SCIENCE & DIPLOMACY

A quarterly publication from the AAAS Center for Science Diplomacy

Yekaterina Y. Kontar et al.,"Disaster-related Science Diplomacy: Advancing Global Resilience through International Scientific Collaborations," *Science & Diplomacy*, Vol. 7, No. 2 (June 2018). http://www.sciencediplomacy.org/article/2018/disaster-related-science-diplomacy-advancing-global-resilience-through-international.

Disaster-related Science Diplomacy: Advancing Global Resilience through International Scientific Collaborations

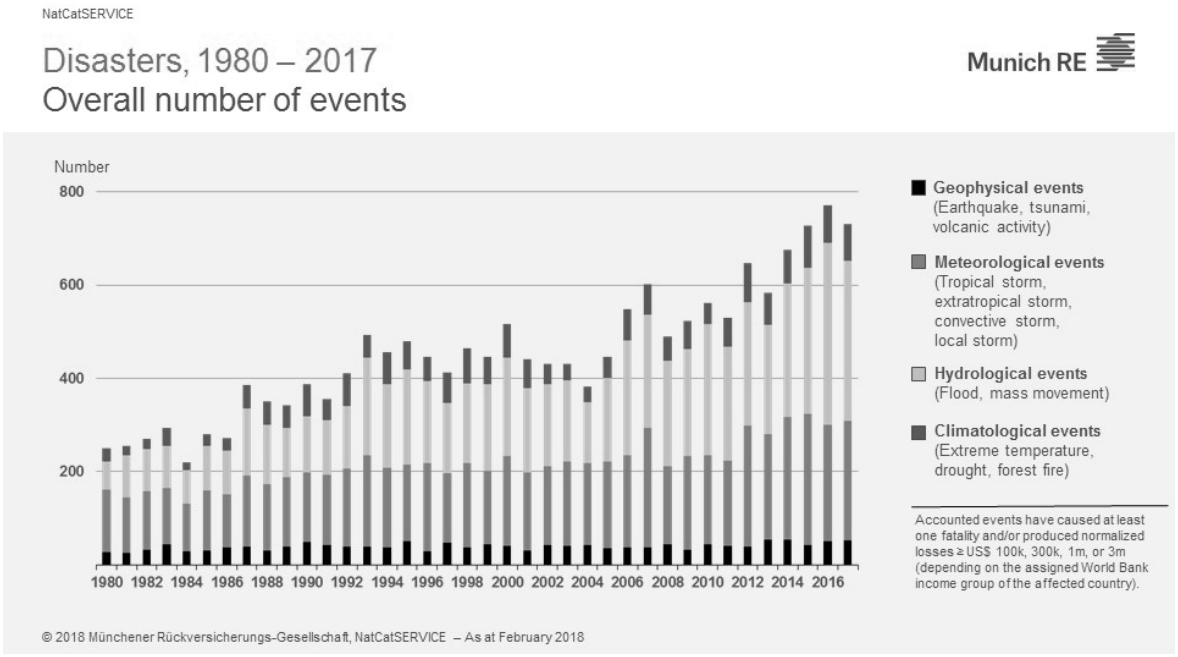
Yekaterina Y. Kontar[1,2]

Tom Beer,[3,4] *Paul A. Berkman,*[1] *John C. Eichelberger,*[5] *Alik Ismail-Zadeh,*[4,6,7] *Ilan Kelman,*[8,9] *John L. LaBrecque,*[2,10] *A. Ester Sztein,*[11] *and Yulia Zaika*[12]

Disasters do not respect geopolitical borders. And disasters are on the rise. Due to a failure to address causal factors that perpetuate vulnerability to disasters, such as poor design and construction of buildings, inadequate land-use planning and environmental management, poverty, and marginalization, the number of disasters and associated losses has been steadily increasing in the last three decades (Figures 1, 2).[1,2,3] In 2017, total global losses from disasters exceeded USD 330 billion and claimed more than 13,000 lives in 121 countries.[4] Yet the boundary-spanning nature of disasters also offers a unique opportunity for transnational cooperation.

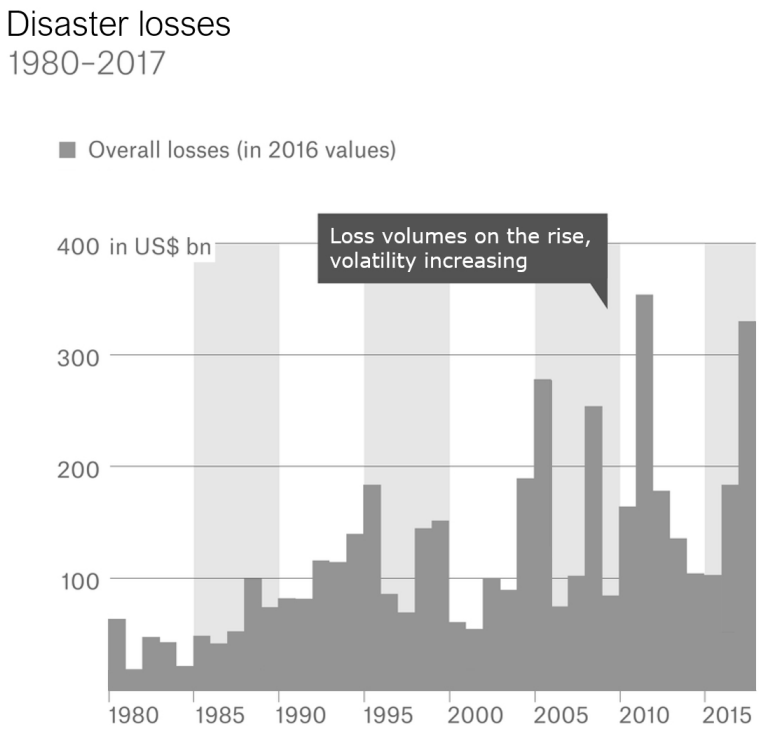
Author affiliations may be found at the end of the article

Figure 1



Worldwide disasters 1980-2017. *The number of reported disasters involving climate, water, and weather has more than doubled in the last three decades. Source: 2018 Münchener Rückversicherungs-Gesellschaft, NatCatSERVICE.*

Figure 2

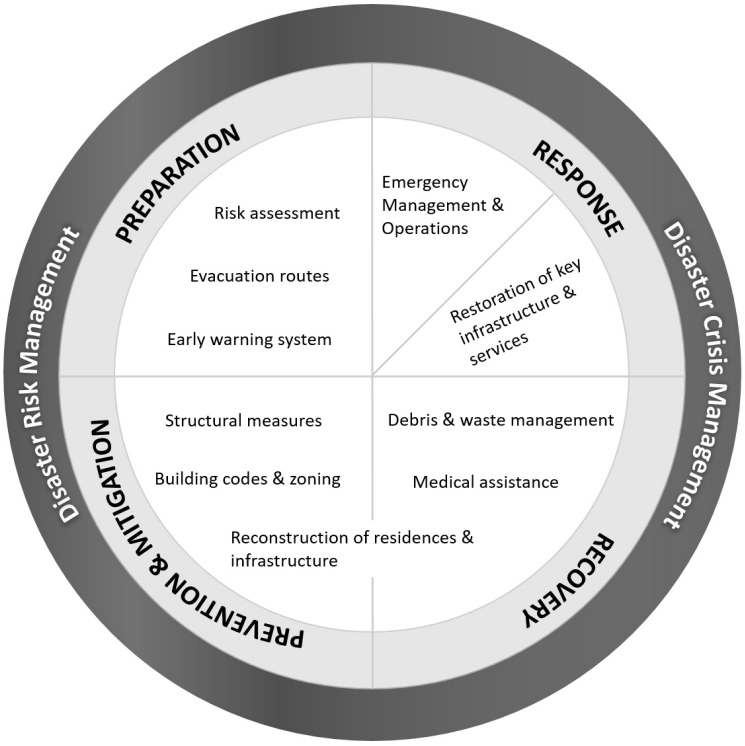


Losses caused by disaster events worldwide 1980-2017. *Overall reported losses in 2017 are the second largest in this time period. Source: 2018 Münchener Rückversicherungs-Gesellschaft, NatCatSERVICE.*

The primary goal of this article is to introduce disaster-related science diplomacy (hereafter "disaster diplomacy")—an emerging and powerful theme within science diplomacy—as an approach to enhance disaster resilience while simultaneously reducing conflicts and fostering cooperation between states where relations might otherwise be strained.[5,6,7] Effective disaster diplomacy combines official conflict-resolution efforts led by governments with peer-to-peer exchanges between scientists and nonacademic disaster experts, such as practitioners and local knowledge holders.[8]

Disaster diplomacy can take many forms, given that it can originate on international, intranational, and local levels, as well as before, during, and after disasters. Thus, disaster diplomacy encompasses all disaster-related activities, including prevention, mitigation, preparedness, response, and recovery (Figure 3).

Figure 3



Disaster-related activities. *In practice, disaster management phases (prevention/mitigation, preparedness, response, and recovery) are not discrete units, but mutually inclusive; and many activities overlap from one phase to another. The concept of resilience is woven throughout each phase of the cycle. Modified from Kontar et al., 2018 [18].*

Case Studies from the Disaster-related Activity Framework

As mentioned above, disaster-related diplomacy can originate during any disaster-related phase— prevention, mitigation, preparedness, response, and recovery—or their intersections (Figure 3). History provides strong examples of disasters opening windows of opportunity to enhance peace among adversarial states with a shared risk while simultaneously enhancing disaster resilience before, during, and after a disaster takes place. The examples that follow are not exhaustive, but rather exemplary, and are based on the authors' research and experience.

To date, the majority of published disaster diplomacy case studies are based on disaster-relevant collaborations during r**esponse and recovery**.[5,9] Adverse impacts from disasters often inspire ample humanitarian assistance even from states in opposition, sometimes reinforcing and setting the scene for future diplomatic efforts. For instance, the decades-long tension between Greece and Turkey was eased after large earthquakes struck the two countries in 1999.[5] Generous assistance provided by the citizens and governments of both countries to each other in the immediate aftermath of the earthquakes supported rapprochement, continuing an already established route to long-lasting conflict resolution.

In most cases, disaster-related collaborations bring states with complex diplomatic situations together only for short periods of time (weeks to months). As memories of collaboration quickly fade, preexisting prejudices and disputes resurface. Disaster and foreign relations scholars argue over whether or not disasters provide a unique opportunity for establishing and fostering collaborations and peace between states with shared risks. Whatever the reality, guidelines are needed on how best to achieve the desired changes in foreign relations.[5,6,10]

During disaster **prevention and mitigation**, the key objective is to assess and minimize or, ideally, eliminate disaster risk. This includes evaluating vulnerability and hazard drivers and their potential impacts, vulnerability and hazard monitoring, community outreach and education, and disaster-resilient infrastructure development. In spite of nearly six decades of severed diplomatic relations, the United States and Cuba—two states prone to experiencing severe hurricanes and other weather-related hazards—have continued to collaborate on storm prediction, forecasting, and modeling with the common goal of improving regional preparedness. Peer-to-peer interactions take place at the intergovernmental level, e.g., the U.S. National Hurricane Center and the Meteorological Institute of Cuba, as well as between scientific groups and individual scientists.[11] Restrictions on Cuban visitors to the United States and U.S. visitors to Cuba significantly hinder scientific cooperation, sometimes limiting U.S. and Cuban scientists to

in-person interactions at conferences in other countries or to joint international projects. Moreover, hurricane-relevant cooperation between the United States and Cuba does not often go beyond hazard modeling, projection, and forecasting, leaving a lacuna regarding vulnerability-related cooperation. The U.S. and Cuban governments have consistently refused disaster assistance from each other, even in the aftermath of Hurricane Katrina—one of the costliest disasters in U.S. history.

Disaster **preparation** incorporates activities that enhance communities' abilities to withstand disaster (e.g., contingency plans, emergency exercises and training, and early warning systems).[12] It provides opportunities for disaster diplomacy in the form of academic exchanges and joint tabletop exercises. For example, Norway and Russia have been conducting annual collaborative search-and-rescue and oil spill preparedness exercises in the Barents Sea since 1995.[13] These efforts are crucial in ensuring timely and efficient assistance to cruise ships and scientific vessels running into problems in Arctic waters, where vast distances, extremely low temperatures, and ice significantly complicate response operations. These efforts have also strengthened regional diplomacy between the Norwegian and Russian coastal communities in the Barents region as well as their respective coast guards and navies.

The examples above demonstrate that opportunities for diplomacy arise during all types of disaster-related activities. However, these opportunities have rarely expanded into official diplomatic efforts with potential long-term impacts on relations between adversarial states. Further analyses of disaster diplomacy case studies are needed to determine the specific elements that make such diplomacy effective. In turn, disaster diplomacy theory should be formalized, and a disaster diplomacy assessment model should be developed - both of which are currently quite rare in the literature.

Challenges for Disaster-related Diplomacy

Case studies reveal how political considerations, including inertia and historical grievances, can form substantial barriers to successful disaster diplomacy, regardless of any humanitarian imperatives.[5,6,14,15] The U.S.-Cuba example outlined above demonstrates national politics interfering with disaster diplomacy efforts by restricting travel and communication necessary for effective collaboration between scientists and other disaster experts. When reconciliation is not a political priority, the merits of disaster diplomacy, including lifesaving and loss-reduction activities, are frequently ignored. Examples of political incentives to disregard, bypass, or scuttle disaster diplomacy opportunities are many. They include leadership change, long-existing prejudices and distrust, and the belief that historical conflicts supersede present-day humanitarian demands or long-term advances in disaster

impact and risk reduction.16 Confrontation between states can also arise from the need to compete for limited resources, which are often tied to geographical boundaries.

Some disaster diplomacy proponents argue that international disaster-related cooperation should first be established on the micro (local) level before any successful long-term cooperation can take place on the macro (national/state) level.[6,15] A series of bilateral and multilateral peer-to-peer collaborations among local actors on subjects of mutual concern (e.g., disaster risk reduction and management, including climate change adaptation) have proven effective at exchanging best practices while simultaneously fostering greater contacts among the communities.[17,18] In most cases, the effectiveness of peer-to-peer collaborations still largely depends on a country's foreign policies, such as travel or visa restrictions and the ability to freely meet in third-party countries. Thus, to be effective, disaster diplomacy should encompass official conflict-resolution efforts led by governments with peer-to-peer exchanges between disaster experts.

From the academic viewpoint, the main challenges arise from the fact that disaster diplomacy is still an evolving field of research. The most prominent contributions, connecting extended theory with specific, detailed case studies, only date to the early 2000s.[9] These case studies are available at http://www.disasterdiplomacy.org. At this point, the concept still lacks a formal definition, and thus has been formulated and presented inconsistently throughout the academic literature.[19] Since no generally accepted theory of disaster diplomacy has yet been formulated, there are no formal principles and metrics of success, or assessment tools and models to effectively evaluate disaster diplomacy efforts with respect to disaster resilience and international relations.[15] Joint and interdisciplinary academic efforts that aim to generate consensus regarding the core conceptual definition, as well as developing disaster diplomacy theory and testing it empirically with new forms of case studies, are necessary to further advance the field.

Another challenge to effective disaster diplomacy is lack of reciprocity when scientists in less powerful partner countries find themselves placed in the role of field assistants or technicians rather than peers and, in extreme cases, do not even share in authorship of professional publications resulting from those scientific endeavors.[20] Lack of reciprocity frequently originates from an economic imbalance between states. Scientists in the more prosperous country may be enthusiastic about examining a problem in their counterpart country, whose scientists have no means of their own to reciprocate. The dominance of English as the international scientific language also frequently leads to Anglophone countries or researchers dictating the discourse and sidelining other perspectives and inputs.[21] These

situations diminish the scientific and diplomatic value of the exchange and can easily lead to tensions.

The Role of Intergovernmental and International Scientific Organizations in Disaster-related Diplomacy

Over the last three decades, increases in the frequency and severity of reported disasters (Figures 1, 2) have encouraged long-term international and multi-stakeholder collaborations between scientific and intergovernmental organizations with the following primary goals:

- to identify and assess global disaster risk drivers;
- to evaluate existing (and, when appropriate, introduce new) practices in disaster risk reduction and crisis management;
- to identify and eliminate gaps in disaster research implementation; and
- to establish and foster communication channels between disaster scientists, nonacademic disaster experts, and policy makers.

Disasters cannot be addressed by any one country or academic discipline.[22] Thus, international collaborations among scientists, nonacademic disaster experts (e.g., disaster management practitioners and local knowledge holders), and policy makers are necessary for identifying best practices.[23] A series of intergovernmental organizations around the world—e.g., the Arctic Council, the African Union, the Andean Community of Nations (CAN),the Association of Southeast Asian Nations (ASEAN), the Caribbean Community (CARICOM), the European Commission, the League of Arab States, the South Asian Association for Regional Cooperation (SAARC), the Pacific Islands Forum (PIF), the Pacific Community (SPC), the Southern African Development Community (SADC), and the United Nations—have adopted disaster-related programs that support international and interdisciplinary collaborations. United by the common goal of protecting lives and reducing or, ideally, preventing economic damage, the intergovernmental organizations listed above encourage and facilitate international and interdisciplinary expert collaborations across all disaster-related activities, especially endeavoring to connect them rather than to create isolated topical silos.

These collaborations have manifested themselves in a series of high-level international conferences (e.g., the UN World Conference on Disaster Risk Reduction in Sendai, Japan, 2015, and the Global Platform for Disaster Risk Reduction in Cancun, Mexico, 2017), interdisciplinary frameworks (e.g., the Sendai Framework for Disaster Risk Reduction 2015–2030), binding agreements (e.g., the 2017 Agreement on Enhancing International Arctic Scientific Cooperation, the 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in

the Arctic, and the 2011 Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic), institutional developments that support graduate degrees (e.g., the UN University Institute for Environment and Human Security and the Institute for Risk and Disaster Reduction at University College London), and research programs (e.g., Integrated Research on Disaster Risk (IRDR), UNESCO Geohazard Risk Reduction Program, UNESCO Tsunami Program, and UNESCO Water-related Disasters Program).

These efforts have resulted in a series of guidelines and targets for disaster risk reduction as well as critiques of the effectiveness of this work.[24,25,26] Despite the significant progress in disaster preparedness, response, and early warning made in the last decade, the concomitant progress in managing the underlying risks of disasters is still limited. To further reduce global disaster risks, disaster experts have called for the establishment of an intergovernmental group on disaster risk assessment.[2,27] Through this endeavor, disaster risk reduction experts from around the world will collectively assess peer-reviewed literature on disaster risks and management, and consequently assemble assessment reports for policy makers on all aspects of disaster risks, potential disaster impacts, and response strategies.

To reduce the adverse impacts of disasters or, ideally, prevent disasters from occurring, it is crucial to first understand their underlying drivers. Disasters result from complex interactions among a series of natural and human-influenced processes that generate conditions of hazard (e.g., earthquakes, floods, and landslides) and human actions that make populations more vulnerable to these hazards (e.g., inadequate or lack of building codes and land use management, discrimination by social status, gender, and age). Today, the scientific community largely agrees that there is no such thing as a natural disaster. The leading cause of the adverse impacts of disasters is a population's vulnerability resulting from human choices about fundamental development variables, such as equity, resource distribution, power relations, human rights, and justice.[3,28,29]

To be comprehensive, disaster risk analyses must be interdisciplinary in scope and address various aspects of the physical, political, and socioeconomic drivers of disasters.[29] Due to the lack of cross-disciplinary understanding and continuous competition for funds, the scientific community has been too fragmented to address disaster risks in a holistic manner.[2,23] Moreover, this fragmentation reduces the possibilities for addressing disaster risks based on their real, fundamental causes.[3,28,29]

Case Study: Natural Hazards and the IUGG

International nongovernmental scientific organizations bridge research gaps and encourage interdisciplinary scientific collaborations by facilitating interaction among scientists across disciplines and national boundaries.[30] For example, the International Union of Geodesy and Geophysics (IUGG) has facilitated international cooperation among nations in earth and space sciences for nearly a hundred years, addressing potentially extreme geophysical processes. In 2000, IUGG created the Union Commission on Geophysical Risk and Sustainability (GRC) specifically to study the likelihood of hazards, their impacts, their consequences as a result of the vulnerability of societies, and recommended measures for adaptation and mitigation.

A few months before the 2004 Indian Ocean earthquake and tsunami disaster, IUGG's GRC had released the first catalog of tsunamis in the Indian Ocean for the public. The commission had likewise prepared a statement that was sent to the UN Secretariat of the International Strategy for Disaster Reduction (ISDR) and presented at the UN World Conference on Disaster Reduction in Kobe, Japan (January 2005). This statement was revised and adopted as IUGG Resolution 8, "Reduction of Risk from Natural Hazards," at the General Assembly in Perugia, Italy, in 2007.[31] Several IUGG associations responded to the statement by convening workshops and symposia to analyze the relevant geophysical processes, and produce recommendations for observation, analysis, and warning systems. The impact of the resolution was significant. The International Council for Science (ICSU), urged by several IUGG experts, established in 2008 the Scientific Program on Integrated Research on Disaster Risk (IRDR), an ad hoc committee on disaster research, which was cosponsored by the International Social Science Council (ISSC) and the UN Office for Disaster Risk Reduction (UNISDR).

In addition to advancing scientific knowledge, IUGG has helped establish global collaborations that have yielded significant benefits for humanity. For example, IUGG was one of the main organizers and promoters of the International Geophysical Year (IGY) (1957–1958), which was cosponsored by the ICSU and the World Meteorological Organization (WMO). The IGY provided a unique opportunity for dialogue and scientific collaborations between Soviet and Western scientists during the Cold War and led to the establishment of the Antarctic Treaty.[22]

Case Study: Volcano Crises under the VDAP

Another example of international scientific collaboration aimed at enhancing disaster resilience while simultaneously increasing cooperation between states is the Volcano Disaster Assistance Program (VDAP)—a U.S. Geological Survey (USGS) disaster assistance program cofunded by the USGS and the U.S. Agency for International Development's Office of Foreign Disaster Assistance. This program was established in 1986 to respond to volcanic crises at short notice anywhere in the world, and has to date worked on more than seventy volcanic crises at over fifty volcanoes around the world.32 VDAP, based at the USGS Cascades Volcano Observatory in Vancouver, Washington, does its work at the request of the government of the host country.

From its origins as a response team during a crisis, VDAP has evolved into a multifaceted program. VDAP helps its counterparts abroad to monitor volcanic activity, assess hazards, produce eruption forecasts, and generate early warning capabilities, which will help prevent the hazard from becoming a disaster. Beyond the core volcano response activities, VDAP provides training through activities and workshops abroad and through offering international scientists extensive courses and specialized workshops in the United States, in addition to contributing to infrastructure development, education, monitoring, and crisis response in-country. USGS scientists thereafter help local scientists publish their findings. With this assistance, host countries can build their own volcano monitoring networks, assess hazards, educate the population, and prepare for future crises. These activities help not only international colleagues but also U.S. scientists, who can establish mutually beneficial collaborations and learn from the phenomena observed abroad. VDAP's ultimate goal is to empower local scientists to take the lead in mitigating hazards in their own countries.

Among the most notable successes of this program was the response to the 2008 eruption of Chaitén in Chile. This previously unmonitored volcano released a seventeen-kilometer-high ash column that lasted six hours and continued emitting ash for several more days. The Chilean government evacuated about five thousand people from the town of Chaitén before 80 percent of it was damaged by remobilization of sediment caused by intense rainfall. The Chilean National Survey of Geology and Mining (Servicio Nacional de Geología y Minería, SERNAGEOMIN) asked for VDAP help to install a real-time seismic monitoring network and for advice on volcanic ash hazards to civilian and military aviation during Chaitén's ash emission activity.[34] VDAP also provided funding for an international initiative to foster better understanding of the history of the volcano and the environmental effects of its activity, and advised the government on a national strategy to reduce risk from volcanic eruptions. Because of the collaboration with VDAP scientists, the

Chilean government completed a hazard assessment for Chaitén and developed a national plan to address volcanic hazards in general.

Conclusion

Disasters, as this paper has shown, are complex phenomena that transcend scientific and political borders. International, interdisciplinary, and multi-stakeholder collaborations are therefore vital in advancing our understanding of the underlying drivers and impacts of disasters. Disaster-related diplomacy provides opportunities to advance our scientific knowledge of disasters while simultaneously building bridges between states where relationships could otherwise be strained.

Examples of disaster diplomacy on international, intranational, and local levels are plentiful throughout human history. As an academic field, however, disaster diplomacy emerged less than two decades ago. To date, disaster diplomacy has been referenced sporadically throughout the academic literature in the fields of hazards and disasters as well as policy and diplomacy. No universally recognized definition has yet been coined, though. Moreover, scholars and practitioners in different fields interpret disaster diplomacy and its concepts in distinct ways. These ambiguities should be finessed for disaster diplomacy to further mature as an academic field as well as better merge with formal diplomatic efforts.

To begin this process, we are proposing here a two-step process toward refining the understanding of disaster diplomacy and moving the field ahead. First, a diverse group of experts should be assembled to develop the conceptual framework for disaster diplomacy. This framework should provide a unified terminology, a set of guiding principles for the emerging field, and standardized metrics of success for the evaluation of projects and case studies. These metrics should evolve from retrospective analyses of disaster diplomacy efforts to the identification of best practices in disaster diplomacy to lessons learned.

Second, the expert group should develop training guidelines to establish a formalized study of successful diplomatic improvements that have arisen from disasters, aimed at scientists and diplomats interested in entering the disaster diplomacy field. Since scientists rarely have diplomatic training and diplomats often lack the necessary scientific expertise, the suggested training program should include diplomacy and disaster science fundamentals. No disaster is the same; disaster drivers and impacts vary based on vulnerabilities and hazards. Consequently, the training program should be inclusive and flexible in order for the disaster diplomacy practitioners to efficiently gain access to the necessary information.

The disaster diplomacy concept could provide opportunities to enhance disaster resilience, while simultaneously establishing and facilitating communication between opposing states and promoting peace. In most cases, disaster-related collaborations bring states with complex diplomatic situations together only for short periods. Thus, the full potential of disaster diplomacy has not yet been realized. International collaborations between disaster and diplomacy experts are necessary in further refining disaster diplomacy theory and practice. Unfortunately, politics (e.g., travel and visa regulations, sanctions, embargoes, and data presumed to be proprietary) often complicate such collaborations between states with strained relations despite their common disaster risks. Case studies have nonetheless revealed that governments tend to put their differences aside in the short term once disasters strike, allowing for disaster-related cooperation.

We encourage scientists and nonacademic disaster experts not to wait until disaster strikes to establish or foster collaboration with their international peers, but instead to seek out opportunities to facilitate such collaborations beforehand. We strongly urge university students and early career scientists to get involved in disaster-related diplomacy. The field can appear dire from the outside, but the challenges are deeply engaging and the rewards profound. International scientific unions (e.g., IUGG) and intergovernmental organizations (e.g., Arctic Council and UNISDR) are inclusive and provide their members with many opportunities to engage in fruitful peer-to-peer collaborations. When in-person meetings are impossible due to financial, logistical, or political constraints, online communication methods could keep those collaborations viable and productive.
SD

Acknowledgments

We would like to thank the two anonymous reviewers and the *Science & Diplomacy* editors for their thorough feedback and constructive advice.

Disclaimer

Opinions expressed here are those of the authors and do not necessarily represent the positions of their organizations, institutions, or agencies.

Author affiliations (from Page 1)

Corresponding author: Yekaterina Y. Kontar[1,2]

Authors (in alphabetical order after the corresponding author) Tom Beer,[3,4] Paul A. Berkman,[1] John C. Eichelberger,[5] Alik Ismail-Zadeh,[4,6,7] Ilan Kelman,[8,9] John L. LaBrecque,[2,10] A. Ester Sztein,[11] and Yulia Zaika[12]

1. Fletcher School of Law and Diplomacy, Tufts University, USA.

2. The Commission on Geophysical Risk and Sustainability (GeoRisk Commission), International Union of Geodesy and Geophysics, Germany.

3. Safe System Solutions Pty Ltd, Australia.

4. Secretariat, International Union of Geodesy and Geophysics, Germany.

5. International Arctic Research Center, University of Alaska Fairbanks, USA.

6. Institute of Applied Geosciences, Karlsruhe Institute of Technology, Germany.

7. Institute of Earthquake Prediction Theory and Mathematical Geophysics, Russian Academy of Sciences, Russia.

8. Institute for Risk & Disaster Reduction and Institute for Global Health, London, University College London, UK.

9. University of Agder, Norway.

10. Center for Space Research, University of Texas Austin, USA.

11. Board on International Scientific Organizations, the National Academies of Sciences, Engineering, and Medicine, USA

12. Department of Geography, Lomonosov Moscow State University, Russia.

Endnotes

1. "Natural Catastrophe Review: Series of Hurricanes Makes 2017 Year of Highest Insured Losses Ever," Munich Re. January 4, 2018. Accessed March 30, 2018. https://www.munichre.com/en/media-relations/publications/press-releases/2018/2018-01-04-press-release/index.html.
2. Susan L. Cutter, Alik Ismail-Zadeh, Irasema Alcantara-Ayala, Orhan Altan, Daniel N. Baker, Salvano Briceno, Harsh Gupta et al. "Global Risks: Pool Knowledge to Stem Losses from Disasters," *Nature* 522, no. 7556 (2015). doi: 10.1038/522277a.
3. Ben Wisner, Piers Blaikie, Terry Cannon, and Ian Davis. *At Risk: Natural Hazards, People's Vulnerability and Disasters*, 2nd ed. Routledge, 2004.
4. "The International Disaster Database," Emdat_db. Accessed March 30, 2018. http://emdat.be/emdat_db/.
5. Ilan Kelman, *Disaster Diplomacy: How Disasters Affect Peace and Conflict*. Routledge, 2012.
6. Louise K. Comfort, "Disaster: agent of diplomacy or change in international affairs?" *Cambridge Review of International Affairs* 14, no. 1 (2000): 277-294. https://doi.org/10.1080/09557570008400342.
7. Ben Koppelman, Natalie Day, Neil Davison, Tracey Elliott, and James Wilsdon, "New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power," (2010). https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2010/4294969468.pdf.
8. Louise Diamond and John W. McDonald, *Multi-track Diplomacy: A Systems Approach to Peace*. West Hartford: Kumarian Press, 1996.
9. "Disaster Diplomacy Investigates How and Why Disaster-related Activities do and do not Influence Conflict and Cooperation," Disaster Diplomacy. Accessed April 10, 2018. http://www.disasterdiplomacy.org.
10. Michael Renner and Zoë Chafe, *Beyond Disasters: Creating Opportunities for Peace*. Worldwatch Institute, 2007.
11. Glantz, Michael Howard, "Climate-related Disaster Diplomacy: A US-Cuban Case Study," *Cambridge Review of International Affairs* 14, no. 1 (2000): 233-253. https://doi.org/10.1080/09557570008400340.
12. Alik Ismail-Zadeh and Kuniyoshi Takeuchi, "Preventive disaster management of extreme natural events," *Natural Hazards* 42, no. 3 (2007): 459-467.
13. Are Kristoffer Sydnes and Maria Sydnes, "Norwegian–Russian Cooperation on Oil-Spill Response in the Barents Sea," *Marine Policy* 39 (2013): 257-264.
14. Philip A. Streich, and David Bell Mislan. "What Follows the Storm? Research on the Effect of Disasters on Conflict and Cooperation," *Global Change, Peace & Security* 26, no. 1 (2014): 55-70.
15. Eric Werker, "Disaster Politics." *Harvard International Review*, August 23, 2010. http://hir.harvard.edu/article/?a=2696.
16. Ilan Kelman, "The Many Failures of Disaster Diplomacy." *Natural Hazards* Observer 37, no. 1 (2012): 12-15. https://hazards.colorado.edu/uploads/observer/2012/sep12_observerweb.pdf.
17. Hartmut Fünfgeld,, "Facilitating Local Climate Change Adaptation through Transnational Municipal Networks," *Current Opinion in Environmental Sustainability* 12 (2015): 67-73.
18. Yekaterina Y. Kontar, John C. Eichelberger, Tuyara N. Gavrilyeva, Viktoria V. Filippova, Antonina N. Savvinova, Nikita I. Tananaev, and Sarah F. Trainor, "Springtime Flood Risk Reduction in Rural Arctic: A Comparative Study of Interior Alaska, United States and Central Yakutia, Russia," *Geosciences* 8, no. 3 (2018): 90.
19. Eugene S. Yim, David W. Callaway, Saleh Fares, and Gregory R. Ciottone, "Disaster Diplomacy: Current Controversies and Future Prospects," *Prehospital and Disaster Medicine* 24, no. 4 (2009): 291-293.
20. Uskali Mäki, "Scientific Imperialism: Difficulties in Definition, Identification, and Assessment," *International Studies in the Philosophy of Science* 27, no. 3 (2013): 325-339. https://doi.org/10.1080/02698595.2013.825496.
21. Jeremy WR Whitehand, "The Problem of Anglophone Squint," *Area* 37, no. 2 (2005): 228-230.
22. A. Ester Sztein,, "Science diplomacy in the geosciences," In *Communicating Climate-Change and Natural Hazard Risk and Cultivating Resilience*, pp. 279-294. Springer, Cham, 2016. https://doi.org/10.1007/978-3-319-20161-0_18.
23. Alik T. Ismail-Zadeh, Susan L. Cutter, Kunioshi Takeuchi, and Douglas Paton, "Forging a paradigm shift in disaster science." *Natural Hazards* 86, no. 2 (2017): 969-988.
24. "Sendai Framework for Disaster Risk Reduction 2015-2030," United Nations Office for Disaster Risk Reduction (UNISDR), Geneva, Switzerland. Accessed April 14, 2018. https://www.unisdr.org/we/inform/publications/43291.
25. Laura M. Stough and Donghyun Kang, "The Sendai Framework for Disaster Risk Reduction and Persons with Disabilities," *International Journal of Disaster Risk Science* 6, no. 2 (2015): 140-149
26. Arielle Tozier de la Poterie and Marie-Ange Baudoin, "From Yokohama to Sendai: Approaches to Participation in International Disaster Risk Reduction Frameworks," *International Journal of Disaster Risk Science* 6, no. 2 (2015): 128-139.
27. James Lewis, "International Hazards Panel," *Disasters* 15, no. 3 (1991): 296.
28. Kenneth Hewitt, "Interpretation of Calamity: From the Viewpoint of Human Ecology," Allen & Unwin, 1983.
29. James Lewis, *Development in Disaster-prone Places: Studies of Vulnerability*, ITDG Publishing, 1999.
30. Alik Ismail-Zadeh, "Geoscience International: the Role of Scientific Unions," *History of Geo-and Space Sciences* 7, no. 2 (2016): 103-123. https://doi.org/10.5194/hgss-7-103-2016.

31. "Resolutions adopted by the council at the IUGG General Assembly, Perugia, Italy, July 2-13, 2007," International Union of Geodesy and Geophysics. Accessed April 10, 2018. http://www.iugg.org/resolutions/perugia07.pdf.
32. "VDAP Brings Nations Together in Volcanic Crisis Management and Response," USGS-Volcano Disaster Assistance Program. Accessed April 15, 2018. https://volcanoes.usgs.gov/vdap/about.html.
33. "Pinatubo, 1991," USGS-Volcano Disaster Assistance Program. Accessed June 26, 2018. https://volcanoes.usgs.gov/vdap/pinatubo.html.
34. "Chaitén Eruption Impacts and VDAP's Response Inspired Hazards Planning," USGS-Volcano Disaster Assistance Program. Accessed June 26, 2018. https://volcanoes.usgs.gov/vdap/chaiten.html.