

ICoE-Vulnerability and Resilience Metrics (VARM)

University of South Carolina, USA

Summary of Activities June 2017-August 2019¹

Formally established: August 2013

Mission Statement: The ICoE-VARM provides core scientific expertise in tools and approaches for measuring social vulnerability, disaster resilience, and loss and damage databases. Specifically the Center of Excellence 1) expands and improves vulnerability and resilience metrics developed for the U.S. context to other regions working collaboratively with partners; 2) provides leadership in improving and harmonizing sub-national hazard event and loss databases; 3) builds capacity through training the next generation of disaster scientists including international students (pre- and post-doctoral) and scientists through short-term study visits; and 4) supports the existing research projects of IRDR related to disaster loss data and integrated assessments.

External Advisory Committee: Kathleen Tierney (University of Colorado, Director, Natural Hazards Center, and Chair, IRDR USA National Committee), Walter Peacock (Texas A&M University, Director, Hazard Reduction and Recovery Center, USA), David Johnston (Massey University, Director, Joint Centre for Disaster Research, and Director IRDR ICoE in Community Resilience, New Zealand), Omar Darío Cardona (Universidad Nacional de Colombia, Director IRDR ICoE in Understanding Risk & Safety), Jörn Birkmann (University of Stuttgart, Director Institute for Spatial Planning and Regional Development)

Activities and Outputs Articulating with IRDR Core Objectives

Research Collaborations (Funded projects and proposals)

1. Päivi Lujala, (Project Leader). Research Council of Norway funded project with Chr. Michelsen Institute (CMI), Norwegian University of Science and Technology (NTNU), and ICoE-VaRM “Creating a political and social climate for climate change adaptation.” ICoE-VaRM assisting in the development and testing of a global resettlement index (GloRI) using geospatial data and techniques. Project time frame: 2018-2020.

2. Carolina Martinez (Pontificia Universidad Católica de Chile) and Paula Villagra Islas (Universidad Austral de Chile), on project “Millennium Nucleus on Evolutionary Processes, Anthropization, and Climate Change Adaptation of Coastal Zones,” international collaborator as Senior Researcher on the proposed project (unfunded). (2017)

3. Carolina Martinez (Pontificia Universidad Católica de Chile) and Paula Villagra Islas (Universidad Austral de Chile), Chilean Commission of Technology and Science (CONICYT).

¹ This report covers 2017-2018 **and** 2018-2019 as I was remiss in not filing the 2017-2018 report of activities of the ICoE-Varm.

Funded project on vulnerability and resilience of the Chilean coast to tsunami hazards, International collaborator (2018-2020).

4. Paulina Paz Aldunce Ide and Carmen Paz Castro (Universidad de Chile), on project “Nucleus Millennium Transforma CSR: Transdiscipline and Transformation in the Social Construction of Disaster Risk,” international collaborator as Senior Researcher on the project (unfunded 2017).

5. Paula Villagra Islas, Universidad Austral de Chile, proposal to Fondecyt, “Community Resilience to Tsunami in Chile: Scenarios, Patterns and Governance,” International collaborator, (submitted June 2019).

6. Helen James, Australian National University, “Risk, Resilience and Reconstruction: Understanding Disaster Vulnerability,” proposal (in review) to the Australian Research Council, partner investigator (submitted January 2019)

7. Michael Ungar (Dalhousie University) and Katrina Brown (University of Exeter) (co-directors), “Multisystemic resilience: Adaptation and transformation in contexts of change and adversity,” proposal to the Canadian Institute for Advanced Research (CIFAR), co-applicant, (submitted 2018, not funded).

Collaborations with other ICoEs and Centers of Excellence

1. Participation with IRDR ICoE-CR in their Summer Institute at Massey University (2019)
2. Partnered with Cuizhen Wang (University of South Carolina) and Li Zhang (RADI, Chinese Academy of Sciences) in receiving the Digital Belt and Road (DBAR) International Center of Excellence (ICoE-Columbia) focused on big earth data for coastal resilience and disasters (2017).
3. Advisory Panel member, Institute for Integrated Research on Disaster Risk Science (estb. 29 August 2019), Australian National University, Canberra.

Consultations

1. Economic Research Institute for ASEAN and East Asia, ERIA, Disaster Risks Resilience Index: Indonesia’s 50 cities (project contributor) 2017-2019.
2. External Reviewer, RAND. HSOAC Draft Recovery Plan, *The Promise of Puerto Rico: An Island of Innovation in the Aftermath of the Storms*. (2018).

Professional Service

1. MunichRe Risk Award Review Committee 2017, 2018
2. Natural Hazards Research Platform review panel member, hosted by GNS Science, New Zealand 2017 Research proposal reviews for FONDECYT Science Council, Chile, and German Research Foundation (DFG- Deutsche Forschungsgemeinschaft)
3. Subject Matter Expert Reviewer, USEPA , Mapping the Vulnerability of Human Health to Extreme Heat in the United States, EPA/600/R-18/212F, August 2018. www.epa.gov/ord.
4. Review coordinator, National Academies of Sciences, Engineering, and Medicine, *The State of Resilience: A Leadership forum and Community Workshop: Proceedings of a Workshop Report* (2018). <https://www.nap.edu/catalog/25054/the-state-of-resilience-a-leadership-forum-and-community-workshop>
5. Appointed as Editorial Board Member, Boletín de la Asociación de Geógrafos Españoles (BAGE)

Visiting Scholars hosted at ICoe-VaRM

1. Carl Anderson, Master's Student, Institute for Environment and Security, UN University Bonn, Germany (January 2017).
2. Jimena Roncancio, PhD student, School of Public Health, University of São Paulo, Brazil (September-December 2018).
3. Solomon Walelign, Post-doctoral scholar, Department of Geography, Norwegian University of Science and Technology (NTNU), Trondheim, Norway (November-December 2019).

Publications (*based on visiting collaborations, student authors are in bold)

- *Villagra, Paula, 2019. Drivers of community resilience to natural hazards: The experience of Southern Chile, *Environment: Science and Policy for Sustainable Development* 61(4):4-17 (mentored the author through the publication process).
- Cutter, S.L. and **S. Derakhshan**, 2019. Implementing disaster policy: exploring scale and measurement schemes for disaster resilience, *J. Homeland Security and Emergency Management*, May 30, 2019 DOI: <https://doi.org/10.1515/jhsem-2018-0029>.
- ***Anderson, Carl C.**, Michael Hagenlocher, Fabrice G. Renaud, Zita Sebesvari, Christopher T. Emrich, and Susan L. Cutter, 2019. Comparing index-based vulnerability assessments in the Mississippi Delta: Implications of contrasting theories, indicators, and methodologies, *Intl. J. Disaster Risk Reduction*, 30 March 2019, <https://doi.org/10.1016/j.ijdrr.2019.101128>.
- Jiang, Yuqin**, Z. Li, and S.L. Cutter, 2019. Social network, activity space, sentiment, and evacuation: What can social media tell us?, *Annals of the American Association of Geographers*,. 31 May 2019, [doi:10.1080/24694452.2019.1592660](https://doi.org/10.1080/24694452.2019.1592660)
- Cutter, S.L. and **S. Derakhshan**, 2018. Temporal and spatial change in disaster resilience in US counties, 2010-2015. *Environmental Hazards* DOI: 10.1080/17477891.2018.1511405 (Aug 20, 2018).
- Cutter, S.L., 2018. Compound, cascading, or complex disasters: What's in a name? *Environment: Science and Policy for Sustainable Development* 60(6): 16-25.
- Cutter, S.L., 2018. Linkages between vulnerability and resilience, Chapter 12 in Sven Fuchs and Thomas Thaler (eds.), *Vulnerability and Resilience to Natural Hazards*, Cambridge University Press, 257-270.
- Cutter, S.L., 2018. Risk, in N. Castree, M. Hulme, and J. Proctor (eds.), *The Companion to Environmental Studies*, Routledge: London & New York, 86-89.
- Aerts, J.C.J.H, W.J. Wouter Botzen, K. C. Clarke, S.L. Cutter, J. Hall, B. Merz, E. Michel-Kerjan, J. Mysiak, S. Surminski, and H. Kunreuther, 2018. Perspective: Integrating human behavior dynamics into flood risk management, *Nature Climate Change* 8 (March): 193-199.
- Cutter, S. L., C. T. Emrich, M. Gall, and R. Reeves, 2017. Flash flood risk and the paradox of urban development, *Natural Hazards Review* 19 (1): 05017005 Doi:10.1061/(ASCE)NH.1527-6996.0000268 (Sept. 25, 2017).
- Martin**, Y., Z. Li, and S. L. Cutter, 2017. Leveraging Twitter to gauge evacuation compliance: Spatiotemporal analysis of Hurricane Matthew, *PLoS ONE* 12(7):e0181701. <https://doi.org/10.1371/journal.pone.0181701>.
- Cutter, S. L., 2017. The changing context of hazard extremes: Events, impacts, and consequences, *J. Extreme Events*, 3(2): doi:10.1142/S2345737616710056 (February 2, 2017).
- *Ismail-Zadeh, A. T., S. L. Cutter, K. Takeuchi, and D. Paton, 2017. Forging a paradigm shift in disaster science, *Natural Hazards* 86(2): 969-988.
- Cutter, S. L., 2017. The forgotten casualties redux: Women, children, and disaster risk, *Global Environmental Change* 42:117-121.

Cutter, S. L., 2017. The perilous nature of food supplies: Natural hazards, social vulnerability, and disaster resilience, *Environment: Science and Policy for Sustainable Development* 59(1): 4-15.

Presentations

- Cutter, S.L., 2017. Disasters: Rescue, Relief, and Recovery, Invited Keynote, Sustainability Teach-In: Disaster Relief in the Caribbean Islands, Clemson Global Engagement & Glenn Department of Civil Engineering, Clemson, SC, November 16, 2017. **Invited keynote**
- Cutter, S. L., 2017. Disaster Risk Research Needs and Opportunities on Seasonal-to-Sub-seasonal Timescales, Committee to Advise the U.S. Global Change Research Program, National Academies of Science, Engineering, and Medicine, Washington D.C., December 5, 2017. **Invited**
- Cutter, S.L., 2018. Understanding community resilience to natural hazards: Concepts, tools, practice, Workshop on disasters and its effect on infrastructure (Taller Desastres y su efecto en la infraestructura), Institute of Engineering, National Autonomous University of Mexico (UNAM), May 8-9, 2018, Mexico City, Mexico. **Invited**
- Cutter, S.L., 2018. Social vulnerability and community resilience to natural hazards: Models, tools, & practice, CDMS (Community Surface Dynamics Modeling System) 2018: Geoprocesses, Geohazards, May 22-24, 2018, Boulder, CO. **Invited**
- Cutter, S.L., 2018. Understanding community resilience to natural hazards: Concepts, tools, practice, CIFAR Workshop on Multisystemic Resilience, June 12-13, 2018, Toronto, Canada. **Invited**
- Cutter, S.L. 2018. Vulnerability and resilience science: concepts, tools, & practice, School of Public and Environmental Affairs, Indiana University, September 20-21, 2018, Bloomington, IN. **Invited**
- Cutter, S.L., 2018. Adapting social vulnerability to other cultural contexts. Seminario: Vulnerabilidad Social ante Eventos Naturales: Desafíos para Integrar Dependencia a la Red Vial, Pontificia Universidad Católica de Chile, Faculty of Engineering, October 8, 2018, Santiago, Chile. **Invited**
- Cutter, S.L. 2018. Measuring community resilience to coastal hazards, Seminario: Vulnerabilidades, Riesgos y Desastres en la Zona Costera 2018, and Evolution of the disaster resilience of place (DROP) model, Pontificia Universidad Católica de Chile, Faculty of History, Geography, and Political Science, October 9, 2018, Santiago, Chile. **Invited**
- Cutter, S.L., 2018. Mmidiendo las resiliencia de las comunidades a los peligros, Universidad Austral de Chile, October 12, 2018, Valdivia, Chile. **Invited**
- Cutter, S.L., 2018. Invited Panelist, Plenary 1: Sustainable Infrastructure: Building Resilience in the Face of Disasters, 18th National Conference and Global Forum on Science, Policy, and the Environment, January 23-25, 2018, Washington D.C. **(Invited)**
- Cutter, S.L., 2018. Invited Panelist/Presenter, Emergency management data sources for studying consequences of disasters for older adults, National Academies of Science, Engineering, and Medicine, Committee on Population (CPOP), June 27, 2018, Washington D.C. **(Invited)**
- Cutter, S.L., 2018. Invited Workshop Participant, Social vulnerability in affluent societies, Center for Security Studies at ETH Zürich and University of Wollongong, Australia, August 22-24, 2018, Zürich, Switzerland. **(Invited)**
- Cutter, S.L., 2018. Invited Panelist, Community resilience in the Gulf Region: Social science inputs, Gulf Research Program bi-annual meeting, September 25, 2018, Washington D.C. **(Invited)**
- Cutter, S.L., 2018. Invited Panelist, Panel 1: Science in Disaster Risk Appraisal and Management, AGU-IUGG Centennial Symposium on Disaster Science: Risk Reduction, Resilience, Response, Recovery, December 9, 2018, Washington D.C. **(Invited)**
- Cutter, S.L., 2019. Disaster vulnerability and resilience science: From theory to practice, Emergency Management Summer Institute, Massy University, Wellington, New Zealand, March 15, 2019.

- Cutter, S.L., 2019. Compounding, cascading or complex disasters: Are these the new normal? Massey University, Wellington, New Zealand, March 13, 2019.
- Cutter, S.L., 2019. Disaster resilience: From theory to models to practice, Modeling Risk and Resilience in Human and Natural Systems Workshop, University of Bern, Bern Switzerland (remote delivery), May 6, 2019.
- Roncancio, D.J., L. Lecha, S.L. Cutter, and A.C. Nardocci, 2019. Evaluation of climate variability in Colombia: Opportunities for the outlining of climate change and human health adaptive strategies, Air Pollution Conference Brazil (extended abstract), July 23-26, 2019, Belo Horizonte, Minas Gerais, Brazil.
- Cutter, S.L. 2019. Social construction of risks and hazards, FEMA National Emergency Training Center, Executive Academy, Emmitsburg, Maryland, August 19, 2019.

Other Activities

Sponsored Lectures

William Solecki, Founding Director of the CUNT Institute for Sustainable Cities, “The transformative capacity of cities,” University of South Carolina, April 12, 2019.

Adam Higginbotham, Author, “Midnight in Chernobyl: A Presentation and Book Reading,” University of South Carolina, April 26, 2019.

Awards Received

Institute for Integrated Research on Disaster Risk Science (estb. 29 August 2019), Australian National University, Canberra, named their lecture series: Distinguished Carolina Professor Susan L. Cutter Seminar Series.

Honorary appointment for Susan L. Cutter: University Professorial Fellow, Charles Darwin University (College of Health and Human Sciences) June 1 2019-May 31 2022.

S.L. Cutter was the Recipient of the American Association of Geographers Presidential Achievement Award (2018), Wilbanks Award for Transformational Research (2019), and AAG Fellow (2019).

Future Plan with IRDR

The IRDR ICoE-VaRM has achieved great success in fostering the development of evidence-based metrics for vulnerability and resilience assessment from local to global scales. In addition to the advancement of integrated science, training and mentoring of the next generation of disaster scholars is one lasting achievement of the ICoE-VaRM. The mentoring covers five continents with significant ongoing collaborations in Norway, Australia, and Chile. The terms of reference for ICoE-VaRM expire June 30, 2020 and we would very much like to continue our work in achieving IRDR goals as a designated ICoE. This will require a new term of reference document from IRDR that I can present to our administration to leverage funding for ICoE-VaRM activities. We also plan to extend our capacities by having two additional centers join our network: National Center for Integrated Coastal Research at the University of Central Florida (Dr. Christopher Emrich) and the Center for Emergency Management and Homeland

Security at Arizona State University (Dr. Melanie Gall). Both Drs. Gall and Emrich were staff members and South Carolina's Hazards & Vulnerability Research Institute and integral in the initial development of ICoE-VaRM and supported the DATA and AIRDR projects. Dr. Gall now maintains the SHELDUS database and remains active in all DATA project concerns. Dr. Emrich has automated and advanced the development of the Social Vulnerability Index (SoVI). The formal addition of these two scholars and the centers they represent into the ICoE-VaRM network will extend and diversity our reach and impact nationally and globally.