

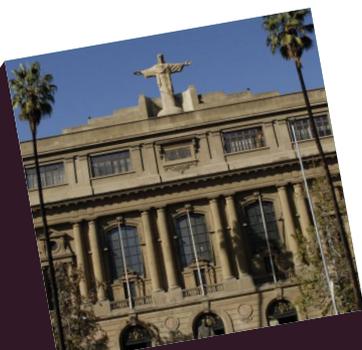


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 GLOBAL RESILIENCE RESEARCH NETWORK
**2018-2019 GRRN Program Highlights
& Second Annual Summit Overview**

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Global Resilience Institute
at Northeastern University

2019 SUMMIT HOSTED BY



For information about the 2019 Summit, visit:
www.globalresilience.northeastern.edu/network

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GRRN PARTNERS

Australia

Flinders University
Royal Melbourne Institute of Technology
University of Newcastle
University of Melbourne

Caribbean

Fundación Antonio Núñez Jiménez
University of the Bahamas
Universidad de la Habana

Chile

CIGIDEN, Pontificia Universidad Católica de Chile

China

Fudan University

France

Université de Technologie de Troyes

Germany

Fraunhofer Ernst-Mach-Institut
University of Freiburg

India

The Energy and Resources Institute
National Institute of Urban Affairs

Israel

The Institute for National Security Studies, Tel Aviv University

Iraq

University of Basrah

Mexico

Universidad Autónoma de Yucatán

New Zealand

Resilient Organisations
Victoria University of Wellington

Switzerland

ETH Zürich

United Kingdom

Northumbria University
Cranfield University

United States

Northeastern University, Global Resilience Institute
University of Hawaii Mānoa, Institute for Sustainability and Resilience
Johns Hopkins University, Applied Physics Laboratory
The Payne Institute for Public Policy, Colorado School of Mines
Universidad de Puerto Rico
Texas Tech University

ABOUT THE GLOBAL RESILIENCE RESEARCH NETWORK

The Global Resilience Research Network (GRRN) is a membership network of leading universities, institutes, non-profit organizations, and companies engaged in resilience research that informs the development of novel tools and applications. The researchers and practitioners affiliated with GRRN participate in interdisciplinary collaborative teams to inform and build resilience across all scales. GRRN was founded in 2017 by the Global Resilience Institute (GRI) at Northeastern University in collaboration with the Fraunhofer Ernst-Mach-Institut (EMI).

The network is animated by a shared commitment to ensuring that societies can better cope with major disruptions and are able to respond to disasters occurring anywhere in the world with resources and resilience expertise. The end goal is for communities and infrastructures to recover, adapt, and even transform so that they can thrive in the face of growing turbulence in the natural and built environments. The GRRN draws on diverse resilience experts to conduct assessments and develop innovative solutions that can be practically adopted on a global scale. By participating in the GRRN, members from around the world derive mutual benefit from:

- The network's ability to identify relevant expertise across member institutions to support the creation of collaborative international research teams.
- The network's support in developing research proposals that are interdisciplinary and have a broad geographic scope that potential funders are most interested in supporting.
- The communications and partnership outreach efforts of the network that elevate the profile of each member's resilience-related research, events, news, and activities.

CHARTING A COURSE FOR THE FUTURE OF THE GRRN

The researchers affiliated with GRRN share a common excitement about the opportunity the network provides for deepening their efforts to undertake innovative, community engaged research. They share a recognition that focusing on resilience **as a capacity for transformation** unifies and motivates researchers and practitioners across different disciplines, sectors, scales and jurisdictions. Innovative resilient solutions for complex social, technical, and environmental challenges require integration of multiple perspectives and local expertise and context. This is why GRRN's global network of partners is a timely and powerful force for envisioning and implementing scalable solutions that respond to the global resilience imperative.

In the next phase of GRRN's development and evolution representatives from the participating member institutions see great potential for the GRRN to expand and support the assembly of culturally diverse, interdisciplinary research teams globally. The network members are committed to focusing on training and capacity building among partner institutions, investing in professional development for students and early career professionals and looking for opportunities to conduct webinars, short courses, and international research exchanges.

Going forward, the GRRN will seek to add new partner institutions globally. The GRRN leadership team is assembling a Steering Committee made of representatives from partner institutions who will lead decisions about the network's future development, including reviewing funding opportunities.





YEAR 1 PROGRAM HIGHLIGHTS

REFLECTING ON GRRN ACHIEVEMENTS

Since the Inaugural Summit and launch of the Global Resilience Research Network in March 2018, the network has had many successes. There are currently over 50 research project teams organized within *Lynx-Net*, GRRN's online collaboration and networking tool. Twenty-two research exchange visits have been facilitated between GRRN partner institutes. Three new peer-reviewed publications were published by inter-GRRN research teams. Nine new proposals for multi-institutional research and program development have been submitted. In order to support the educational and capacity building goals of the GRRN, three student exchange programs between GRRN partners have been established. While the most profound and impactful outputs of the GRRN are not easily quantified by traditional metrics for academic research, these numbers help illustrate some of the tangible collaborative outputs as well as the enormous potential of this evolving global research network.

250+
GRRN researchers

22 research
exchange
visits

3 new inter-GRRN
publications

9 new research
proposals
submitted

3 student exchange
programs

A satellite-style image of the Caribbean region, showing the islands of the West Indies, the northern coast of South America, and parts of Central America. The land is shown in shades of green and brown, while the surrounding waters are deep blue. The text is overlaid on the left side of the image.

ANNOUNCING THE ISLAND RESILIENCE INITIATIVE

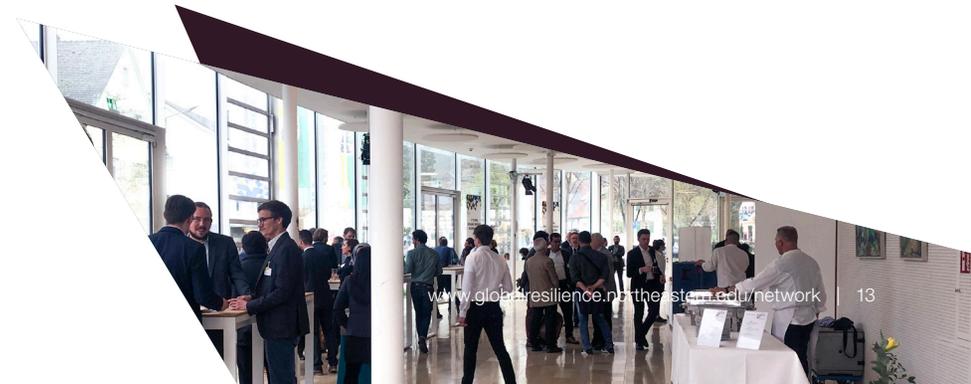
Recently the GRRN has initiated the Island Resilience Initiative (IRI), a network of island and coastal members of the Global Resilience Research Network. The IRI links research centers, non-governmental organizations, institutes and universities around a shared vision for informing and advancing the preparedness of island peoples and the transformative potential of their societies in the face of mega-storms, rising seas, and long-standing structural challenges heightened by global warming and systemic change. Initially forged by researchers from the Fundación Antonio Núñez Jiménez for Nature and Humanity (Havana, Cuba), the University of the Bahamas, Universidad de la Habana, Universidad de Puerto Rico, and Northeastern University's Global Resilience Institute, IRI has grown to include partners beyond the Caribbean archipelago including Universidad Autónoma de Yucatán and the University of Hawaii.

The IRI creates a community that supports interdisciplinary resilience research across multiple national jurisdictions by facilitating knowledge sharing and capacity building among communities facing similar vulnerabilities and management challenges. The goal of the IRI is to build a regional alliance informed by traditional and local practices to develop strategies and new models of cooperation. The IRI is affirmed by the U.S. State Department's recently renewed Caribbean 2020 Framework and the April 2019 announcement of a new U.S.-Caribbean Resilience Partnership.



OVERVIEW OF THE APRIL 9-11, 2019 SUMMIT IN FREIBURG, GERMANY

The goal of the GRRN Summit is to provide a forum where GRRN members can gather each year to learn from renowned thinkers and practitioners, showcase the results of their research and educational efforts, and generate new collaborative research ideas and project teams. The theme of the Second Annual GRRN Summit was Baking Resilience In: Engineering Global Research for Novel Solutions, Applications and Technologies. The GRRN Summit was held at the FORUM Merzhausen, which is a world-class sustainably-designed cultural and community center. This global event brought together scholars in applied resilience research with government and industry leaders to explore emerging research, novel technologies, and solutions for advancing resilience across multiple sectors and scales.





SETTING THE STAGE FOR GLOBAL COLLABORATION TO ACHIEVE RESILIENT SOLUTIONS

Fraunhofer EMI Director Stefan Hiermaier opened the summit with a keynote address outlining compelling insights on structural resilience, drawn from an engineering context. Dr. Hiermaier emphasized that resilient systems are achieved by iterations of adaptive cycles to preserve system functionality, enable quick recovery, and build in graceful degradation. Representing Northeastern University, Dean Uta Poiger of the College of Social Sciences and Humanities outlined the importance of global collaboration for transformative interdisciplinary research.

Other opening speakers emphasized that in an increasingly interconnected world where global climate change is amplifying many threats, there is an urgent need for new collaborative approaches to bring cutting-edge research to bear in decision-making. These speakers included Northeastern University's Global Resilience Institute Founding Director Stephen Flynn; Engelbert Beyer, the Deputy Head of the Directorate of Research and Innovation for the German Federal Ministry of Education and Research; Maximilian Steiert, the Director of Political and International Affairs at Fraunhofer-Gesellschaft e.V.; and Hans-Jochen Schiewer, the President of the Albert-Ludwigs University in Freiburg.



PANEL & SPEAKER SESSIONS

PANEL SESSION 1 **Creating Benefit Through Resilience**

Moderator: S. Flynn, Northeastern University

*Panelists: M. Bruneau, University at Buffalo; W. Hynes, University College Cork;
S. Trometer, virtualcitySYSTEMS GmbH; J. Vargo, Resilient
Organisations Ltd*

The first panel session began with a keynote presentation by one of the world's preeminent scholars in the field of resilience engineering, Dr. Michel Bruneau from the Department of Civil, Structural, and Environmental Engineering at the University of Buffalo in New York. Drawing on an analysis of the Christchurch, New Zealand Central Business District impacts and reconstruction following 2011's devastating earthquake, Dr. Bruneau provided insight into the technical factors and the social and political factors that inform structural engineering decisions during post-earthquake reconstruction.

Dr. Stephen Flynn led a substantive discussion with panelists Dr. Bruneau; Williams Hynes, Managing Director of Future Analytics, and Adjunct Professor at the University College Cork; Stefan Trometer, Head Urban Simulations Division, virtualcitySYSTEM GmbH; and John Vargo, Executive Director of Resilient Organizations. The panelists discussed the role of risk management in resilience theory, reflecting that the things which we as a society choose to measure have a profound effect on how we address risks. Arguing that we have to move beyond assessing financial impacts exclusively, they explained that a cultural shift toward quantifying social dynamics is critical as well. John Vargo made a compelling case for moving beyond thinking of risk as something to be avoided: "We need a parallel way of thinking where we embrace risk. We learn by making mistakes and then improving." Embracing risk as a learning opportunity can generate new opportunities for collaboration, and inspire efforts to strategically reinvent or transform the structure of communities for greater equity, including fostering deeper social interconnections.

PANEL SESSION 2

Adaptive Capacity – A Key Enabler for Resilience

Moderator: J. C. Stephens, Northeastern University

Panelists: L. Alexander Augustine, National Academies of Sciences, Engineering, and Medicine; J. Coaffee, New York University; I. Giuliani, City of Milan; P. Arbon, Torrens Resilience Institute

A leading expert on community resilience capacity building, Dr. Lauren Alexander Augustine, opened the second panel by highlighting the urgent need to compress the traditional research cycle in order to speed the development and deployment of applied resilience solutions. “Risks aren’t just evolving, they’re concentrating and converging – we have plenty of data but need usable information.” Dr. Alexander Augustine is the Executive Director of the Gulf Research Program of the U.S. National Academies of Science, Engineering, and Medicine.

The panel discussion that followed was moderated by Dr. Jennie Stephens, Director of Strategic Research Collaborations at the Global Resilience Institute and Director of the School of Public Policy & Urban Affairs at Northeastern University. Joining Dr. Alexander Augustine as panelists in this session were Jon Coaffee, Professor of Urban Geography, University of Warwick CUSP and NYU; Ilaria Giuliani, Deputy Chief Resilience Officer for the city of Milan; and Paul Arbon, Director of the Torrens Resilience Institute, Flinders University in Australia. In discussing the importance of building adaptive capacity, the group identified a unifying theme for the 2019 summit: true resilience is about system transformation. Dr. Stephens explained, “More than returning to form, we should think about the potential for resilience to transform to more inclusive, more equitable, more sustainable solutions.” In any management decision, policy-makers must consider who has power and whose voices are being listened to. Jon Coaffee’s remarks supported this concept, noting that making a shift from focusing on resilient outcomes towards understanding resilience as a process places adaptive capacity at the center of the policymaking process.



Speakers in this panel highlighted the importance of developing innovative solutions that emphasize building resilience across sectors and scales. There is a need for scientists to think beyond traditional research program outputs that aim to provide policymakers with toolkits and resilience checklists. What is required is more community engagement centered around iterative dialogue. Cultivating relationships and building political power and leadership capacity at the local level are key to strengthening resilience.

PANEL SESSION 3

Complex Systems Resilience – How do we do it?

Moderator: *S. Hiermaier, Fraunhofer EMI*

Panelists: *H. Heinemann, ETH Zurich; A. Stolz, Fraunhofer EMI; F. Sedehizade, Berliner Wasserbetriebe; B. Heydari, Northeastern University*

Dr. Hans Heinemann, Future Resilient Systems Programme Director & Principal Investigator at ETH Zürich/FRS Singapore, gave the keynote talk that set the stage for the third and final panel session. Dr. Heinemann is a reknown researcher on resilience modeling. He framed his discussion around Albert Einstein's famous words, "You cannot solve problems with the same line of reasoning that created them." He argued that humans are predisposed to map things that we observe in the world to the categories that we hold in our minds, but innovating solutions requires practicing mindfulness and thinking beyond our assumptions about system behavior. "Resilience is not about decision-making," Heinemann said, "It's about sense-making-- the process of interpreting information and signals from interlinked systems."

The panel discussion that followed the keynote, explored opportunities and limitations associated with using big data to understand and inform resilience planning. It was moderated by Stefan Hiermaier and in addition to Hans Heinemann, included Alexander Stolz, Head of Business Unit Security and the Department Safety Technology and Protective Structures at Fraunhofer EMI; Fereshte Sedehizade, Operations Coordinator at Berliner Wasserbetriebe; and Babak Heydari, Professor in the Department of Mechanical and Industrial Engineering at Northeastern University. The panelists highlighted the importance of moving beyond the ability to collect and manage vast quantities of data and towards developing a deep understanding of system dynamics. As top manager for the city of Berlin's water infrastructure, Fereshte Sedehizade made the point that academic researchers have traditionally had a tendency to design sophisticated technical models that are of little use for managers if they are not designed in a collaborative process that provides opportunities for modifying components and running simulations.

This is not to say that models are unimportant. But special emphasis should be placed on leveraging modern technology to simulate the behavior of complex, interconnected systems under stress and provide decision support tools that are useful for infrastructure operators. To accomplish this, researchers need to focus on how humans and their behavior can be integrated into models. Dr. Heydari suggested that there are parallels between complex sociotechnical systems and biological systems. This comparison generates thought provoking questions: How does the human immune system inform understanding of other complex systems? Can parallel systems be designed in ways that respond to disturbances in an adaptive manner?



SUMMIT DAY 2 KEYNOTE

Challenging Assumptions & Advancing the Resilience Discourse

B. Walker, The Australian National University

The second day of the summit was opened with a thoughtful and engaging talk by distinguished sustainability and resilience scholar Brian Walker, Research Fellow in the Sustainable Ecosystems program at CSIRO and Honorary Professor at the Australian National University. Dr. Walker challenged Summit participants to question their assumed definitions of resilience. Underscoring the power of a holistic approach, one that is inclusive of the scales and disciplines that Global Resilience Research Network partners work within, Dr. Walker identified several core ideas to guide the study of resilience:

1. We must be clear about for whom and for what we are seeking resilience. Resilience at one scale or within one system is not necessarily compatible across all other scales and systems.
2. There is a critical need to incorporate analysis of politics and power dynamics within the study of resilience.
3. Adaptive management depends on understanding thresholds or boundary conditions beyond which a system cannot be sustained and then allowing systems to self-organize within those boundary conditions.
4. Given that socio-ecological systems are complex and self-organizing, we cannot predict particular outcomes and must embrace solutions that support resilience across a broad range of possible future conditions.
5. Resilience is not simply “bouncing back”. The notion of system transformation and reorganization is at the heart of resilience.



SUMMIT DAY 2

GRRN PARTNER RESEARCH UPDATES

Three researchers shared updates on new and ongoing research taking place across institutions within the network:

- 1. Dr. Nader Naderpajouh of Australia's Royal Melbourne Institute of Technology** shared updates on collaboration with researchers based at Northeastern University and Resilient Organisations in New Zealand. The projects integrate engineering and social sciences perspectives and include "Multi-layer definitions of resilience across individuals, teams, and organizations;" "An operational paradigm for engineering resilience of interdependent infrastructure systems;" and "Industry primers for resilience."
- 2. Dr. Nadia Fawzi of the Marine Science Center at the University of Basrah, Iraq,** presented her extensive work with faculty at Northeastern University, building an egalitarian partnership between Iraqi and U.S.-based researchers to restore the Hammar Marshes and reestablish connections between Iraqi researchers and the international scientific communities. Fawzi notes that there is a history of aid organizations and researchers that step into the region for brief projects and then disappear. This sustained partnership has been different and has enabled sharing of scientific equipment and resources. Long term, there is interest in establishing student exchanges focused on ecological restoration and building resilience in the region.
- 3. Dr. Jennie Stephens of Northeastern University** shared updates about collaborative research connecting researchers focused on energy resilience at the University of Puerto Rico and Northeastern University. Together, researchers at Northeastern and the University of Puerto Rico have collaborated on multiple National Science Foundation funding proposals related to resilience education, energy system innovation and cooperative distributed energy business models. A collaborative editorial about Puerto Rico's energy future was published in Science by a cross-institution team. Ongoing research looks at energy and climate policy pre- and post-Hurricane Maria to determine the different narratives driving decisions and the ways that resilience is conceptualized in policy documents.



GRRN YOUNG RESEARCHER AWARD

2019 was the first year that a competition was held for young resilience researchers. At the summit, a series of short talks provided the opportunity for GRRN partners to learn from five GRRN Young Researcher Award finalists: Kai Fischer from Fraunhofer EMI; Ellie Kay from Resilient Organisations; Tino Mitzinger from the University of Bremen; Garrett Morrow and Lizzy Warner both from Northeastern University. Ellie Kay, communication research fellow at Resilient Organisations, was awarded this year's prize for her work on a resilience measurement system that allows for comparison and trend analysis across every New Zealand municipality. The network plans to continue this competition for early career researchers in future summits.



GLOBAL RESILIENCE RESEARCH NETWORK

ABOUT THE GLOBAL RESILIENCE INSTITUTE

The research and educational mission of the Global Resilience Institute (GRI) at Northeastern University is to develop and deploy practical and innovative tools, applications, and skills that drive social and technical changes, which strengthen the capacity of individuals, communities, systems and networks to adapt to an increasingly turbulent world. Our objective is to help advance preparedness at multiple levels to effectively respond to slowly emerging disruptions and sudden disasters, both human-made and naturally-occurring.

GRI accomplishes this by facilitating new interdisciplinary research collaborations; working in close partnership with industry, government, communities, and non-governmental organizations; and engaging in external outreach to inform, empower, and scale bottom-up efforts that contribute to individual and collective resilience.





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