation Fellowship for academic year 2009–2010.

Greg Black was awarded a University Fellowship for International Research, Internships, and Performances for Graduate Students in 2009.

Susan Brink was awarded a National Science Foundation Graduate Research Fellowship for academic years 2009–2012.

Undergraduate Student Achievements

DRC undergraduate students typically achieve high academic standards and participate in various academic and professional organizations as they are relevant to the students' course of study and academic interests. Below is a partial list of undergraduate students along with some of their most recent accomplishments and activities.

Sarah Cornwell

- Dean's List
- Undergraduate Research Program Summer Scholars scholarship recipient
- Independent study on the effects of Katrina on adolescent literacy
- Study Abroad global scholarship recipient

Christina Dalton

- Dean's List
- Participant in the 2009 REU program

Lauren Lobo

- ITE Student Chapter (Secretary)
- UD-UTC funded participant in the 2009 REU program

Chance Malkin

- Dean's List
- Phi Kappa Phi
- Chi Epsilon
- Tau Beta Pi (Vice President of Membership)
- UD-UTC funded participant in the 2009 REU program

Samantha Penta

- Dean's List
- Study Abroad participant (Ghana)
- Summer Scholars Program participant, Social Sciences category, Undergraduate Research Program
- General Honors Award recipient

Yesenia Rodriguez

- President of HOLA (Hispanic Student Association)
- Recruitment Chair, Latinas Promoviendo Comunidad/Lambda Pi Chi Sorority

Spencer Schargorodski

- Dean's list
- Participated in and helped lead a special conference for the Army Corps of Engineers in Honolulu, Hawaii regarding emergency management planning strategies
- Citation for Outstanding Participation as the International Association for Emergency Managers (IAEM) University and College Caucus (UCC) Student Region Representative 2009

Brittany Scott

- Dean's list
- Member, Phi Beta Kappa

Research Experience for Undergraduates (REU) Year Four Activities

The Disaster Research Center's REU program included the following guest speakers:

Anne Bowler, University of Delaware

Erin Daix, University of Delaware

Lindsay Hoffman, University of Delaware

Rusty Lee, University of Delaware

Marcia Nickle, University of Delaware

Lori Peek, Colorado State University

Enrico Quarantelli, University of Delaware

Dorry Ross, University of Delaware

Kathleen Tierney, University of Colorado at Boulder

Tricia Wachtendorf, University of Delaware

Pat Young, University of Delaware

The following is a list of the 2009 REU participants, their institutional affiliations, and their research topics:

Christina Dalton, University of Delaware, Newark, Delaware, USA

"New Flash: Public Response to Media Warnings"

Siddarth Daniels David, TATA Institute of Social Sciences, Mumbai, India

"Exit at Your Own Risk: A Study of the Factors Affecting the Choice of Egress in the Rhode Island Station Nightclub Fire"

Linda Eliasson, Mid-Sweden University, Östersund, Sweden

"Rethinking Everyday Emergencies"

Jessica Fernandes-Flack, Oklahoma State University, Stillwater, Oklahoma, USA

"Severe Storm and Tornado Warnings: The Impact of Age on Protective Action"

Devin Fisher, Millersville University, Millersville, Pennsylvania, USA

"Identifying 'Special' Populations in Delaware for Communicating Warning and Evacuation Information: Elderly Population"

Megan Frazier, Western Washington University, Bellingham, Washington, USA

"Vulnerable Vacationers: An Analysis of Tourist Industry Preparedness in Southern Sussex County"

Sumedha Goel, TATA Institute of Social Sciences, Mumbai, India

"Organizational Transformation in Self Help Groups Due to a Disaster: Case of Mumbai Floods, 2005"

Lauren Lobo, University of Delaware, Newark, Delaware, USA

"Hazard Mapping of Earthquake Prone Transportation Areas—Beginning with Oat Mountain"

Chance Malkin, University of Delaware, Newark, Delaware, USA

"Climate Change and Rising Sea Levels: A Geographic Information Systems Analysis of the Potential Impact on Railroad Corridors in New Castle County, Delaware"

Natasha Mata, Florida State University, Tallahassee, Florida, USA

"Not in the Job Description: Analysis of Employee Behavior in the 2003 Rhode Island Station Nightclub Fire"

Kim Nguyen, Berea College, Berea, Kentucky, USA

"Gender Behavior in the Rhode Island Station Nightclub Fire"

Samantha Oppenheimer, University of Delaware, Newark, Delaware, USA

"Competing with Katrina: The Rise and Fall of Social Problems in the Wake of Hurricane Katrina"

Cassie Sanford, Gettysburg College, Gettysburg, Pennsylvania, USA

"Demographics and Disasters: How They Intersect and Affect Protective Action"

Trent Steidley, Oklahoma State University, Stillwater, Oklahoma, USA

"Delaware's Plan for (Almost) Everyone: A Policy Analysis of the All Hazards Evacuation Annex and Special Needs Populations in Delaware"

Ysaye Zamore, Colorado State University, Fort Collins, Colorado, USA

"Being Black: Looking at the Relationship between Socio-demographic Features and Evacuation from Disaster"

Outreach/Dissemination

DRC is well known in the academic community of disaster researchers as a major force for the development of research methods and theory within the field. This section illustrates our activities aimed at applying or distributing the information and knowledge gained from DRC research projects and institutional history.

Peer Reviewed Publications

The following are publications authored or co-authored by DRC faculty, students and staff that are related to disasters and which have undergone the peer review process. The list is divided according to publication type.

Articles

Ellen J. Bass, Leigh Baumgart, Brenda Philips, Kevin Kloesel, Kathleen Dougherty, Havidán Rodríguez, Walter Díaz, William Donner, Jenniffer Santos, and Michael Zink

2009. "Incorporating Emergency Management Needs in the Development of Weather Radar Networks." *Journal of Emergency Management,* 7(1): 45–52.

Rachel Davidson

2009. "Modeling Post-earthquake Fire Ignitions Using Generalized Linear (Mixed) Models." *Journal of Infrastructure Systems,* 15(4): 351–360.

Gayathri Mahalingam, Chandra Kambhamettu, and Benigno Aguirre

2009. "Crowd Analysis Using Video." *Proceedings of 2009 NSF Engineering Research and Innovation Conference,* Honolulu, Hawaii. (http://vims.cis.udel.edu/~mahaling/_private/gayathri_cmmi09.pdf)

E. L. Quarantelli

2009. "Origin and History of the International Research Committee on Disasters (RC-39)." *International Journal of Mass Emergencies and Disasters* Web site (School of Policy, Planning, and Development, University of Southern California, host). (www.usc.edu/schools/sppd/ijmed/history)

Taronne Tabucchi, Rachel Davidson, and Susan Brink

2009. "Simulation of Post-earthquake Water Supply System Restoration." *Civil Engineering and Environmental Systems,* online edition (www.informaworld.com/smpp/content~content=a911737010~db=all~jumptype=rss)

Pantea Vaziri, Rachel A. Davidson, Linda K. Nozick, and Mahmood Hosseini

2009. "Resource Allocation for Regional Earthquake Risk Mitigation: A Case Study of Tehran, Iran." *Natural Hazards,* online edition (www.springerlink.com/content/c87x214767472711/)

Tricia Wachtendorf

2009. "Trans-system Social Ruptures: Exploring Issues of Vulnerability and Resiliency." *Review of Policy Research,* 26(3): 379–393.

Book Chapters

Jing Gong, Earl E. Lee, John E. Mitchell, and William A. Wallace

2009. "Logic-based Multiobjective Optimization for Restoration Planning." Pp. 305–324 in *Optimization and Logistics Challenges in the Enterprise* edited by Wanpracha Chaovalitwangse, Kevin C. Furman, and Panos M. Pardalos. New York: Springer.

DRC Preliminary Paper Series

Lynn Letukas, Anna Olofsson, and John Barnshaw

2009. "Solidarity Trumps Catastrophe? An Empirical and Theoretical Analysis of Post-tsunami Media in Two Western Nations." Preliminary Paper No. 363.

Pat Young

2009. "Objects of Value: Addressing Emergency and Disaster Mitigation, Preparedness, Response and Recovery Issues in Collections." Preliminary Paper No. 364.

Other Publications

The following are lists of publications authored by DRC faculty, students, and staff generated by DRC-conducted research projects or represent writings within the recognized area of expertise for the author or authors.

Final Project Reports

Lauren Lobo

2009. "Landslide Hazard Mapping of Earthquake Prone Transportation Areas—Case Study: Oat Mountain Area Along Route 5 in the State of California." Final Project Report No. 52.

Chance Malkin

2009. "Climate Change and Rising Sea Levels: A Geographic Information Systems Analysis of the Potential Impact on Railroad Corridors in New Castle County, Delaware." Final Project Report No. 53.

Miscellaneous Reports

Bruce M. Altevogt, Andrew M. Pope, Martha N. Hill, and Silvana V. Croope

2009. "Working With HAZUS-MH." Miscellaneous Report No. 63.

Rachel Davidson

2009. "Generalized Linear (Mixed) Models of Post-earthquake Ignitions." MCEER Technical Report, MCEER-09-0004, Buffalo, NY. Miscellaneous Report No. 64.

Sue McNeil

2009. "Adaptation Research Programs and Funding." Special Report 299: Reducing Transportation Greenhouse Gas Emissions and Energy Consumption: A Research Agenda, Transportation Review Board. Miscellaneous Report No. 65.

Uri Rosenthal, Karen Engel, Marco Zannoni, Sanne Ebbinkhuijsen, Sue McNeil, and Joseph Trainor

2009. "Strengthening Flood Management through US-Dutch Cooperation: Learning from a Large Scale Flood Exercise in the Netherlands. Part II: Process Report." Miscellaneous Report No. 66.

Uri Rosenthal, Karen Engel, Marco Zannoni, Sue McNeil, Joseph Trainor, John R. Harrald, and Greg Shaw

2009. "Strengthening Flood Management through US-Dutch Cooperation: Learning from a Large Scale Flood Exercise in the Netherlands. Part II: Findings." Miscellaneous Report No. 67.

Working Papers

E. L. (Henry) Quarantelli

2009. "The Earliest Interest in Disasters and Crises, and the Early Social Science Studies of Disasters, as Seen in a Sociology of Knowledge Perspective." Working Paper No. 91.

Presentations at Professional Conferences

DRC personnel regularly participate in conferences and professional meetings that contribute to the field. Below are lists of these activities.

Paper Presentations

John Barnshaw

"Characteristics and Consequences of Catastrophe: Theoretical and Policy Considerations for Crisis." Presented at the 3rd Annual Meeting of Kris och Risk i det Heterogena *Sambället* (Crisis and Risk in a Heterogeneous Society), September 30, 2009, Östersund, Sweden.

John Barnshaw and Lynn Letukas

"Watts, Racial Politics, Racial Scholarship and a Theory for Social Change." Presented at the 79th Annual Meeting of the Eastern Sociological Society, March 21, 2009, Baltimore, Maryland.

"A World-system Approach to Post-catastrophe International Relief." Presented at the 104th Annual Meeting of the American Sociological Association, August 10, 2009, San Francisco, California.

"Disaster and World Religions in the World-system." Presented at the 71st Annual Meeting of the Association for the Sociology of Religion, August 10, 2009, San Francisco, California.

Lauren Barsky and Tricia Wachtendorf

"Examining Perceptions of Individual Verses Collective Responsibility in the Aftermath of Routine Periods and Extreme Events." Presented at the 79th Annual Meeting of the Eastern Sociological Society, March 21, 2009, Baltimore, Maryland.

"Who is Responsible for At-risk Populations? The Role of Media in Shaping Perceptions of Responsibility." Presented at the 104th Annual Meeting of the American Sociological Association, August 11, 2009, San Francisco, California.

Silvana Croope

"Integrating GIS with Decision Support Systems to Enhance the Management of Critical Infrastructure." Presented at the University of Delaware's Geospatial Research Day, November 19, 2009, Newark, Delaware.

Rachel Davidson, Meredith Legg, Pantea Vaziri, Linda Nozick, and Mahmood Hosseini

"Resource Allocation for Regional Hurricane and Earthquake Risk Mitigation." Presented at the Society for Risk Analysis Annual Meeting, December 7, 2009, Baltimore, Maryland.

Sizheng Li

"Comparison of a New Physics-based Simulation Model and the Hamada Equations in Determining Post-earthquake Fire Spread." Presented at the Fifth Annual Inter-University Symposium on Infrastructure Management, June 20, 2009, University of Iowa, Iowa City, Iowa.

Samantha Penta

"Masculinity on the Hudson: Gendered Portrayals of the Flight 1549 Response." Presented at the Eastern Sociological Society Annual Meeting, March 20, 2009, Boston, Massachusetts.

Havidán Rodríguez

"Technology, Society, and Severe Weather Events: Developing Integrated Warning Systems." Presented at the Integrated Warning Team Workshop, National Weather Service, January 22, 2009, Kansas City, Missouri.

Havidán Rodríguez and Jenniffer Santos

"Societal Impacts of Weather Hazards: Understanding Public Response to Tornado Events." Presented at the 4th Symposium on Policy and Socio-economic Research, American Meteorological Society 89th Annual Meeting, January 13, 2009, Phoenix, Arizona.

Jenniffer Santos-Hernández and Havidán Rodríguez

"Improving Warning Systems: An Assessment of Public Response to Tornado Warnings during the 2008 Tornado Season." Presented at the 4th Symposium on Policy and Socio-economic Research, American Meteorological Society 89th Annual Meeting, January 14, 2009, Phoenix, Arizona.

Joseph E. Trainor

"Designed for Disaster." Presented at the International Research Committee on Disasters Hazards Researchers Meeting, July 19, 2009, Broomfield, Colorado.

Tricia Wachtendorf and James M. Kendra

"The Making of a Megacrisis: 9/11 as a Case for the Concept." Presented at the Conference on Mega Crisis, June 18, 2009, The Hague, Netherlands.

"Diffuse Sensemaking in Large-Scale Crisis Environments." Presented at the International Research Committee on Disasters (IRCD) Workshop, July 19, 2009, Bloomfield, Colorado.

Poster Presentations

Sue McNeil

"University of Delaware—Disaster Research Center Graduate Programs." Presented at the 34th Annual Hazards Research and Applications Workshop, July 15–18, 2009, Bloomfield, Colorado.

Jenniffer Santos

"Disaster Decision Support Tool (DDST): Social Vulnerability to Disasters in Puerto Rico." Presented at the University of Delaware's Geospatial Research Day, November 19, 2009, Newark, Delaware.

Brittany Scott

"Research Experience for Undergraduates (REU) Program: Enhancing Disaster Research through Undergraduate Training." Presented at the 34th Annual Hazards Research and Applications Workshop, July 15–18, 2009, Bloomfield, Colorado.

Invited Presentations

B. E. Aguirre

"Station Nightclub Fire and Agent Based Modeling." Presented at the National Science Foundation CMMI Grantees Workshop, June 26, 2009, Honolulu, Hawaii.

"The Cuban Model of Disaster Management: Continuing Controversies." Presented at the Association for the Study of the Cuban Economy, July 31, 2009, Miami, Florida.

Lauren Barsky

"Who is Responsible for At Risk Populations? The Role of Media in Shaping Perceptions of Responsibility." Presented at the 104th Annual Meeting of the American Sociological Association, August 11, 2009, San Francisco, California.

Lauren Barsky and Tricia Wachtendorf

"Examining Perceptions of Individual Verses Collective Responsibility in the Aftermath of Routine Periods and Extreme Events." Presented at the 79th Annual Meeting of the Eastern Sociological Society, March 21, 2009, Baltimore, Maryland.

Susan Brink, Rachel Davidson, and Taronne Tabucchi

"Estimated Durations of Post-earthquake Water Service Interruptions in Los Angeles." Presented at the TCLEE2009 Conference (ASCE Technical Council on Lifeline Earthquake Engineering), June 29, 2009, Oakland, California.

Rachel Davidson, Tricia Wachtendorf, and Rochelle Brittingham

"DRU: Integrated Optimization of Evacuation and Sheltering for Hurricanes." Presented at the NUWCReN Meeting, December 15, 2009, Newark, Delaware.

Sue McNeil

"Climate Change Adaptation Research Programs and Funding." Presented at the Joint Meeting of The World Road Association's (PIARC) Technical Committee on Preserving the Environment and the Transportation Review Board's Special Task Force on Climate Change and Energy, January 12, 2009, Washington, DC.

"Climate Change Adaptation Research Programs and Funding." Presented at the Transportation Research Board Executive Committee meeting, January 14, 2009, Washington, DC.

"Integrating Adaptation to Climate Change with Asset Management." Presented at the IBTTA and ITS America Joint Conference on Sustainability, October 5, 2009, St. Louis, Missouri.

Joseph E. Trainor

"A Critical Evaluation of the Incident Command System and NIMS." Presented at the Montgomery County Emergency Management Agency Training Series, March 11, 2009, Conshohocken, Pennsylvania.

"Disaster Science: Fact vs. Fiction in the Human Dimensions of Disasters." Presented at the Pennsylvania Emergency Managers Conference, September 28, 2009, Harrisburg, Pennsylvania.

Lucia Velotti and Joseph E. Trainor

"Understanding Vertical Evacuation." Presented at the NUWCReN Meeting, Disaster Research Center, December 15, 2009, Newark, Delaware.

Tricia Wachtendorf

"Are Catastrophes Different?" Presented at the 37th Annual Hazards Research and Applications Workshop, July 17, 2009, Bloomfield, Colorado.

"Disaster Myths and Realities." Presented to the Maryland Volunteers Active in Disasters, September 11, 2009, Columbia, Maryland.

Sessions Organized or Moderated

B. E. Aguirre

Regular Session on "The Effects of Disasters in Cuba." Association for the Study of the Cuban Economy, July 31, 2009, Miami, Florida.

Joseph Trainor

Co- Meeting Organizer, International Research Committee on Disasters and Natural Hazards Center Hazards Researchers Meetings, August 17–18, 2009, Bromfield, Colorado.

In addition, DRC staff members regularly attend various professional conferences, workshops, etc. and contribute to the collective knowledge of the disaster research field through their attendance. Below is a partial list of events recently attended.

All-Hazards Consortium Spring Workshop, Wilmington, Delaware, May 5–6, 2009. Attended by Sue McNeil.

FEMA All-Hazards Higher Education Conference, Emmitsburg, Maryland, June 1–4, 2009. Attended by Lauren Barsky, Pat Young, and Joe Trainor.

Disasters Roundtable: "Children and Youth in Disasters: Closing Gaps among Research, Practice, and Policy," June 25, 2009, Washington DC. Attended by Sue McNeil, Deb Alvarez, Lauren Barsky, Manuel Torres, and REU participants.

Hazards Workshop, Broomfield, Colorado, July 15–18, 2009. Attended by Havidán Rodríguez, Jenniffer Santos, Sue McNeil, Laura Black, Lauren Barsky, and REU participants.

DRC in the News

DRC events and activities were publicized regularly throughout the calendar year by the University's electronic newsletter, UDaily. The following are the news stories for 2009 along with their Web URLs:

"Emergency, Disaster Awareness Event Planned April 16"

> This article described "Emergency and Disaster Awareness Day," an event organized by the Earthquake Engineering Research Institute (EERI) Disaster Studies student chapter. Several of the chapter's officers and members were DRC graduate and undergraduate students.
>
> Available online at www.udel.edu/udaily/2009/apr/emergency041409.html

"NSF Grad Fellowships Support UD Engineering Students"

> DRC Graduate Research Assistant Susan Brink was among the students highlighted in this article recognizing their selection as National Science Foundation Graduate Research Fellowship recipients.
>
> Available online at www.udel.edu/udaily/2009/may/nsf050409.html

"UD and Argonne National Lab Sign Agreement"

> In April the University entered into a collaborative research agreement with Argonne National Laboratory through the efforts of DRC's research faculty. This article details the scope and purpose of that agreement.
>
> Available online at www.udel.edu/udaily/2009/apr/argonne042209.html

"UD Participating in Capstone Test of NEESWood Project"

> DRC graduate student Greg Black was featured in this article, which describes his study of seismic effects on woodframe buildings via computer models. The article notes Black's participation in a simulation test utilizing a shake table located at the Hyogo Earthquake Engineering Research Center in Miki City, Japan.
>
> Available online at www.udel.edu/udaily/2010/jul/neeswood071009.html

"UD Prof Serves on National Research Council Infrastructure Committee"

> This article recognizes UD Professor and DRC Director Sue McNeil's service to the National Research Council's ad hoc Infrastructure Committee which produced the report, "Sustainable Critical Infrastructure Systems: A Framework for Meeting 21st Century Imperatives." The full report can be downloaded for free from the National Academies Press at www.nap.edu/catalog.php?record_id=12638.
>
> Available online at www.udel.edu/udaily/2010/jul/mcneil071409.html

"UD Provides Undergraduate Researchers with Experience in Disaster Research"

This article presents information about DRC's Research Experience for Undergraduates (REU) program, in its fourth year as of 2009.

Available online at www.udel.edu/udaily/2010/jul/drcreu072309.html

"University Prepares for Disaster through Simulation"

On July 24, 2009, twenty University employees joined employees from Newark, Delaware in an emergency management exercise to strengthen their skills and understanding for such an event. The program included DRC personnel among others.

Available online at www.udel.edu/udaily/2010/jul/drill073109.html

"UD Graduate Wins National Award for Dissertation on Disaster, Behavioral Science"

University of Delaware graduate and former DRC graduate student Bethany Brown was honored with the inaugural awarding of the Samuel H. Prince Award. The award is given by the International Research Committee on Disasters in recognition of notable accomplishments by disaster researchers in the social and behavioral sciences for a disaster related doctoral dissertation. This article details Brown's recognition.

Available online at www.udel.edu/udaily/2010/oct/princeaward101509.html

In addition to regular inclusion in the UDaily, DRC staff members were also contacted for expert opinions that appeared in outside news sources. The following are examples of these DRC appearances in the news.

"What Katrina Has Wrought, Four Years Later." Patrik Jonsson, *The Christian Science Monitor*

Those interviewed for the article include DRC cofounder and Professor Emeritus Russell Dynes.

Article available online at www.csmonitor.com/USA/2009/0829/p02s01-usgn.html

"Why Cops Should Trust the Wisdom of the Crowds." Michael Bond, *NewScientist,* Issue 2717.

Those interviewed for the article include DRC Associate Director Tricia Wachtendorf.

Information on accessing copies of this article can be found online at www.newscientist.com/article/mg20327171.400-why-cops-should-trust-the-wisdom-of-the-crowds.html

Visitors to DRC

The DRC hosts numerous national and international visitors throughout the year, many of whom come to work with DRC personnel and to utilize the E. L. Quarantelli Resource Collection. In addition, the DRC also sponsors a speaker series intended to initiate novel and provocative discussion of disaster related topics.

The following is a list of the visitors to the DRC during the past year including their institutional affiliation.

February

Per Becker, Lund University Centre for Risk Analysis and Management, Lund, Sweden

Kerstin Eriksson, Lund University Centre for Risk Analysis and Management, Lund, Sweden

Lars Fredholm, Lund University Centre for Risk Analysis and Management, Lund, Sweden

Kurt Petersen, Lund University Centre for Risk Analysis and Management, Lund, Sweden

Joseph Scanlon, Emergency Communications Research Unit, Carleton University, Ottawa, Ontario, Canada (also visited in October)

Christian Uhr, Lund University Centre for Risk Analysis and Management, Lund, Sweden

Menno Wiebe, The KonTerra Group, Washington, D.C.

March

Misse Wester, The Royal Institute of Technology, Stockholm, Sweden

April

David A. Friedman, Forell/Elsesser Engineers, Inc., San Francisco, California

May

Erna Danielsson, Mid Sweden University, Östersund, Sweden

June

Chris Webb, Auckland University of Technology, Auckland, New Zealand

Jane Pierard, Ministry of Civil Defence and Emergency Management, Wellington, New Zealand

August

M**ark de Groh**, Princeton University, Princeton, New Jersey

September

David Mendonça, New Jersey Institute of Technology, Newark, New Jersey

October

James Kendra, University of North Texas, Denton, Texas

Nuno Martins, Universidade dos Açores, São Miguel, Açores

Terrie Modesto, Thanatological Education and Resource Center, Millington, Maryland

Halit Yagmur, Private Architectural Consultant (Engineering Architecture), Istanbul, Turkey

Özlem Bek Yagmur, Istanbul Technical University, Istanbul, Turkey

November

Tomohide Atsumi, Osaka University, Osaka, Japan

Andrew Horowitz, Yale University, New Haven, Connecticut

Takumi Miyamoto, Osaka University, Osaka, Japan

December

Kees van Dongen, TNO, The Hague, The Netherlands

Karen Engel, Instituut voor Veiligheidsen Crisismanagement (COT), The Hague, The Netherlands

Georg Frerks, Wageningen University, Wageningen, The Netherlands

Jack Harrald, Virginia Tech, Blacksburg, Virginia

Ali Jordan, Natural Hazards Center, University of Colorado at Boulder, Boulder, Colorado

Peter van der Made-Hodge, The Hague Centre for Strategic Studies, The Hague, The Netherlands

Liesel Ritchie, Natural Hazards Center, University of Colorado at Boulder, Boulder, Colorado

Kees van Ruiten, Deltares, Delft, The Netherlands

Greg Shaw, Institute for Crisis, Disaster, and Risk Management, George Washington University, Washington, DC

Pauline Veldhius, Virginia Tech, Blacksburg, Virginia / George Washington University, Washington, DC

Jeroen Warner, Wageningen University, Wageningen, The Netherlands

Marco Zannoni, Instituut voor Veiligheidsen Crisismanagement (COT), The Hague, The Netherlands

Other Disaster-Related Activities

In addition to the activities listed above, DRC faculty, students and staff also participate in a range of activities pertaining to disasters including affiliations with various Boards, reviewers for disaster related journals, etc.

Below is a brief list of affiliations currently held by DRC personnel.

Benigno E. Aguirre

- Reviewer, special issue on Terrorism, Disaster, and Organizational Management of the *Journal of Organizational Behavior*
- Reviewer, *Sociological Inquiry*
- Reviewer, *International Migration Review*

John Barnshaw

- Reviewer, *American Journal of Sociology*
- Reviewer, *Disasters: The Journal of Disaster Policy, Study and Management*
- Member, Contingency Planning Association of the Carolinas
- Member, Metrolina AIDS Project

Rachel Davidson

- President-Elect, Society for Risk Analysis
- Executive Committee Member, American Society of Civil Engineers (ASCE) Technical Council on Lifeline Earthquake Engineering
- Mentor, Next Generation of Hazards and Disaster Researchers

Havidán Rodríguez

- Reviewer, *Journal of Economic Behavior & Organization*
- Reviewer, *The Journal of Disaster Studies, Policy and Management*
- Reviewer, *Journal of Emergency Management*

Joseph Trainor

- Reviewer, *Disasters: The Journal of Disaster Studies, Policy and Management*
- Reviewer, *Journal of Disaster Planning*
- Reviewer, *Journal of Homeland Security and Emergency Management*
- Reviewer, *International Journal of Mass Emergencies and Disasters*
- Reviewer, *National Science Foundation*
- Member, University of Delaware Disaster Science and Management Program Committee
- Member, University of Delaware Disaster Mitigation Committee

Tricia Wachtendorf

- Course Session Developer, "Responses to Catastrophe" course, Federal Emergency Management Agency Higher Education Division and University of Maryland, Baltimore
- Faculty Adviser, UD-EERI Student Chapter
- Advisory Board Member, Learning from Earthquakes, Earthquake Engineering Research Institute
- Board Member, Student Activities, Earthquake Engineering Research Institute
- Contributing Author, Canadian Assessment of Natural Hazards Project
- Reviewer, *International Journal of Mass Emergencies and Disasters*
- Reviewer, *Natural Hazards Review*
- Moderator, Annual Workshops on Hazards Research and Application
- Recorder, Annual Workshops on Hazards Research and Applications
- Panel Reviewer, National Science Foundation
- Proposal Reviewer, National Science Foundation
- Member, International Research Committee on Disasters, International Sociological Association
- Member, Earthquake Engineering Research Institute
- Member, Institute for Operations Research and Management

Pat Young

- Vice Chair, Emergency Response Working Group (ERWG), University of Delaware
- Board Member, Delaware Disaster Assistance Team (DDAT)

The E. L. Quarantelli Resource Collection

Pat Young, Resource Collection Coordinator, is seated in the collection space of the E. L. Quarantelli Resource Collection.

(photo by Erna Danielsson, DRC visiting researcher from Mid Sweden University)

Report of Activities

One of the key functions at DRC that supports its ongoing missions of Research, Education/Mentoring, and Outreach/Dissemination is the continuing maintenance and growth of the E. L. Quarantelli Resource Collection. During the past year the Collection has seen regular growth and Collection staff have undertaken and continued several initiatives to improve and enhance the quality and accessibility of the Collection.

The transition to a web-based software platform to support the Collection's catalog database, DISCAT, continues to progress. During the past year much work has been done to improve and enhance the database records, thus providing a more useful research tool in the future. Once upgrade of the records is complete, the process of migrating the database to the new software will be completed. Barring any unforeseen technical issues, look for the database to make its debut on the web sometime within the next year.

Efforts continue to also focus on ensuring that the Resource Collection is adequately protected by a complete emergency response plan and that all possible mitigation actions are taken. To this end, an emergency response kit was created to triage the immediate issues resulting from any potential emergency or disaster situation that might impact the collection materials. For information on this process, contact Pat Young, Resource Collection Coordinator, at pyoung@udel.edu. Additionally, Pat continues to remain very active in both ERWG, the Emergency Response Working Group at the University of Delaware, and DDAT, the Delaware Disaster Assistance Team. Both organizations address the broad spectrum of emergency- and disaster-related topics that pertain to collections. Additional information on both groups can be found on their respective web sites (ERWG – www.udel.edu/ERWG; DDAT – www.udel.edu/DDAT).

Resource Collection staff assisted a total of 23 visiting researchers from Sweden, New Zealand, Japan, Turkey, the Azores, Canada and the Netherlands as well as various institutions throughout the United States. Additionally, staff assisted with a total of 25 student visits as well as working closely with the 15 visiting students who participated in this year's Research Experience for Undergraduates (REU) program hosted by DRC.

The E. L. Quarantelli Resource Collection saw an expansion of 1,362 new acquisitions during the past year. Current collections include print materials, journals and newsletters, electronic files, microfilm, microfiche, videos in both VHS and DVD format, slides and film and currently numbers approximately 57,000 items. New acquisitions included items obtained during two visits by the Resource Collection Coordinator to the Library of Congress as part of their Surplus Books Program.

The Collection continues to expand to meet the developing needs of researchers who utilize its resources. It is our hope that we will be able to continue our efforts to expand access to the Collection as well in the future.

DRC Publications

The DRC produces a number of publications throughout the year including published articles, peer-reviewed Preliminary Papers, book chapters, miscellaneous reports, and invited commentaries. For a complete list of this year's publications, please refer to the "Peer Reviewed Publications" and "Other Publications" in the Outreach/Dissemination section of this report beginning on page 31.

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