DPRI Award 2022

for Outstanding Contributions
in Research and Education

研究教育貢献賞

Dr.James D.Goltz

Researcher in Residence of University of Colorado Boulder

選考経緯・業績紹介・講演資料

Dec. 1, 2022

Disaster Prevention Research Institute
Kyoto University, Uji, Kyoto, Japan
京都大学　防災研究所

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James D. Goltz 先生へのお祝いの言葉

京都大学防災研究所　教授
矢守克也

Goltz 先生、このたびは DPRI AWARD のご受賞おめでとうございます。心よりお祝いを申し上げます。こうしたお祝いの機会をもてましたことを、これまで、防災研究所において何度か先生のホスト役をつとめてきた者として大変うれしく思っています。

振り返ってみますと、先生と防災研究所との関係は、直接的には、先生に「最初に」外国人客員教授として赴任いただいた 2015 年 10 月にさかのぼります。最初に、というのは、二度目があったからで、15 年 10 月から 16 年 9 月までの最初の滞在に引き続き、17 年 11 月から 18 年 9 月にも、同じく外国人客員教授としてお越しいただきました。

本当にうれしいことに、さらに先があります。19 年 4 月から 20 年 11 月まで日本学術振興会の招聘研究者として 3 回目の長期滞在を、そして、現在は、同じく日本学術振興会の外国人招聘研究者として 1 年弱の計画で防災研究所に滞在いただいています。短期間にこれほど頻繁に防災研究所にお越しいただき、多くのスタッフ、学生と密に関係を結んでいただいた方は、防災研究所の長い歴史の中でも希有なケースだと思われます。

この間、Goltz 先生とはいくつもの研究を共同で進めさせていただきました。たとえば、米国の USGS（アメリカ地質調査所）が進めてきた「DYFI（Did You Feel It?）プロジェクト」に関する研究、コロナ禍や気候変動を「Slow-onset Disaster」（始点や終点を特定しにくい災害）のマネジメントの問題として考察した研究、そして、今ご一緒に手がけている「南海トラフ地震に関する臨時情報」についての研究など、です。

いずれの研究においても、Goltz 先生は、長年にわたる実務経験と災害社会学の研究者としてのキャリアの両方の側面から私たちをリードし、またサポートし続けてくださいました。また、米国における地震学研究や災害社会学研究の最新の成果をご紹介くださり、私たちの共同研究に国際性と文化比較の観点を加えてくださいました。

さらに、共同研究を通して、多くの大学院生、若手研究者を指導してくださったことも特筆すべきことと思っています。先生が参加くださった研究所のセミナー、ゼミ、そして日常的なやりとりの中で、豊かな国際性を育んだ学生、スタッフは数十人にのぼります。

以上のように、Goltz 先生は防災研究所との交流をとても大切にしてきてくださいました。心からお礼を申し上げます。これからも、私たち防災研究所とますます深く交流いただきますようお願い申し上げます。

最後に、私事にわたりますが、長期滞在のたびに一緒に来日くださっている奥様 Eileen さんとも家族ぐるみで親しくお付き合いさせていただいていることも、私にとって大変大きな喜びです。Goltz 先生そして奥様のご健勝とご発展を心から祈念いたします。

2022 年 12 月 1 日

Congratulatory Message to Dr. James D. Goltz

Professor, Disaster Prevention Research Institute, Kyoto University
Katsuya Yamori

Congratulations, Dr. Goltz, on receiving the DPRI AWARD. I would like to congratulate you from the bottom of my heart. As someone who has served as a host for Dr. Goltz on several occasions at the Disaster Prevention Research Institute, I am very happy to have this opportunity to celebrate.

Looking back, the direct relationship between Dr. Goltz and the Disaster Prevention Research Institute (DPRI) can be traced back to October 2015, when he was appointed as a foreign visiting professor for the first time. I say first, because there was a second time. Following the first stay from October 2015 to September 2016, Dr. Goltz also came from November 2017 to September 2018 as a foreign visiting professor.

Thankfully, there is more to come. From April 2019 to November 2020, Dr. Goltz stayed for the third time as an invited researcher of the Japan Society for the Promotion of Science (JSPS). Currently, he is staying at DPRI for a period of less than a year as a foreign researcher invited by JSPS. I believe that it is a rare case in the long history of DPRI for someone to have visited the institute so frequently and formed close relationships with so many staff and students.

During these times, I have collaborated on several research projects with Dr. Goltz. These include research related to the "DYFI (Did You Feel It?) Project" promoted by the USGS (United States Geological Survey), research on the COVID-19 pandemic and climate change as problems of management of "Slow-onset Disaster" (disasters for which starting and ending points are difficult to specify), and research on "Nankai Trough earthquake temporary information " that we are currently working on.

In all of the studies, Dr. Goltz has guided and supported us both through his many years of practical experience and his career as a researcher in disaster sociology. In addition, he introduced the latest results of seismological research and disaster sociological research in the United States, and added an international perspective and cultural comparison to our joint research.

Furthermore, I think it is worth noting that he has guided many graduate students and young researchers through joint research. Dozens of students and staff have cultivated a rich international perspective through seminars and daily interactions at DPRI that Dr. Goltz has participated in.

In these ways, Dr. Goltz has placed great importance on his relationship with DPRI. I would like to thank him very much. We hope that Dr. Goltz will continue to interact more deeply with us at DPRI.

Lastly, on a personal note, it is a great pleasure to also be able to have a close relationship

with Dr. Goltz's wife, Eileen, who comes to Japan with him every time he stays for a long period of time. I sincerely hope for the good health and future development of Dr. Goltz and his wife.

1 December 2022

DPRI Award 設立の趣旨および

第 8 回 DPRI Award 受賞者決定の経緯

研究教育担当副所長　松島　信一

防災研究所は、国内外で発生する自然災害を研究対象とすることから、国際交流協定の締結、国際共同研究、海外災害調査や留学生・海外共同研究者の受け入れなどの国際的な活動にも積極的に取り組んで参りました。平成２２年度に認定され開始した共同利用・共同研究拠点は令和４年度から３期目に入りました。また、防災研究所が事務局を務める世界防災研究所連合（GADRI）は今年度、第 6 回世界防災研究所サミットを開催いたします。このように防災研究所は頻発する国内外での自然災害に備えるための国際防災研究拠点として、その地位を確立するために、様々な新しい取り組みを推進しています。

これらの一環として平成２３年３月に「京都大学防災研究所国際表彰規程」が制定され、DPRI Award が設立されました。その表彰の要件は

１）　防災研において、客員教員や共同研究者などとして滞在し、セミナーや共同研究などを実施し、防災研の研究教育に成果を上げた方

２）　防災研が主催する研究集会等において、基調講演、招待講演等を務め、又は企画運営に携わり、防災研の活動に貢献した方

３）　防災研が実施する国際共同研究及び現地調査等において貢献した方

となっております。

平成２５年度には第１回の防災研究所国際表彰 DPRI Award をカリフォルニア工科大学名誉教授の金森博雄博士に授与いたしました。また、平成２６年度には第２回 DPRI Award をメキシコ自治大学教授のフランシスコ・サンチェズセスマ博士に、平成２７年度には第３回 DPRI Award をウォータールー大学教授のキース・ハイペル博士に、平成 28 年度の第４回 DPRI Award では、ローザ

ンヌ大学教授のミシェル・ジャボイエドフ博士と国際応用システム分析研究所のリスク・レジリエンスプログラムに授与いたしました。平成 30 年度の第 5 回 DPRI Award ではネバダ大学リノ校教授のジョン・グレッグ・アンダーソン博士に「研究教育業績賞」を、令和元年の第 6 回 DPRI Award では、ノーサンブリア大学教授のアンドリュー・コリンズ博士に「研究教育貢献賞」を授与しました。令和 2 年度には、第 7 回 DPRI Award を台湾国立防災救助技術センター（NCDR : National Science and Technology Center for Disaster Reduction ）の元センター長である陳亮全（チェン・リアン チュン Liang-Chun CHEN）博士に「研究協力貢献賞」を授与しました。

今回、令和 3 年度の国際表彰について、令和 4 年 2 月に防災研究所の矢守教授から推薦があり、表彰選考委員会で慎重に審議しました。その結果、コロラド大学ボルダー校・行動科学研究所・自然災害センター（Natural Hazards Center, Institute of Behavioral Science, University of Colorado, Boulder）の Researcher in Residence であり、令和 4 年度に防災研に共同研究者として長期滞在されている、James D. Goltz（ジェームズ・デニス・ゴルツ）博士に対し、第 8 回の防災研究所国際表彰 DPRI Award の「研究教育貢献賞」の受賞者として所長に推薦することを決定いたしました。その後、所長の承認を受け、これを教授会に諮り承認されました。

ゴルツ博士は 1970 年に米国オハイオ州立大学（Ohio State University）社会学部を卒業後、米国カリフォルニア大学ロサンゼルス校（University of California Los Angeles）社会学専攻の修士課程を 1978 年に修了されました。また、2006 年には米国カリフォルニア大学ロサンゼルス校社会学専攻より Ph.D の学位を取得されました。

ゴルツ博士は、災害社会学、地震学に関するアウトリーチ研究、災害リスクマネジメントを専門とされ、1983 年以降、California Office of Emergency Services の Earthquake Program の Research and Evaluation Program Manager、EQE International Inc.の Senior Policy Analyst、California Institute of Technology（カリフォルニア工科大学）における Office of Earthquake Programs の Manager と Consultant to the Governor’s Office of Emergency Services、California Office of Emergency Services における Earthquake and Tsunami Program Specialist と Earthquake, Tsunami and

Volcanic Hazards Program の Branch Chief、カリフォルニア工科大学の Visiting Associate in Mechanical and Civil Engineering、日本学術振興会のリサーチフェローを歴任され、現在はコロラド大学ボルダー校・行動科学研究所・自然災害センターの Researcher in Residence として研究を進められています。この間、防災研究所には 3 度に亘り長期滞在をされ、2022 年度には日本学術振興会外国人招聘研究者として防災研究所に 4 回目の長期滞在をされています。

ゴルツ博士は、2011 年に米国カリフォルニアにおける津波ハザードに対する軽減策・普及啓発・非常時対策への強力なリーダーシップが評価され、“Inspirational Leadership in Tsunami Hazard Mitigation, Public Awareness, and Emergency Preparedness for the State of California”との理由で 2011 WSSPC (Western States Seismic Policy Council) Leadership Award を受賞されました。

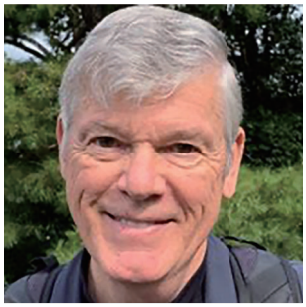
防災研究所との関係は、ゴルツ博士が 2015 年 10 月に最初の防災研究所・招へい研究員（客員教授）として 1 年間に及ぶ長期滞在をされたことから始まりました。2017 年 11 月からは 2 回目の招へい研究員（客員教授）として 11 ヶ月間滞在されました。その後、2019 年 4 月から 8 ヶ月間は日本学術振興会外国人招聘研究者として防災研究所に滞在して、「地震動に対する人間行動と社会的反応に関する国際比較研究」に関する共同研究を実施されました。さらに、2022 年 4 月から 2023 年 2 月までの予定で再度日本学術振興会外国人招聘研究者として防災研究所に滞在中で、「南海トラフ地震の臨時情報に対する地方自治体の対応計画に関する研究」に関する共同研究を実施されています。

ゴルツ博士は、現在を含めた 4 度の長期滞在の間に、米国 USGS（アメリカ地質調査所）が進めてきた「DYFI（Did You Feel It?）プロジェクト」に関する研究、コロナ禍や気候変動を「Slow-onset Disaster」（始点や終点を特定しにくい災害）のマネジメントの問題として考察した研究、「南海トラフ地震に関する臨時情報」についての研究など、多くの国際共同研究を実施されてきています。いずれの共同研究においても、長年に亘る実務者および災害社会学の研究者としての経験から幅広い知見を提供されて来られました。また、米国における地震学や災害社会学の研究成果の紹介などを通じ、共同研究に国際性と文化比較の観点を加えるなど、多くの貢献をされています。さらに、共同研究より防災研究所メンバとともに共著論文を複数発表するとともに、共同研究等を通して多く

の若手研究者や大学院生の指導に携わり、国際性を身につけた学生、スタッフが数十人にのぼるなど、研究面だけではなく教育面でも大いなる貢献をされています。

これらのゴルツ博士との継続的な共同研究の実績は、防災研究所の国際的な学際研究、異分野融合研究を牽引し、国際プレゼンスの向上に大いに貢献してきました。ゴルツ博士には、これまでのご貢献に深く感謝するとともに、今後も受賞者に授与される終身称号の DPRI Fellow として、防災研究所の研究・教育に大所高所からご指導・ご助言いただければ大変ありがたく存じます。

Goltz 博士の御略歴



氏名： James D. Goltz

称号： Researcher-in-Residence

国籍： アメリカ合衆国　United States of America

所属機関： University of Colorado Boulder

部局： Natural Hazards Center, Institute of Behavioral Science, University of Colorado Boulder（コロラド大学ボルダー校・行動科学研究所・自然災害センター）

専門分野： 災害社会学　地震学に関するアウトリーチ研究
災害リスクマネジメント

学歴（Education）：

University of California Los Angeles, Ph.D. Sociology, 2006.

University of California Los Angeles, M.A. Sociology, 1978.

Ohio State University, Columbus, OH, B.A. Sociology, Cum Laude, Phi Beta Kappa, University Fellow, 1970.

Columbus West High School, Columbus, Ohio. Graduation, June 1966.

経歴（Experience）：

Guest Scholar, Disaster Prevention Research Institute, Kyoto University. April 2022 to Present.

Recipient of a Japan Society for the Promotion of Science Fellowship and a grant from the US-Japan Foundation to study planning among local government jurisdictions in the Nankai region of Japan for receipt of "special earthquake warning information" from the Japan Meteorological Agency regarding potential precursory seismic activity in the Nankai Trough.

Researcher in Residence, Natural Hazards Center, Institute of Behavioral Science, University of Colorado, Boulder. April 2020 to Present.

After returning from Japan in November 2019, I was invited to join the Natural Hazards Center as a resident researcher; however, measures to control the coronavirus pandemic prevented me from actually being present on campus. Nevertheless, I am listed as a Researcher in Residence and am currently working on an NSF funded project to develop a companion questionnaire for the USGS 'Did You Feel It' program for respondents who received an earthquake early warning message from ShakeAlert.

Research Fellow, Japan Society for the Promotion of Science (JSPS), Disaster Prevention Research Institute, Kyoto University, April 1, 2019 to November 30, 2019.

Returned to the Disaster Prevention Research Institute and Kyoto University with a JSPS fellowship to conduct a study of human behavioral response in 12 global earthquakes using data from the USGS 'Did You Feel It?' database. This was a USGS funded study in which I served as Principal Investigator, Prof. Katsuya Yamori as Co-Principal Investigator and two graduate students served as research assistants. The results of the study were compiled into a research paper which is pending publication in the journal *Earthquake Spectra*.

Visiting Research Professor, Disaster Prevention Research Institute, Kyoto University, Japan. October 1, 2015 to September 29, 2016, November 1, 2017 to September 30, 2018.

Two one-year visiting faculty positions involving invited lectures, research collaboration, advising graduate students and earthquake and tsunami knowledge transfer. The focus of research collaboration was in earthquake early warning, tsunami evacuation strategies, operational earthquake forecasting and earthquake reconnaissance for the April 14-16, 2016 earthquake sequence in Kumamoto Prefecture Japan. Delivered several invited lectures

focusing on risk communication, hazard warnings and behavioral dimension of seismic intensity scales.

Visiting Associate in Mechanical and Civil Engineering, California Institute of Technology, January 2012- September 30, 2015

Participate in an organized working group to promote the development and implementation of an earthquake early warning system in California. I helped organize and participated in a coalition of states, territories and commonwealths that are members of the National Tsunami Hazard Mitigation Program (NTHMP) and have sought to promote the reauthorization of the Tsunami Warning and Education Act of 2006. I am collaborating with a US Geological Survey colleague to advocate and ultimately develop a protocol for public information messaging in response to potentially precursory seismic activity in or near the Cascadia Subduction Zone. In 2012, I served on an oversight committee convened by the National Institute of Building Sciences to develop a tsunami module for HAZUS, the national loss estimation methodology for several natural hazards. I am currently serving on the Advisory Committee of the National Earthquake Hazard Reduction Program (NEHRP) for a six-year term that began in September 2013.

Branch Chief, Earthquake, Tsunami and Volcanic Hazards Program, California Office of Emergency Services (Cal OES), January 2007 to Retirement in December 2011

Under the general direction of the Assistant Secretary, Planning, Protection and Preparedness, the Branch Chief, is responsible for planning, organizing and directing the Cal OES Earthquake, Tsunami and Volcanic Hazards Program, the earthquake component of which includes funding of the California Integrated Seismic Network (CISN); the integration of CISN research and development into Cal OES planning, preparedness, warning, response and recovery activities; the development and delivery of research and findings to multidisciplinary professional constituents; and, for serving as the representative, on behalf of the Secretary and Undersecretary, to the CISN and other organizations with earthquake hazard programs. The tsunami component includes managing funds from the National Oceanic and Atmospheric Agency (NOAA) to develop tsunami inundation maps for all California coastal jurisdictions, promote local government planning for tsunamis, provide technical assistance to local government in the development of plans, interpretation of inundation maps, conducting workshops and exercises, and representing California in the National Tsunami Hazard Mitigation Program.

Earthquake and Tsunami Program Specialist, California Office of Emergency Services, April 2003-December 2006

Responsible for all activities identified under the job description below as well as the design and execution of the state's Tsunami Hazard Mitigation Program which includes monitoring the contract for the tsunami hazard mapping project, planning and carrying out workshops to promote the development of local tsunami mitigation and response plans,

reviewing plans and designing exercises, including the generation of scenarios to test local plans.

California Institute of Technology, Consultant to the Governor's Office of Emergency Services, March 2002 - March 2003

Design and carry out a program of scientific outreach and technology transfer associated with the new California Integrated Seismic Network (CISN). Work closely with Cal OES executive staff and technical specialists in developing network-based products for use in managing earthquake emergencies and explore the applicability of these products to other emergencies. Carry out technology transfer through presentations to selected target audiences, publication of articles and papers, lectures at the California Specialized Training Institute, participation in exercises, holding workshops and other means. Conduct research to identify opportunities and barriers to effective technology transfer and, as necessary, write proposals for grants to support research activities.

California Institute of Technology, Manager, Office of Earthquake Programs, October 1997-February 2002

Responsible for management of the Caltech-USGS Broadcast of Earthquakes (CUBE) program and for technology transfer associated with the TriNet project. Some of the major projects under TriNet include development of new real-time information products for emergency response and recovery including: accurate and reliable earthquake source information, ground shaking maps (ShakeMap), and an earthquake early warning system for southern California. Duties involve program administration, contract management, liaison with a broad array of user groups, workshop and conference organization and curriculum development.
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EQE International Inc., Irvine, California, Senior Policy Analyst, October 1993-September 1997

Responsible for EQE's research program in natural hazards and public policy and specialized in the transfer and application of new technologies. With support from the National Science Foundation, investigated the application of real-time seismic information for emergency response; the use of loss and damage estimates for emergency management and decision support in the Northridge earthquake; inter-organizational coordination of emergency response and early recovery in the Hanshin-Awaji earthquake in Japan; and, public policy and behavioral response associated with earthquake early warning systems. He also served as editor and contributor to the Northridge general reconnaissance report published by the National Center for Earthquake Engineering Research.

Earthquake Program, California Office of Emergency Services, Pasadena, California, Research and Evaluation Program Manager, June 1983-September 1993

Principal responsibilities included program evaluation research, advising local government, conference organizing, project/contract management and response/recovery planning. Also, served as Executive Secretary of the California Earthquake Prediction Evaluation Council for seven years. Principal earthquake prediction response planner and designated representative of the California Office of Emergency Services at the California Institute of Technology upon the occurrence of significant earthquakes in southern California.

受賞（Honors/Awards）：

Recipient of 2022 Research Collaboration Prize, Disaster Prevention Research Institute, Kyoto University for “Outstanding Contributions to Research Collaboration.”

Recipient of 2011 WSSPC (Western States Seismic Policy Council) Leadership Award presented for “Inspirational Leadership in Tsunami Hazard Mitigation, Public Awareness, and Emergency Preparedness for the State of California.”

出版物（Publications (1984 to Present, * Denotes Refereed Journal Article)）：

*Goltz, James D. 2022. “Social Science Contributions to Earthquake Warnings: An Essay Commemorating the Work of Dennis S. Mileti” submitted for publication in the Natural Hazards Review, July 2022.

*Goltz, James D. 2022. "An Additional Perspective on “Is the Long-Term Probability of the Occurrence of Large Earthquakes along the Nankai Trough Inflated? Conflict between Science and Risk Management–by Manabu Hashimoto" *Seismological Research Letters*, June 8, 2022.

*Goltz, J.D., Wald, D.J., McBride, S.K., DeGroot, R., Breeden, J.K. and Bostrom, A., 2022. Development of a companion questionnaire for “Did You Feel It?”: Assessing response in earthquakes where an earthquake early warning may have been received. *Earthquake Spectra*, p.87552930221116133.

*Bostrom, Ann, Sara McBride, Julia Becker, James Goltz, Robert DeGroot, Lori Peek, Brian Turbush and Maximilian Dixon 2022. “ShakeAlert: Great Expectations for Earthquake Early Warnings on the U.S. West Coast,” *International Journal of Disaster Risk Reduction*, publication pending (April 2022).

*Lindell, Michael K., Ann Bostrom, James D. Goltz, and Carla S. Prater 2021. "Evaluating hazard awareness brochures: Assessing the textual, graphical, and numerical features of tsunami evacuation products," *International Journal of Disaster Risk Reduction,* 61:

*Yamori, K. and James D. Goltz, 2021. "Disasters Without Borders: The Coronavirus Pandemic, Global Climate Change and the Ascendancy of Gradual Onset Disasters," *International Journal of Environmental Research and Public Health,*18(6): 3299.

* Goltz, James D., Hyejeong Park, Vincent Quitoriano and David Wald 2020. "Human Behavioral Response in the 2019 Ridgecrest Earthquakes: Assessing Immediate Actions Based on Data from 'Did you feel it?'" *Bulletin of the Seismological Society of America*, 110 (4): 1589–1602.DOI:

*Goltz, James D., Hyejeong Park, Genta Nakano and Katsuya Yamori 2020. "Earthquake Ground Motion and Human Behavior: Using DYFI Data to Assess Behavioral Response to Earthquakes", *Earthquake Spectra*,

*Goltz, James D. and Evelyn Roeloffs 2020. "Imminent Warning Communication: Earthquake Early Warning and Short-Term Forecasting in Japan and the US", in K. Yamori (Ed.) *Disaster Risk Communication: A Challenge from a Social Psychological Perspective*, Springer, Singapore, Heidelberg, New York, Dordrecht, London.

*Goltz, James D. and Katsuya Yamori 2020. "Tsunami Preparedness and Mitigation Strategies" in *Oxford Research Encyclopedia of Natural Hazard Science*, Oxford University Press doi: http://dx.doi.org/10.1093/acrefore/9780199389407.013.324

Goltz, James D. 2018. "What was learned from the Osaka Earthquake (of June 18, 2018)", Opinion Essay published in the Japan Times, 7/3/18.

Goltz, James D. 2018. "Earthquake Advisories Can Save Lives," Opinion Essay published in the Japan Times, 4/18/18.

*Goltz, James D. and Linda B. Bourque 2017. "Earthquakes and Human Behavior: A Sociological Perspective," *International Journal of Disaster Risk Reduction*, 21:251-265.

*Goltz, James D. 2017. "Tsunami Tendenko: A Sociological Critique," *Natural Hazards Review*, Vol.18 (4) November 2017.

*Roeloffs, Evelyn and James D. Goltz 2017: The California Earthquake Advisory Plan: A History," *Seismological Research Letters,* Vol. 88(3) October 2017.

Goltz, James D. 2016, "The Kyushu Earthquake Sequence of April 2016: A Report to EERI," Reconnaissance Report prepared for the Earthquake Engineering Research Institute, May.

*Goltz, James D. 2016. “Status and Power Differentials in the Generation of Fear in Three California Earthquakes,” *International Journal of Disaster Risk Reduction,* 16: 200-207.

*Goltz, James D. 2015. “A Further Note on Operational Earthquake Forecasting: An Emergency Management Perspective,” *Seismological Research Letters,* Volume 86, No. 5: September/October, p. 1231-1233.

*Atsumi, Tomohide and James D. Goltz, 2014, “Fifteen Years of Disaster Volunteers in Japan: A Longitudinal Fieldwork Assessment of a Disaster Non-Profit Organization,” Vol. 32, No.1, pp. 220-240, *International Journal of Mass Emergencies and Disasters.*

Goltz, James D., 2013, “Models of the Organization of Earthquake Early Warning Systems,” Internal California Office of Emergency Services briefing document for the Cal OES Director and Executive Staff, March 15, Mather, California.

*Krishnan, Swaminathan, Emanuele Casarotti, James Goltz, Chen Ji, Dimitrri Komatitsch, Ramses Mourhatch, Matthew Muto, John H. Shaw, Carl Tape, and Jeroen Tromp 2012, “Rapid Estimation of Damage to Tall Buildings Using Near Real-Time Earthquake and Archived Structural Simulations,” *Bulletin of the Seismological Society of America.*Vol.102, No.6, December.

Porter, Keith, Lucile Jones, Dale Cox, James Goltz, Ken Hudnut, Dennis Mileti, Sue Perry, Daniel Ponti, Michael Reichle, Adam Z. Rose, Charles R. Scawthorn, Hope A. Seligson, Kimberly I. Shoaf, Jerry Treiman, and Anne Wein 2011, “The ShakeOut Scenario: A Hypothetical M7.8 Earthquake on the Southern San Andreas Fault,” *Earthquake Spectra* Vol. 27, pp 239-261.

*Goltz, James D. and Dennis S. Mileti 2011, “Public Response to a Catastrophic Southern California Earthquake: A Sociological Perspective,” *Earthquake Spectra* Vol. 27, pp 487-504

Wilson, R.I., Lori A. Dengler, James D. Goltz, Mark R. Legg, Kevin M. Miller, Andy Ritchie, and Paul M. Whitmore, 2011, “Emergency Response and Field Observation Activities of Geoscientists in California (USA) During the September 29, 2009, Samoa Tsunami.” *Earth-Science Reviews*, Volume 107, Issues 1–2, July 2011, Pages 193–200.

*Barberopoulou A., J.C. Borrero, B. Uslu, N. Kalligeris, J.D. Goltz, C.E. Synolakis and R.I. Wilson, 2009 "Unprecedented Coverage of the Californian Coast Promises Improved Tsunami Response", invited feature article, *EOS Transactions*, American Geophysical Union, vol. 90, no. 16, pp.137-138, 21 April, 2009.

Perry, Suzanne, Dale Cox, Lucile Jones, Richard Bernkopf, James Goltz, Kenneth Hudnut, Dennis Mileti, Suzanne Perry, Daniel Ponti, Keith Porter, Michael Reichle, Hope Seligson,

Kimberly Shoaf, Jerry Treiman and Anne Wein, 2008, *The ShakeOut Scenario: A Story that Southern Californians are Writing,* Circular 1324, United States Geological Survey, US Department of the Interior.

Jones, Lucile, Richard Bernknopf, Dale Cox, James Goltz, Kenneth Hudnut, Dennis Mileti, Suzanne Perry, Daniel Ponti, Keith Porter, Michael Reichle, Hope Seligson, Kimberly Shoaf, Jerry Treiman and Anne Wein, 2008, *The ShakeOut Scenario: Effects of a Potential M7.8 Earthquake on the San Andreas Fault in Southern California,* USGS Open File Report 25.

Goltz, James D. 2006*, Initial Behavioral Response to a Rapid Onset Disaster: A Social Psychological Study of Three California Earthquakes* (2006) Doctoral Dissertation, University of California, Los Angeles.

Goltz, James D. 2006, Chapter Seven, "Benefits for Emergency Response and Recovery," *Improved Seismic Monitoring, Improved Decision-Making: Assessing the Value of Reduced Uncertainty,* The National Academies Press: Washington, D.C.

*Goltz, James D. 2003, "Science *Can* Save Us: Outreach as Necessity and Strategy," *Seismological Research Letters.* Volume 74, Number 5, September/October.

*Goltz, James D. 2003, "Applications for New Real-Time Seismic Information: The TriNet Project in Southern California" *Seismological Research Letters.* Volume 74, Number 5, September/October.

Wald, David J., C. Bruce Worden, Vincent Quitoriano and James Goltz, 2002, "ShakeMap: It's Role in Pre-Earthquake Planning and Post-Earthquake Response and Information" Proceedings of the SMIP02 Seminar on Utilization of Strong Motion Data, Los Angeles, May.

*Hauksson, Egill, Patrick Small, Katrin Hafner, Robert Busby, Robert Clayton, James Goltz, Tom Heaton, Kate Hutton, Hiroo Kanamori, Jascha Polet , Doug Given, Lucile M. Jones, and David Wald, 2001, "The Southern California Seismic Network: The Caltech/USGS Element of TriNet, 1997-2001" *Seismological Research Letters,* Vol. 72, No. 6, November/December.

Goltz, James D. and Egill Hauksson, 2001, "TriNet: New Tools for Rapid Earthquake Response through Interdisciplinary Research," *Natural Hazards Observer,* Volume XXV Number 6, July.

*Goltz, James D., P. J. Flores, S.E. Chang, T. Atsumi, 2001, "The '921' Chi-Chi, Taiwan Earthquake: Emergency Response and Early Recovery" *Earthquake Spectra,* Supplement A to Vol.17, April.

*Eguchi, Ronald T., J.D. Goltz, C.E. Taylor, S.E. Chang, P.J. Flores, L.A. Johnson, H.A. Seligson, and N.C. Blais, 1998, "Direct Economic Losses in the Northridge Earthquake: A Three-Year Post-Event Perspective," *Earthquake Spectra*, Vol.14, No. 2, May.

*Goltz, James D. and Paul J. Flores, 1997, "Real-Time Earthquake Early Warning and Public Policy: A Report on Mexico City's Sistema de Alerta Sismica," *Seismological Research Letters*, Vol. 68, No. 5, September/October.

Eguchi, Ronald T., James D. Goltz and Hope A. Seligson 1997. "Integrated Real-Time Disaster Information Systems: The Application of New Technologies," US-Japan Joint Seminar on Civil Infrastructure Systems Research, Honolulu, HI, August 28-30, 1997.

Goltz, James D., 1996, *Use of Real-Time Seismic Information by Government Agencies, Utilities and Large Corporations in the Pre- and Post-Northridge Environments*, Irvine, CA: EQE International for the National Science Foundation.

Eguchi, R. T., Goltz, J. D., Taylor, C. E., Chang, S. E., Flores, P. J., Johnson, L. A.& Blais, N. C. 1996. "The Northridge Earthquake as an Economic Event: Direct Capital Losses." In *Proceedings: The Northridge Earthquake: Analyzing Economic Impacts and Recovery from Urban Earthquakes: Issues for Policy Makers*.

*Goltz, J. D. 1996. "Use of Loss Estimates by Government Agencies in the Northridge Earthquake for Response and Recovery. *Earthquake Spectra*, *12*(3), 441-455.

Goltz, J. D. 1996. "Emergency Response in the Great Hanshin-Awaji Earthquake of January 17, 1995: Planning, Mobilization and Inter-Organizational Coordination." *Proceedings of the Eleventh World Conference on Earthquake Engineering, Paper No. 589.*

*Russell, L. A., Goltz, J. D., & Bourque, L. B. 1995. "Preparedness and Hazard Mitigation Actions Before and After Two Earthquakes." *Environment and Behavior*,*27* (6), 744-770.

Eguchi, Ronald T., Hope A. Seligson and James D. Goltz 1995. "Rapid Post-Earthquake Damage Assessment for Lifeline Facilities," Sixth US-Japan Workshop on Earthquake Disaster Prevention for Lifeline Systems, July 18-19,1995 Osaka, Japan.

Eguchi, R. T., Goltz, J. D., Seligson, H. A., & Heaton, T. H. 1994. "Real-time Earthquake Hazard Assessment in California: The Early Post-Earthquake Damage Assessment Tool and the Caltech-USGS Broadcast of Earthquakes." In*: Proceedings of the U. S. National Conference on Earthquake Engineering. Vol.2. Earthquake Engineering Research Institute, Oakland, CA, pp. 55-63.*

Goltz, J. D. 1994. *The Northridge, California Earthquake of January 17, 1994: General Reconnaissance Report.* National Center for Earthquake Engineering Research. Report No. NCEER-94-0005, Buffalo, NY, USA.

Goltz, J. D., Russell, L. A., & Bourque, L. B. 1993. “Individual and Family Disaster Preparedness in California: A Tale of Two Earthquakes.” In *Earthquake Hazard Reduction in the Central and Eastern United States: A Time for Examination and Action.* Central US Earthquake Consortium, Memphis, TN.

Bourque, L. B., Russell, L. A., & Goltz, J. D. 1993. “Human Behavior During and Immediately After the Earthquake. In *The Loma Prieta, California, Earthquake of October 17, 1989: Public Response*. US Geological Survey Professional Paper, 1553, 3.

*Goltz, J. D., Russell, L. A., & Bourque, L. B. 1992. “Initial Behavioral Response to a Rapid Onset Disaster: A Case Study of the October 1, 1987, Whittier Narrows Earthquake.” *International Journal of Mass Emergencies and Disasters*, *10*(1), 43-69.

Bourque, L. B., Aneshensel, C. S., & Goltz, J. D. 1991. “Injury and Psychological Distress Following the Whittier Narrows and Loma Prieta Earthquakes.” In Proceedings of the *UCLA International Conference on the Impact of Natural Disasters. Los Angeles, CA*.

Goltz, James D. 1985 “Earthquake Insurance: A Public Policy Dilemma,” Southern California Earthquake Preparedness Project, Federal Emergency Management Agency, FEMA 68, May 1985.

*Goltz, J.1984. “Are the News Media Responsible for the Disaster Myths?
A Content Analysis of Emergency Response Imagery.*" International Journal of Mass Emergencies and Disasters, 2, 345- 368.*

主要な講演等（Presentations (2004-2022)）：

September 23, 2022: Annual Conference of the Integrated Disaster Risk Management Society, Session chair and presenter (virtual), “Operational Earthquake Forecasting and Planning for Response to “Special Early Warning Information” in the Nankai Region of Japan.

September 1, 2022: Annual Conference of the Japanese Society for an Inclusive Society, Keynote Lecture (virtual), “Access and Function Needs: Lessons Learned from Recent Disasters”

September 22, 2021: Annual Conference of the Integrated Disaster Risk Management Society (virtual), Session organizer and chair, “The Coronavirus Pandemic: What Lessons are Emerging for Integrated Disaster Risk Management?”

December, 7, 2020: American Geophysical Union Meeting (virtual) Poster: “SY005-0004 - How Do People Respond During an Earthquake? Using ‘Did you feel it?’ Data to Assess Human Behavioral Response to Earthquakes.”

September 23-24, 2020: Annual conference (virtual) of the Integrated Disaster Risk Management Society (IDRiM), Session Organizer for two sessions entitled “Conceptions of Disaster and the Coronavirus: What the Pandemic is Teaching Us” (with co-chair Katsuya Yamori) and “Risk and Culture” (with co-chair Asthildur Bernhardsdottir).

January 30, 2020: Annual conference of the Seismological Society of America, “Adventures in Social Seismology: Empirical Investigations of Human Behavioral Response in Earthquakes Using Data from ‘Did you feel it?’ Accepted for presentation, Albuquerque, NM (April, 27-30, 2020). Conference was cancelled due to the coronavirus pandemic; all abstracts published in *Seismological Research Letters*, Issue 2B.

October 18, 2019: Annual Conference of the Integrated Disaster Risk Management Society (IDRiM), Session Organizer for “Adventures in Social Seismology: Human Behavior in Earthquakes With and Without Warning”, Nice, France.

September 13, 2019: International Symposium on Strategy of Disaster Risk Management for Sustainable Growth, Kansai University, “What Do Emergency Managers Need from the Fields of Engineering and Science”, Osaka, Japan.

July 16, 2019: Poster Presentation, Natural Hazards Workshop, “Earthquake Response Behavior: What Do People Do When the Earth shakes?” Broomfield, Colorado.

June 28, 2019: Graduate Seminar, Disaster Prevention Research Institute, Kyoto University, “Earthquakes and Human Behavior: An Analysis of 12 Global Events”, Kyoto, Japan. Same lecture repeated at a graduate seminar at Osaka University, July 2, 2019.

September 27, 2018: Conference Presentation, World Social Science Forum, “Trans-disciplinary Environments for Emergency Management: The Case of the California Earthquake, Tsunami and Volcanic Hazards Program,” Fukuoka, Japan

July 9, 2018: Special Session, Natural Hazards Workshop, “The Osaka Earthquake of June 18, 2018: A Summary,” Broomfield CO

May 25, 2018: Colloquium Presentation. “Earthquake Risk Communication Challenges for Japan: Earthquake Advisories for the Nankai-Tonankai-Tokai Region.” Disaster Reduction Systems, Kyoto University, Japan.

May 15, 2018: International Conference for the Decade Memory of the Wenchuan Earthquake, Chengdu, China, Co-Convener and Moderator for the session entitled “Integrated disaster risk studies and innovative technology.”

February 21, 2018: Disaster Prevention Research Institute, Annual Meeting, “Rethinking Earthquake Prediction in Japan: A Risk Communication Perspective.” Kyoto University.

January 25, 2018: Colloquium Presentation. “Rethinking Earthquake Prediction in Japan: A Risk Communication Perspective.” Disaster Reduction Systems, Kyoto University, Japan.

November 24, 2017: Colloquium Presentation. “Evolving Conceptions of Community Engagement in Disaster Response in the United States: Post World War II to the Present.” Disaster Reduction Systems, Kyoto University, Japan.

August 25, 2017: Conference Session Chair: “Best Practices in Engagement Strategies.” Integrated Disaster Risk Management Conference (IDRiM), Reyjkavik, Iceland, August 23-25, 2017.

August 24, 2017: Conference Presentation. “Operational Earthquake Forecasting: A Risk Communication Challenge.” Integrated Disaster Risk Management Conference (IDRiM), Reyjkavik, Iceland, August 23-25, 2017.

August 23, 2017: Conference Presentation. “Community-based Participation for Effective Earthquake and Tsunami Preparedness and Recovery in Japan and the United States.” Integrated Disaster Risk Management Conference (IDRiM), Reyjkavik, Iceland, August 23-25, 2017.

March 21, 2017: Conference Presentation: “Operational Earthquake Forecasting: A Risk Communication Challenge.” Pacific Risk Management Ohana (PRIMO) Annual Conference, Honolulu, Hawaii, March 20-24, 2017.

July 13, 2016: Workshop Presentation: “Public Communication and Seismic Hazards” 2016 Natural Hazards Workshop, Broomfield, Colorado.

June 21, 2016: Conference Keynote Lecture: “Operational Earthquake Forecasting: A Public Policy Challenge,” International Conference on Operational Earthquake Forecasting, Haifa University, Haifa Israel.

June 14, 2016: Invited Lecture, “Tendenko: A Sociological Critique,” Graduate School of Human Sciences, Osaka University.

June 11, 2016: Invited Lecture: “The Voyage of Komome: A Story of Hope and Friendship,” Invited guest presentation in Noda Village, Iwate Prefecture, Japan, sponsored by Osaka University.

May 27, 2016: Colloquium Presentation, “Anticipating Large Earthquakes: Operational Earthquake Forecasting,” Disaster Prevention Research Institute, Disaster Reduction Systems, Kyoto University, Japan.

April 15, 2016: Colloquium Presentation, “Tendenko: A Sociological Critique,” Disaster Prevention Research Institute, Disaster Reduction Systems, Kyoto University, Japan.

January 29, 2016:Invited Lecture, “Tendenko, Acceptable Risk and Tsunami Hazard Mitigation in the United States and Japan,” Invited public lecture, Hirosaki University, Hirosaki City, Japan.

October 22, 2015: Colloquium Presentation, “Human Behavior Dimension of Seismic Intensity Scales,” Disaster Prevention Research Institute, Disaster Reduction Systems, Kyoto University, Japan.

March 10, 2015: Invited Lecture, “ Warning Systems for Earthquakes in the United States and Japan,” Symposium on Research and Policies for Disaster Recovery and Reconstruction, Hirosaki University.

November 18, 2014: Colloquium Presentation, “Operational Earthquake Forecasting in California: A Transferable Prototype for the Pacific Northwest?” with Evelyn Roeloffs Ph.D. United States Geological Survey, Department of Geology, Humboldt State University, Arcata, California.

November 5, 2014: Committee Presentation, “What Can Be Learned from Existing Earthquake Early Warning Systems,” meeting of the California Earthquake Early Warning System, Committee on EEW Education and Training Committee, video conference.

February 14, 2014: Lecture, “Using Science and Technology in Managing Earthquake Emergencies,” at the California Specialized Training Institute, San Luis Obispo, California. Please note that I presented some variant of this lecture at CSTI four times per year since 2002.

November 15, 2013: Seminar Presentation, “Introducing Earthquake Early Warning in the United States: The Broader Context,” Veterans Emergency Management Evaluation Center (VEMEC), Veteran’s Administration, Northridge, California (Updated Cascades Volcano Observatory presentation).

October 27, 2013: Conference Presentation, “What You Should Know Before the Next Big California Earthquake,” Southern California Association of Activities Professionals (a professional association of activities directors for assisted living centers), Woodland Hills, California.

July 10, 2013: Organized session at the Natural Hazards Workshop, “Anticipating a Major Earthquake and Tsunami in the Cascadia Subduction Zone: Potential Precursors and What to Say to the Public” Organized session, recruited speakers and served as Moderator, participants included: Dr. Lucile Jones, US Geological Survey, Dr. Evelyn Roeloffs, US Geological Survey, Dr. Lee Wilkins, University of Missouri, Mr. John Schelling, Washington State Emergency Management Agency, Broomfield, Colorado.

May 22, 2013: Conference Presentation, “Social and Behavioral Aspects of Earthquake Early Warning,” National Earthquake Program Managers Meeting, May 22-24, Denver, Colorado.

October 8, 2012: Invited Presentation, “Introducing Earthquake Early Warning in the United States: The Broader Context,” Department of Geology, Humboldt State University, Arcata, California. (Same presentation as September 9, 2012 at the Cascades Volcano Observatory).

September 9, 2012: Invited Presentation, “Introducing Earthquake Early Warning in the United States: The Broader Context,” Cascades Volcano Observatory, United States Geological Survey, Vancouver, Washington.

August 25, 2012: Conference Presentation, “The Communicative Survey: Science, Therapy or Both?” International Conference on Disaster Management (IIIRR), Kumamoto, Kyushu, Japan.

July 26, 2012: Conference Presentation, “Ultimate Vulnerability: Death and Injury in Tsunamis,” National Tsunami Hazard Mitigation Meeting, July 25/26, 2012, Seattle, Washington.

June 4, 2012: Training Presentation, “Human Behavior in Disaster: Contributions from the Social Sciences,” California Specialized Training Institute: Tsunami Planning for Coastal Communities, June 4-5, 2012, San Luis Obispo, California.

September 9, 2011: Conference Presentation, “The California Earthquake Clearinghouse,” with Dr. Anne Rozinski, California Geological Survey, Annual Meeting of the Southern California Earthquake Center, University of Southern California, Palm Springs, California.

July 26, 2011: Workshop Presentation, “Operational Use of Earthquake Forecasts: An Emergency Management Perspective,” SCEC-NASA Workshop on Evaluating Ground-Based and Space-Based Methods of Earthquake Forecasting, University of Southern California, July 26-27, 2011. Same presentation at Department of Homeland Security, Science and Technology Directorate Seismic Forecasting, Warning and Alerting Meeting, September 20, 2011, Arlington, Virginia.

July 16, 2011: Conference Presentation, “Tsunami Response in California and Lessons Learned from the Tohoku Japan Earthquake and Tsunami,” 2nd International Conference of the Society for Integrated Risk Management, July14-16, 2011, Los Angeles, California.

February 11, 2011: Conference Presentation, “California’s Tsunami Program: Addressing the Tsunami Hazard in California,” Earthquake Engineering Research Institute Annual Meeting, February 9-12, 2011, La Jolla, California.

January 25, 2011: Workshop Presentation, “State of California Earthquake and Tsunami Warning, Notification and Response,” Workshop on Applications of Remote Sensing, Naval Postgraduate School, January 24-27, 2011, Monterrey, California.

December 7, 2010: Conference Presentation, “Earthquakes and Tsunamis: The Year 2010 in Review,” California Industrial Hygiene Council Conference, San Diego, California. Same presentation made at the Orange County/American Red Cross Disaster Academy, October 27, 2010, Anaheim, California.

July 21, 2010; Briefing for Chilean Delegation, “An Introduction to California Emergency Management and the Great California ShakeOut,” Briefing for Ministry of Foreign Affairs, Chile, July 21, 2010, Sacramento, California

April 29, 2010: Workshop Presentation, “Vertical Evacuation: When Getting to Higher Ground is Not Feasible,” Santa Barbara Tsunami Planning Workshop, Santa Barbara California.

October 17, 2009: Symposium Presentation, “Earthquake Early Warning and the Loma Prieta Earthquake: First Experiment with a New Technology,” Loma Prieta Earthquake Commemorative Symposium, October 17, 2009, San Francisco, California.

September 17, 2009: Presentation to Local Government, “Can We Have Warnings for Earthquakes? The Story of Scientific Earthquake Prediction and Early Warning,” City of Anaheim, California.

April 23, 2009: Workshop Presentation, “Earthquake Early Warning: Societal and Public Policy Issues,” 2nd International Workshop on Earthquake Early Warning, April 21-24, 2009, Kyoto, Japan.

December 11, 2008: “ShakeOut” Presentation, “The ‘Big One’ and Southern California’s Community Colleges,” California Community Colleges Region One Meeting, Anaheim, California.

November 6, 2008: Invited Presentation, “Earthquake Early Warning: Societal and Public Policy Issues,” National Academies, Board on Earth Sciences and Resources, Washington DC.

July 14, 2008: Workshop Presentation, “Earthquake and Tsunami Early Warning and Response: Challenges and Strategies for Technology Transfer,” 2008 Natural Hazards Workshop, July 12-15, 2008, Broomfield, Colorado.

July 1, 2008: Workshop Presentation, “Learning What Has Happened in an Earthquake: Clearing the Fog of War,” Governor’s Office of Emergency Services, Alert, Warning and Communications Workshop, Los Angeles, California.

November 24, 2007: Conference Presentation (Co-Presented with Mr. Paul Jacks), “The Great Sumatra Earthquake and Indian Ocean Tsunami and Disaster Planning in California,” Second International Conference on Urban Disaster Reduction, November 27-29, 2007, Taipei, China.

September 10, 2007: Local Government Presentation, “Earthquake Scenarios for the City of Anaheim,” Presentation to City of Anaheim, California. Note: This is an example of the many presentations made between 2003 and 2012 using ShakeMap and HAZUS scenarios

to provide cities, school districts, hospitals and other entities with detailed information on local earthquake risk and mitigation strategies.

April 25, 2007: Presentation, “The California Office of Emergency Services Earthquake and Tsunami Program,” National Earthquake Program Managers Meeting April 24-26, 2007, Salt Lake City, Utah.

October 16, 2006: Conference Presentation, “New Earthquake Information Products for Emergency Response: Learning from the Loma Prieta and Northridge Earthquakes,” 2006 California Department of Transportation (Caltrans) Response and Recovery Conference, October 16, 2006, San Francisco, California.

July 11, 2006: Workshop Presentation, “Emotion and Disaster Response: A Sociological Assessment of Fear and Human Behavior During Three Damaging Earthquakes,” Natural Hazards Workshop, July 10-12, 2006, Boulder, Colorado.

April 20, 2006: Conference Presentation, “Earthquake Prediction Planning and Response in California,” Quake ’06/ Disaster Resistant California, April 20, 2006, Sacramento, California.

June 8, 2005: Workshop Presentation, “The California Tsunami Program: An Overview,” Asia Pacific All Hazards Workshop, June 6-10, 2005, Honolulu, Hawaii.

November 30, 2004: Workshop Presentation, “Communicating With the Public: Some Sociological Contributions,” California Tsunami Workshop, November 30-December 2, 2004. November 30 to December 2, 2004, Burlingame, California.

January 20, 2004: Panel Presentation, “The Benefits of Enhanced Seismic Monitoring for Emergency Response and Recovery,” National Academies of Science Panel on the Economic Benefits of Enhanced Seismic Monitoring, Washington, DC.

Goltz 博士　防災研究所への貢献の足跡

２０１５年１０月１日～２０１６年９月３０日

防災研究所　招へい研究員（客員教授）として滞在

２０１７年１１月１日～２０１８年９月３０日

防災研究所　招へい研究員（客員教授）として滞在

２０１９年４月１日～２０１９年１１月３０日

「地震動に対する人間行動と社会的反応に関する国際比較研究」に参加［日本学術振興会外国人招聘研究者として防災研究所に滞在］

２０２２年４月２５日～２０２３年２月２３日

「南海トラフ地震の臨時情報に対する地方自治体の対応計画に関する研究」に参加［日本学術振興会外国人招聘研究者として防災研究所に滞在中］

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Article

Disasters without Borders: The Coronavirus Pandemic, Global Climate Change and the Ascendancy of Gradual Onset Disasters

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Abstract: Throughout much of its history, the sociological study of human communities in disaster has been based on events that occur rapidly, are limited in geographic scope, and their management understood as phased stages of response, recovery, mitigation and preparedness. More recent literature has questioned these concepts, arguing that gradual-onset phenomena like droughts, famines and epidemics merit consideration as disasters and that their exclusion has negative consequences for the communities impacted, public policy in terms of urgency and visibility and for the discipline itself as the analytical tools of sociological research are not brought to bear on these events. We agree that gradual-onset disasters merit greater attention from social scientists and in this paper have addressed the two most significant ongoing disasters that are gradual in onset, global in scope and have caused profound impacts on lives, livelihoods, communities and the governments that must cope with their effects. These disasters are the coronavirus pandemic and global climate change both of which include dimensions that challenge the prevailing definition of disaster. We begin with an examination of the foundational work in the sociological study of a disaster that established a conceptual framework based solely on rapidly occurring disasters. Our focus is on several components of the existing framework for defining and studying disasters, which we term "borders." These borders are temporal, spatial, phasing and positioning, which, in our view, must be reexamined, and to some degree expanded or redefined to accommodate the full range of disasters to which our globalized world is vulnerable. To do so will expand or redefine these borders to incorporate and promote an understanding of significant risks associated with disaster agents that are gradual and potentially catastrophic, global in scope and require international cooperation to manage.

Keywords: borders; gradual-onset disasters; coronavirus; global climate change

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1. Introduction

Prior to the current daily news reports on the impacts of the coronavirus pandemic, few Americans would have identified the 1918–1920 "Spanish" flu, a gradual-onset disaster that claimed the lives of 550,000 [1] to 675,000 [2] Americans and caused significant and lasting economic impacts [3] as the worst disaster in American history. Similarly, a resident of Japan might say that the worst disaster suffered in that country was the 1923 Tokyo-Yokohama earthquake, but the risk from the increasing frequency of typhoons and weather-related damage and fatalities due to global climate change will likely outstrip other disasters in damage, disruption and possibly fatalities in the not very distant future. In the broader context of public perceptions, it is not surprising that gradually occurring disasters receive less attention. The rapidly occurring major earthquake, typhoon, flood or fire will dominate headlines in the various news media where one will see vivid images of damage to buildings and infrastructure and read or hear eyewitness accounts of the unfolding disaster

and reports of response efforts. The high visibility of these rapidly occurring disasters will inevitably result in calls for changes in public policy, particularly if there is an identifiable failure like a particular type of structure that performed poorly in an earthquake. In contrast, slowly evolving disasters may receive only sporadic media attention or, more likely, attention to rapidly occurring manifestations of an underlying gradual-onset disaster (e.g., a particularly violent storm exacerbated by global climate change). Lest we overstate our case, gradually occurring disasters like the current coronavirus pandemic do indeed receive media and public attention when their effects become acute, but whether they result in lasting policy change and achieve cultural salience is questionable. Thus, gradual-onset disasters may not receive the public policy attention necessary to mitigate the impacts that will inevitably follow.

Paralleling the low visibility of gradual-onset disasters among the public is the lack of adequate attention to these disasters among social scientists, mainly sociologists. The low salience of gradual-onset disasters in sociological disaster research lies in a conceptual framework in which rapidly occurring disasters like earthquakes, hurricanes, wildfires and other hazard events that unfold in seconds to a few hours have served as a paradigm in which disasters are assessed and to which a significant amount of public policy attention is directed. Anthropologists, by contrast, have been more expansive in scope, emphasizing disasters as processes rather than events and thus are less constrained by definitional limitations that have tended to exclude slowly evolving disasters [4–6]. Nor do we argue that sociologists alone shoulder the responsibility for policy change in regard to disasters, but as sociologists, we must contribute as other disciplines have in addressing the societal implications of gradually occurring disasters. Further, we recognize that there is diversity within the category of gradual-onset disasters and that global climate change and the current pandemic differ in a number of ways. Nevertheless, we have focused on their commonalities; both would be defined as "nondisasters" according to prevailing concepts in sociology; that is, neither is rapidly occurring, spatially limited, conform to the prevailing phased occurrence of a disaster and disaster response and fall within the bounds of prevailing protocols for disaster management.

In this paper, our objective is to explore the manner in which slowly occurring disasters deviate from this paradigm, drawing on observations from the current coronavirus pandemic and global climate change. We will first explore the history of sociological thought regarding natural disasters and how such events have been defined, and the framework for their study has been established. Next, we will explore how two gradual-onset disasters, the current and ongoing coronavirus pandemic and global climate change have challenged the existing conceptual framework in the context of four "borders", which are temporal, spatial, phasing and political, or positioning. We will also examine the concept of vulnerability, whether it transcends these borders or whether it too requires modification. Finally, we will discuss the implications for future disaster research and for public policy. As a caveat, both the coronavirus pandemic and global climate change are ongoing and evolving, so the views we express about the specifics of these disasters must be considered tentative.

2. Concepts, Frameworks and Borders in Sociological Disaster Research: The Literature

Social science and particularly sociological studies of disaster date back at least one hundred years, but the development of a consistent and conceptually coherent framework that has guided the most focused work can be traced to the late 1940's, particularly to the establishment of the Disaster Research Center at Ohio State University in 1963 by E. L. Quarantelli, Russell Dynes and J. Eugene Haas. The Disaster Research Center conducted both laboratory and field studies of various types of disasters, challenged the prevailing myths of post-disaster social break down, documented the emergence of community groups that responded to the many needs of the post-disaster community and produced case studies of the major events of the era [7]. Disaster research pioneer Charles Fritz provided one of the earliest definitions of disaster, which delimited the concept as: "an

event concentrated in time and space, in which a society, or a relatively self-sufficient subdivision of a society, undergoes severe danger and incurs such losses . . . that the social structure is disrupted . . . ," [8] (p. 655). This foundational definition limited the range of inquiry to rapidly occurring hazard events that occur in a limited geographical space and cause disruption to an identifiable social system. Although this definition left open the types of hazard events or processes that could cause disasters, later refinements distinguished between human caused (e.g., war, terrorism, collective violence and climate change), technological (e.g., explosions, nuclear accidents, chemical releases into the atmosphere) and natural disasters (e.g., earthquakes, floods, tornados) [9].

The nearly sixty-year-old definition of a disaster by Fritz begs the question of conceptual clarification during the intervening years and indeed there have been important new ideas, but the temporal and geographical limitations on the concept of a disaster have persisted. In a more recent examination of concepts, Quarantelli and Perry [10] argue against an expansion of the disaster definition to include epidemics (in this case the AIDS epidemic) saying "we are inclined to exclude from the concept of "disaster" all very diffused events, including traditional droughts and famines and certain kinds of epidemics . . . it is best to think of the concept of a disaster as an occasion involving an immediate crisis or emergency" (p. 335). In justifying a narrow definition of disasters, these same authors suggest that slowly occurring disasters like droughts and famines (and presumably, epidemics) create "murkiness", which concise definitions of a disaster and empirical generalizations based on such concepts of a disaster are ill equipped to analyze. Quarantelli and Perry further argue that "we should stop trying to squeeze relatively heterogeneous phenomena under one label (which would) improve not only our theoretical understanding of a disaster phenomena, but create knowledge useful for planning and managing purposes." (p. 334). In summarizing the distinction between rapid and gradual-onset disasters, Dynes [11] states that the existing research is "predominantly Western, community-based, urban, and deals with sudden onset agents from 'natural' causes." Disasters involving slow-onset hazards, in contrast, "involve displaced populations, are predominantly rural, deal with conflict . . . (and) might represent new, previously unseen types of disaster" (p.2). Dynes comparison suggests that slow-onset disasters have mainly occurred in the developing world where famines, droughts and epidemics have been more common than in the developed world, but climate change and the coronavirus are global in scope impacting both developing and developed nations and should be addressed with social scientific concepts that expand to incorporate these disasters.

Closely related to the temporal confinement in conceptions of disaster is the spatial limitation or zoning aspect. While our principal focus will be on the questionable geographic confinement of disasters to sub-global regions, we must acknowledge that zoning is one of the most ubiquitous tools of academic disaster social science and disaster countermeasures for multiple hazards [12]. The zones printed on various types of hazard maps, such as red and yellow zone designations for landslides, maps of flood districts around particular rivers, tsunami hazard maps, and fire perimeter maps, are literal expressions of zoning. The various districts created in response to the Fukushima Daiichi nuclear disaster, such as the "difficult-to-return zone" and "evacuation order cancellation preparation zone," are also, of course, examples of zoning. We may also view geographic designations aimed at disaster prevention and relief, such as the "special zone for reconstruction in response to the Great East Japan earthquake," "Nankai Trough earthquake disaster prevention districts," and "tsunami evacuation plan special reinforcement districts", as examples of zoning more broadly defined. Disaster studies have both affirmed the efficacy of disaster zoning and identified its limits and numerous failures.

Both the efficacy and limitations of zoning to prevent or respond to natural disasters are currently attracting attention from scholars. Research demonstrating efficacy includes a series of studies by Ushiyama [13] and Ushiyama et al. [14], who comprehensively examined the locations where deaths occurred during recent heavy rainfall disasters in Japan. They found that over eighty percent of deaths from flooding and related causes occurred in

low-lying areas where flooding was possible due to topographic features, pointing out that "such incidents can by no means be considered 'unforeseen' if a geomorphological map is consulted" [13] (p. 76). These same authors concluded that ninety percent of landslide deaths in the 2018 rains occurred in or near landslide hazard areas, and other recent disasters showed a similar locational trend for landslides. These data suggest that measures to reduce storm and flood deaths based on zoning, while not perfect, are reasonably effective. On the other hand, certain facts also suggest a downside to zoning. In the well-known warning by Katada (2012) to "not be misled by expectations," one of his three principles of tsunami evacuation is one such example. Tsunami inundation zones on hazard maps are naturally uncertain, and if people mistakenly feel safe because they are in a location outside the map's hazard zone, this can be viewed as a negative result of uncertainties in zoning. In fact, according to Katada, [14] during the Great East Japan Earthquake, 65% of those killed or missing in Kamaishi, Iwate Prefecture, lived outside of tsunami inundation hazard zones. Yamori [15] notes that in many communities—especially those in mountainous regions with challenging topographic conditions—it is impossible to establish a public evacuation site that is not located in a landslide hazard zone, flooding or tsunami hazard zone. Another example is Geller's [16] observation that most of the earthquakes in Japan since 1979 that have caused 10 or more deaths were in areas designated as lower in seismic vulnerability. Area specification of higher earthquake risk has not been so successful.

In another conceptual development consistent with the preferred narrow definition of a disaster is the "disaster cycle", a two-dimensional taxonomy that is both temporal and structural [17,18]. The temporal dimension identifies the sequential phases of a disaster as-preparedness, response, recovery and mitigation. Preparedness includes planning and warning; response is conceptualized as both pre-impact mobilization and post-impact emergency response; recovery is divided into early recovery (6 months or less) and restoration (6 months or more), and mitigation consists of actions and attitudes toward and adoption of adjustments designed to eliminate or reduce the impact of a disaster. The structural dimensions, essentially levels of analysis, are ordered in terms of increased structural complexity to include the individual, group, organization, community, society and global or international levels. The disaster cycle has become a standard paradigm for both the academic study of disasters and a template for emergency management planning for multiple rapid-onset disasters [9]. See Figure 1. The disaster cycle framework has found a receptive audience among disaster planners in that specific actions as well as programs of disaster management are assigned to each phase. Training manuals used by all levels of government, disaster-oriented non-governmental organizations and private sector emergency management divisions often begin with this typology.

Recent papers by Staupe-Delgado [19], Hsu [20] and Fiske and Marino [21] that address the concept of disasters have questioned the validity of a definition that limits disaster to rapidly occurring events. All three of these studies argue for a conceptual reconsideration of the temporal aspect of disasters and advocate greater academic and public policy attention to slowly occurring disasters. The Hsu and Staupe-Delgado articles summarize earlier literature, and point to the disadvantages of narrowly defining disaster temporally in terms of both knowledge production and public policy. Hsu's study is specifically sociological and addresses the need for an expanded typology by addressing slowly occurring or developing disasters. Staupe-Delgado offers a broader multidisciplinary examination of disaster definitions with a focus on rapidly and gradually occurring disasters. The Fiske and Marino study is both a critique of the rapid occurring disaster paradigm and an analysis of climate change as a slowly occurring disaster.

Figure 1. The four phases of disaster (disaster cycle). Source: Hyejeong Park, used with permission.

Hsu provides a detailed critique of the Quarantelli and Perry [10] argument that disasters should be narrowly defined and offers some conceptual guidance to a more expanded temporal typology of disaster. Hsu states that the definition of disaster as rapidly occurring has remained unchallenged until recently and that Quarantelli and Perry's analysis relegated gradual-onset disasters, such as droughts, famines and the incremental spread of disease to consideration as social and ecological problems. The notion of rapidity is relative; in short, disasters that are considered sudden vary in time—while a destructive earthquake will transpire over a few seconds to a few minutes, the approach, warning and landfall of a hurricane will transpire over a period of days. Hsu further argues that the Quarantelli and Perry concept fails to clearly distinguish between disasters as narrowly defined and social and ecological problems in which the earlier analysis classifies slow-onset disasters. The author cites the work of DeMit et al. [22] in justifying a more expanded temporal definition of disaster in that 21st-century disasters have become more complex with impacts that are more protracted in time and space and difficult to manage. Further, following Matthewman [23] and Nixon [24], Hsu points out that disasters are, to a lesser extent, events and, more accurately, processes, which become ongoing adjustments or "slow violence." Hsu concludes by advocating "a temporal definition of disasters that remains sufficiently complex without being overly open-ended" (p.913). In doing so, he draws on the work of Barton [25], who distinguishes situations of collective stress, which are sudden, gradual and chronic (p. 129). Finally, the temporal critique is extended to the spatial –Hsu argues that there is a need to question the assumption that disasters are necessarily concentrated in space, pointing out that "there is a need to understand how disasters circulate around the world and how they can be spatially diffuse" (p. 915).

Adding to the definitional debate is a paper by Staupe-Delgado, who has noted that " . . . elusive and slow-onset hazards represent a large part of the global disaster burden (while) conceptual and policy innovations developed by disaster researchers over the last century mainly draw on research focused on sudden-onset disasters" (p. 623). Staupe-Delgado also points out that the assumed phased occurrence of mitigation, preparedness, response and recovery have relatively well-defined beginnings and endings, which may not characterize slow occurring disasters, and specifically from our perspective, pandemics

and climate change. The author argues that this more traditional view of disasters provides little insight into the nature and unique challenges of gradual-onset disasters and meager guidance for disaster risk reduction policy and practice. In an extensive literature review focusing on the temporal aspect of disasters, Staupe-Delgado found that the few studies addressing slowly occurring disasters focused mainly on adverse impacts but failed to generalize findings to gradual-onset disasters and their unique challenges. The lack of higher-order generalization has resulted in low visibility and neglect of gradually occurring disasters both empirically and theoretically, under prioritization as a research and public policy priority, and fragmented and delayed response or response to rapidly occurring manifestations of underlying gradual processes. In addition, significant in terms of delayed response is the observation of Wisner et al. [26] that gradual-onset disasters like droughts, famines and epidemics often occur in the least developed regions where they are neglected by developed nations until the disaster has become acute.

Fiske and Marino [21] present a cogent critique of disaster defined as rapid in time and geographically concentrated in their paper on global climate change and public policy. Acknowledging that the prototype for both disaster scholarship and public policy has been the rapidly occurring disaster, they describe climate change as "global, gradual, and cumulative over time, and alters the underlying environmental baselines on which disasters occur" (p.139). The baseline referred to in this quote has two aspects derived from the nature of slow-onset disasters: first, the underlying gradual environmental changes that characterize global climate change (e.g., higher sea levels, a warmer atmosphere, etc.) exacerbate the incidence and severity of rapid-onset disasters, and second, the invisibility of climate change and the ever-present possibility that belief systems among the public will be altered toward normalization of increased disaster events, allowing decision-makers to continue to regard slow-onset processes as non-disasters. The impacts of slow-onset disasters, which in addition to global climate change include drought, famine and pandemics, are "death and diaspora, loss of property and community, loss of cultural icons and way of life, and loss of livelihoods" (p. 141). These impacts do not fall upon populations equally, but differentially based on social class, ethnicity, demographic category and certain geographic locations. This observation raises the issue of environmental justice and the vulnerability of marginalized groups in the context of gradual-onset disasters.

The political dimension of disaster, including gradual-onset disasters, is taken up in an older but still relevant paper by Olson [26]. Olson first affirms the political nature of disasters saying, "government officials are confronted with the need to not only manage the situation, but to explain it (that is): what happened, why the losses were so high and/or the response so inadequate, and what will happen now?" (p. 155). Thus, disasters increase demands on the political system and decisions must be made at each of the phases of disaster, which, as modified for slow-onset disasters include pre-recognition, recognition, response, recovery and reconstruction. How decisions are made, and the effectiveness of programs can impact the level of approval of elected or appointed officials and in extreme cases the legitimacy of the political leadership. An extreme example often cited by those who have studied the politics of disaster is the fall of the Samoza regime in Nicaragua fueled by a corrupt and ineffective response to the 1972 earthquake. Olson speaks of "agenda control", which broadly includes the issues, or subset of issues with which governments must deal at a given time. Since not all issues can be addressed, agendas necessarily include a zone or "screen" of non-decision. The author applies these concepts to disasters in declaring that "disasters are political crises because they puncture, at least temporarily, the non-decision-making screens on all the political agendas and thereby place a large number of new, complex and conflictual items on all of the agendas simultaneously – hence the temptation to suppress issues or to define the disaster event in other terms" (p. 162). Agenda control is one aspect of the politics of disaster and the second is what Olson refers to as "constructing meaning, causal stories and blame management" (p. 162–167), processes that seek to control narratives about the significance of events, their causes, the assignment

of responsibility and blame, provide excuses for the occurrence of the event or how it was addressed, and justifications for actions taken or not taken during the course of the disaster.

Closely related to the political dimension of disasters is the expertise that is brought to bear when a disaster occurs, that is, what roles are played by disciplinary experts and how do these experts emerge and claim the authority to define the parameters of the disaster and how well managed is the "hand-off" between those who provide authoritative commentary on the disaster and those who formulate decisions on how the disaster will be managed? Further, a third category of actors must be identified that includes communities either actually or potentially impacted by disaster and the local knowledge that may be consistent with or diverge from that of experts and political decision-makers. The literature in this area is not extensive, but the relationship between these groups can seriously affect the way disasters are understood and the measures taken in response and recovery. More recent work has focused on the importance of local knowledge and engagement by community-based organizations with outside experts and officials in the context of natural and technological hazards [27–29]. This emphasis on community engagement in promoting resilience has been a theme of three generations of "frameworks," the most recent, of which is the Sendai Framework for Disaster Risk Reduction 2015–2030 [30]. While most of the available literature focuses on rapid-onset disasters, we will explore the dynamic of interaction among disciplinary experts, government decision-makers and community-based groups in the context of slowly occurring disasters.

One of the most significant contributions of sociology to the study of disasters is the concept of vulnerability and the many insightful studies that have highlighted the differential impact of disasters, both rapid and gradual based on class, race and ethnicity [31], geographic location and the built environment [32,33], disability [34–36] and various demographic categories, particularly gender [37] and age [7,38]. There is a sense in which the concept of vulnerability contributes to our argument that the temporal and spatial aspects of disaster should be broadened because vulnerability is often a product of long-term social processes that preceded disaster, are exacerbated by it and continue to be present when the acute phase or phases of the disaster have passed. Scholarly assessments of disaster vulnerability rarely consider the temporal dimension, and since disaster agents like global climate change trigger rapid-onset disasters and pandemics have acute phases, we must consider all possible factors that produce differential vulnerability. Tierney [7] provides a thorough summary of studies that address disaster vulnerability, which she defines as "a combination of long-term disadvantages, such as those typically associated with race and social class and situational conditions that vary over time and across communities" (p. 126) and include three dimensions: the hazardousness of place, the built environment and infrastructure, and social vulnerability. The main contribution of sociology and the social sciences, in general, has been this last factor. Tierney, citing Fordham [39], emphasizes the importance of "intersectionality" or the fact that vulnerability is an "amalgamation of factors in place and time that dictates that some groups will be harder hit and less able to recover" (p. 128). Intersectionality implies that vulnerability is not an "intrinsic characteristic of members of particular groups" (p. 127) and acknowledges the fact that vulnerability factors are likely to be multiple and cumulative.

In this brief review of the literature, we have called into question the prevailing conceptual framework that disasters are exclusively rapidly occurring events confined in time and space and proceed predictably and reliably from a discreet hazard event to disaster response followed by recovery and an inter-emergency phase of mitigation and preparedness. Drawing on the insights of three recent papers and the literature they summarize, which challenge this conceptual framework, we will provide observations from the two major slow-onset disasters that are currently impacting our world, global climate change and the coronavirus pandemic. These observations will emphasize, in addition to the need for conceptual clarification of disaster, the implications of these two gradually occurring disasters for public policy and vulnerability. It is important to mention that our intention in this paper is not to reject the important work that has been accomplished by

social science disaster research historically but to expand the concepts to incorporate the most important disasters of our generation and the generations to come.

3. The Dilemma of Gradual Onset Disasters: Discussion

Since the beginning of the 21st century, there have been rapid-onset disasters that have caused devastating impacts. Those, which stand out include the 2004 Indonesia earthquake and Indian Ocean tsunami, the 2005 Hurricane Katrina and the 2011 Great East Japan earthquake and tsunami. These events fell reasonably well within the existing conceptual paradigm of disasters, but the two major disasters that are now ongoing, fall outside the borders of this paradigm and defy easy conceptualization with our current analytical tools are the coronavirus pandemic and global climate change. In this section, we will describe the manner in which current concepts of a disaster fall short in adequately describing and understanding these disasters, which occur in a protracted time frame over months and years and are spatially variable from localized to global. We will point to some aspects of gradually occurring disasters that stretch our understanding of their political management and highlight aspects of a vulnerability that vary from the existing paradigm. Our plan is to examine what is currently known about the coronavirus pandemic and global climate change in the context of four conceptual "borders" in disaster research: the temporal, spatial or zoning, phasing and positioning (status and roles of communities, experts and government decision-makers). We will also address the issues of vulnerability associated with these two slowly occurring disasters.

3.1. Temporal Borders

The temporal dimension of disaster as a concept in disaster sociology has been debated over the last 60 years or so, and the notion of rapidity has won out over attempts to broaden the definition and, over this same period, social scientists have documented and analyzed the prevailing disasters of their generation, which were mostly rapidly occurring. However, current and subsequent generations will face global climate change, a slowly evolving disaster, which will require a long-term coordinated global response, will transpire over decades and may result in some level of adaptation rather than "recovery." One of the downsides of considering slowly occurring disasters as social or environmental problems, as Quarantelli and Perry [10] have argued is that social problems may lack the urgency of disasters and, like racism or economic inequality, which actually are social problems, be treated episodically as the most egregious manifestations of these systemic problems emerge. The episodic nature of the response to global climate change will likely be in the form of response to the most frequent and severe meteorological hazards, the impacts of sea level rise and coastal erosion and other changes that are generated by climate change but occur more rapidly and can be responded to in a more familiar and planned manner. Although global climate change has received considerable attention among "climate" scientists, it has received inadequate attention from social scientists, who could bring the insights of sociology to bear on this issue of existential importance.

Among social scientists who have addressed climate change the recent paper by Fiske and Marino [21] provides several points regarding temporal aspects of global climate change. The prevailing paradigm for scientific understanding of disasters holds that disasters occur rapidly; climate changes are gradual and are "almost imperceptible at any given moment, but lead to permanent changes in the ecology and landscape that will render some homes, communities, and cities uninhabitable" (p. 139). The authors note that there are both public perception and public policy implications of the "invisibility" of global climate change. As the perceived risks of increased and more severe flooding, coastal erosion, and hurricanes (also typhoons in Asia) are accepted by the public over time, they become a new normal, allowing decision-makers to side-step the issues regarding slow-onset processes like climate change as non-disasters.

Like climate change, global pandemics are also slow-onset disasters. According to the World Health Organization (WHO), as of 22 March, 2021, there have been approximately

123 million confirmed cases and 2.7 million fatalities due to the coronavirus pandemic in 223 countries [40]. The exact date of origin in Hubei Province, China, where the coronavirus is believed to have originated, is unknown, but the disease was first reported to the WHO on 31 December 2019, based on cases in Wuhan, Peoples Republic of China. Since that time, the disease has spread throughout the world. Some nations took measures to contain the virus with considerable success (e.g., South Korea, New Zealand and China (including Taiwan)) and others did very poorly (e.g., the United States, Brazil, Italy and India). Successful strategies included isolation of those infected, testing and contact tracing, mask wearing, social distancing, frequent hand washing and shutting down venues where large numbers of people congregate and on a national level, closing borders and restricting travel into and out of the country. Currently, we are 15 months into the pandemic with the resurgence of the virus in regions and nations where precautions have not been rigorously followed. The most analogous previous pandemic disaster was the "Spanish" Flu that began in the fall of 1918 and resurged in three distinct phases until the spring of 1920. The advantage of a century of medical science progress is that the current pandemic is likely to be thwarted by a vaccine that was not possible in the earlier outbreak, and as of this writing, multiple vaccines have been developed, thoroughly vetted and are now available for immunizations on a prioritized basis. The current projection is that multiple independently developed vaccines will be available for general distribution by mid-2021.

One additional aspect of the temporal dimension of disasters deserves mention, and that is that slow-onset disasters are similar to, but not identical with, compound/complex disasters, which may be rapidly occurring but extended by hazards secondary to an initial event. For example, following the 2004 Chuetsu earthquakes, heavy rain triggered landslides extending a disaster that began with a rapid-onset event. The Fukushima Nuclear Power Station accident triggered by the 2011 Tohoku earthquake and tsunami is also categorized as a compound/complex disaster. The two current disasters addressed in this paper present a far greater challenge than those, which are rapidly occurring, confined in space with readily identifiable experts and fall more into the phases of a disaster that are characterized by clearly defined borders with predictable beginning and end states. Having neither established social science concepts to define them nor well-defined plans based on established public policy to combat them, nations are struggling with the long-term prospect of heavy death tolls and social and economic disruption from the pandemic. In the background, while nations struggle to address the pandemic, the relentless evolution of global climate change will continue unabated and manifest itself in more frequent and severe meteorological, atmospheric and hydrological disasters.

3.2. Spatial Borders or "Zoning"

Recall that one component of Fritz's [8] early definition of a disaster was that disasters were events *concentrated in time and space*. Disasters, as narrowly defined, can vary from a relatively small geographic area to multiple nations. Compare, for example, the Great Hanshin-Awaji earthquake of 1995 or the Northridge California earthquake of 1994, which were of limited geographic impact to the 2004 Indian Ocean tsunami that caused casualties and damage in 14 nations. Like rapid-onset disasters, slowly occurring disasters may be confined in space as well. The examples we have cited as slow-onset disasters, droughts, famines and epidemics can be confined to a particular locality or region, but the two major disasters we now confront are global in scope and fall outside the narrow definition established in the early days of social science disaster research. In this section, we will explore the spatial dimension of a disaster as it has been applied and offer some observations and justifications for expanding the definition of a disaster to events, or rather processes, which are global in scope.

The word "pandemic"—the outbreak of a disease affecting many people around the world—is a combination of the Greek words *pan* (all) and *demos* (people). The term itself thus refers to the nullification of spatial borders (universal, to all people in the world). Saeki [41] uses the keyword of political and economic "globalism" to point out that in

the case of the coronavirus, this essential characteristic of infectious diseases becomes remarkably apparent. Indeed, even without mentioning the rapid global spread of the virus, the fact that China and the United States—the two countries at the center of the global economy—are, respectively, its point of origin and current epicenter speaks powerfully to the inseparability of the coronavirus pandemic and globalism. Could we not have sealed off the disease before it became a pandemic? Today, that question is merely empty counterfactual thinking. Yet, the fact that the phrase "sealed off" is rooted precisely in zoning-based ways of thinking deserves attention. The risk originates in nature and is caused by humans, while our sense of safety and security is founded in "zoning." As long as the risk is being controlled through zoning—or rather, as long as it is perceived as being managed in that way—people will not have a strong sense of impending crisis.

This sense of risk confinement through zoning is immediately apparent if we examine the progression of the coronavirus outbreak in Japan. Phrases, such as: "It is something happening in Wuhan," "It is a domestic problem for China," "It is limited to certain types of places like houseboats and cruise ships," and "As long as you do not go downtown . . . " all indicate that zoning lies at the foundation of the public's sense of safety and security. The same can be said of those in infectious disease management positions. Protective measures at airports, the prohibition of travel to or from a certain country, requests for citizens to refrain from frequenting business districts, emergency declarations limited to certain well defined regions, and requests for citizens to refrain from visiting certain jurisdictions are all based on the concept of zoning. Above all, the currently trending term "hot spot" or "cluster" is deeply reflective of the zoning concept. However, it appears that under globalization, this societal trump card has lost its power to solve our most difficult problems.

Climate change is inherently global in that the gradual warming of the planet affects the ocean and atmosphere, causing environmental changes that threaten every nation around the world. It is gradual in that the changes occur incrementally and have been taking place since the early industrial era (see Figure 2). It is also cumulative, and many of the environmental changes caused by climate change will be permanent. Though global in scope, its current negative impacts and the secondary disasters it generates are regional and local. Fiske and Marino [21] note that "climate change is unique (among slow-onset disasters) in that it continuously shifts the ecological baselines through subtle and insidious sea rise, warming oceans and land areas, increasing erosion, and declining sea ice and snowpack" (p. 139). In the context of zoning, some nations, regions and localities will experience acute changes. Japan has experienced more frequent and severe meteorological hazards, including rainfall and typhoons, flooding and landslides. California in the U.S. has experienced climate change-related drought and larger, more frequent fires. Eastern U.S. coastal areas and Alaska face sea-level rise, causing erosion, loss of wetlands, and habitat on islands, peninsulas and low-lying coastal lands. Globally, climate change includes impacts on water resources (e.g., water supplies, water quality, irrigation, hydroelectric generation, and fish habitat); agricultural production (e.g., crop yields, infestations, plant diseases, salt water intrusion); loss of forests due to cutting, disease, fire and drought, and impacts on human health due to food scarcity, thermal stress, degradation of air and water quality and vector-borne infectious diseases [42,43].

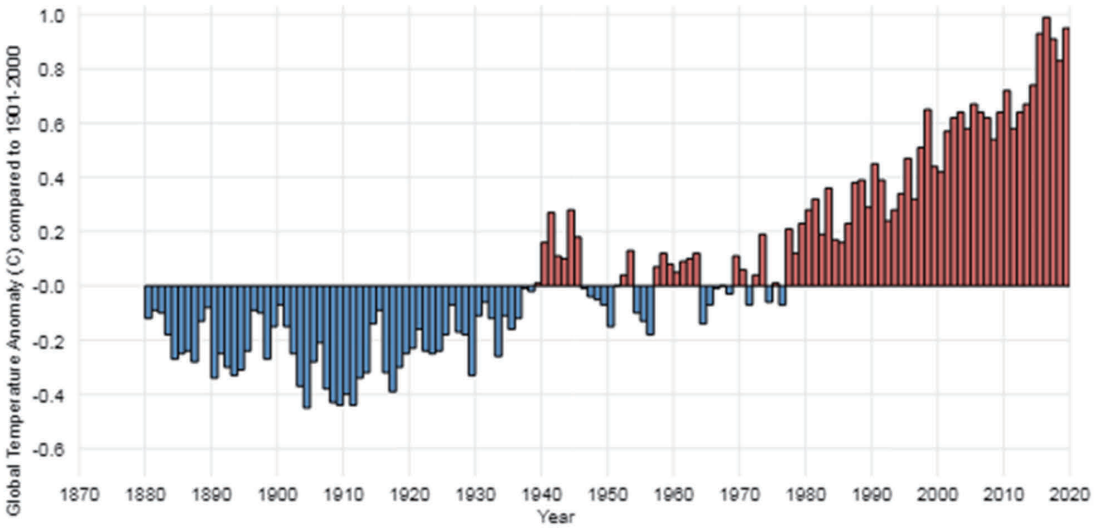

Figure 2. History of global surface temperature since 1880. The five warmest years in the 1880–2019 graph have all occurred since 2015; nine of the 10 warmest years have occurred since 2005. Source: NOAA Climate.gov (authors Rebecca Lindsey and LuAnn Dahlman) [44].

3.3. The Disaster Cycle: Phasing

One of the mainstays of both social science disaster research and disaster planning is the assumption of phased stages of preparedness, response, recovery and mitigation (see Figure 1) as a cycle with more-or-less identifiable beginnings and end states. The second author spent his career in emergency management and planning for various rapid-onset disasters was based on this assumption, and to some significant degree, the agency in which he worked was broken into divisions dedicated to managing and administering these phases. As we noted previously, the assumed phased cycle has served both the social scientist and disaster planner as a template for rapidly occurring disasters like earthquakes, fires, hurricanes and volcanic eruptions. If we are to define disaster more broadly to include slowly occurring disasters, however, the assumption of phased stages becomes opaque and breaks down at several points. We will address this poor fit between the disaster cycle concept and slowly occurring disasters as applied to the coronavirus and global climate change.

Global pandemics like the current coronavirus are rare, though infectious diseases are not, and there have been many epidemics that affected large regions (e.g., Ebola) and specific populations (e.g., HIV-AIDS), and some pandemics of lesser lethality (1957, 1968), but we have not experienced a global pandemic of comparable severity since the 1918–20 "Spanish" flu. The flu pandemic of a century ago occurred in a world that could hardly be labeled "globalized", but the Great War (World War I) simulated globalized conditions as soldiers moved from country to country, facilitating the spread of disease. Since the existence of viruses was unknown at the time, the only defense was the use of masks, distancing, and isolation, strategies difficult or impossible to implement during wartime or during the repatriation of soldiers and displaced populations in its aftermath. That pandemic persisted for approximately two years and had three surges, or acute phases, the second of which occurred in late 1918 and was the deadliest. We digress on the earlier pandemic because we are in the midst of the coronavirus, and much regarding its persistence is not known. In terms of phasing, which is the subject of this section, we can say the following: despite the precedent of epidemics having occurred in the recent past, warnings of a global pandemic and preparedness in advance of its arrival were few and inadequate; response, while in some nations timely, failed to stop the rapid spread of

infections and given the nature of periodic surges, it has never been entirely clear whether we are responding to or attempting to recover from the disease. Perhaps we have witnessed a relatively new phenomenon in disaster evolution that could be termed "response-recovery cycles" in which measures assumed to reduce infections are implemented, appear to be working, and recovery is being achieved only to witness renewed surges in infections, prompting a return to response measures (See Figure 3). Clearly, we have observed ambiguity in the length of response and recovery phases and a lack of clarity as to what phase prevails at any given point.

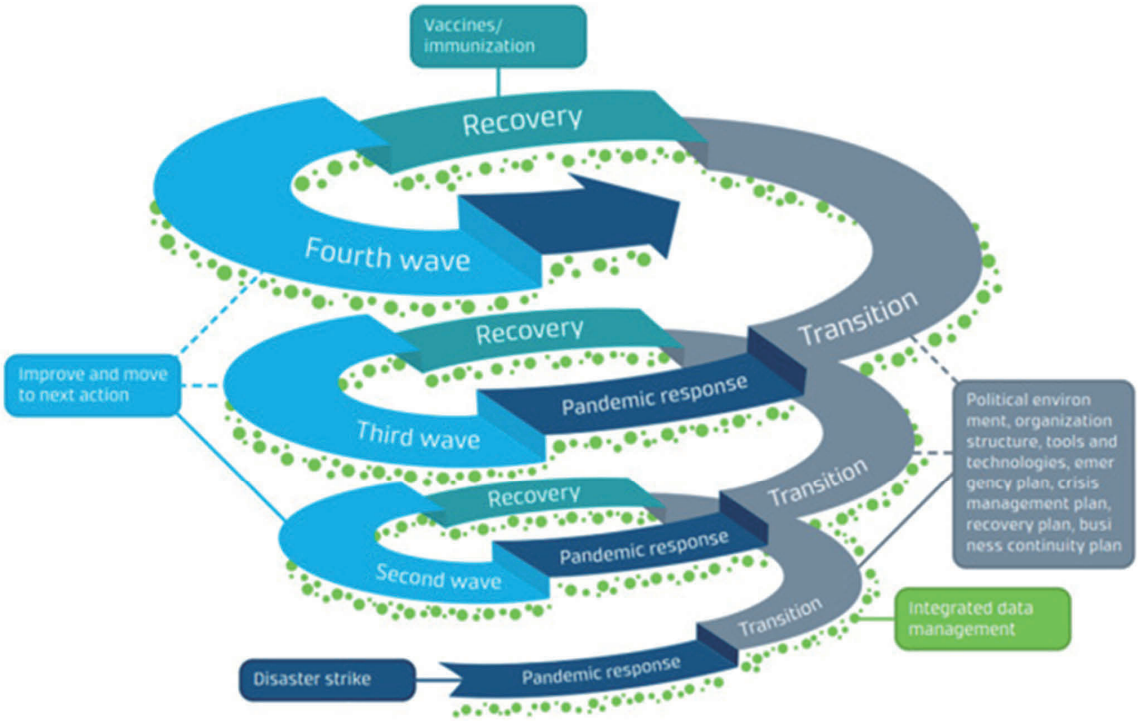

Figure 3. Complex nature of a pandemic management cycle involves "transitioning from pandemic response to recovery in a spiral fashion" [45]. Reproduced unmodified with permission of the author.

At the level of public perceptions, recent survey research in Japan revealed anxiety regarding whether respondents could maintain recommended coronavirus response actions, including handwashing, use of alcohol-based disinfectants, proper etiquette when coughing, use of masks and ventilation of indoor spaces *until the situation is resolved*? Repeated administration of the survey over a two-week interval in April 2020 identified a decline in perceived resolve to continue these measures despite a surge in infections over this same two-week period [46,47]. These results reflect growing anxiety over not knowing when the crisis will end or how long preventive measures will be necessary. Another way to describe anxiety felt during the coronavirus pandemic is to say that it arises from being unable to determine which temporal phase of this disaster we are currently in, even though we believe it will end at some point. Are we *right now* at the peak of the calamity, are we *already* entering the recovery phase, or are we *still* merely in the run-up to a long period of suffering? This uncertainty regarding "phasing" is a consistent background note in the coronavirus pandemic. As a result, anxiety over being too late in our response to the coronavirus pandemic coexists with anxiety and concern over being too early. We believe the former concern is clear in criticisms, such as "Why did Japan's government take so long to declare a state of emergency?" While arguments for a slower response are currently

rare, it is quite possible that in the future, critics will point to the negative impacts of the shutdown and reduced social and economic activity resulting from corporate bankruptcies; a rapid rise in unemployment numbers; the collapse of welfare, health, or educational services; devastating impacts on cultural activities; related psychological devastation; and increasing crime, domestic violence, and divorces. If these negative outcomes reach a level comparable to the direct impacts of the virus, then people may begin to question whether certain prefectural emergency declarations should have been issued or whether requests for self-isolation or school closures were made too early. The inability to fully dispel anxiety over unclear phasing—that is, the uncertainty regarding whether actions were taken too soon or too late, which is the defining temporal characteristic of the coronavirus pandemic—is closely linked to problems in the management of natural disasters according to the prevailing "disaster cycle."

Phasing as applied to global climate change is perhaps more problematic than it is to the pandemic. The impacts of global climate change are profound, universal, and cumulative and pose an existential threat that traditional notions of phased response and recovery fail to address either conceptually or in terms of public policy. Conceptually, climate change has not been readily identified as a disaster per se; rather, it has remained largely uncategorized as an ongoing process that has exacerbated the frequency and severity of rapid-onset disasters. Having no definitional association with a disaster has had the effect of walling off climate change from the analytical tools of social science disaster research and numbing it as an urgent issue of public policy. Being global in scope, it must be addressed in a coordinated international manner, which the Paris (climate change) Agreement was established to facilitate. The accord includes 197 nations with the objective of reducing global greenhouse gas emissions to limit the global temperature increase this century to 2 degrees Celsius above preindustrial levels. The U.S. was a participant in the Paris Agreement until 2017 when the administration of Donald Trump withdrew the nation, denying that climate change was a problem, or even a reality, which obviously made response and mitigation a low priority for the U.S. While it is not defined as a disaster, applying the disaster management paradigm to global climate change is not particularly useful, though there have been efforts to mitigate its effect at a sub-national level in the U.S. Fiske and Marino [21] point out that hazard mitigation policy in the US is poorly adapted to climate change in that it focuses on individual property owners rather than community viability, which climate change mitigation requires.

3.4. Disaster Politics: Positioning

Olson [26] observes that "in any disaster, government officials are confronted with the need to not only manage the situation but also to explain it" (p. 154). Since few political officials are disaster subject matter experts, additional actors become involved depending on the type of expertise required to explain the hazard or disaster agent. Sometimes, multiple experts must play roles. For example, if a major earthquake occurs, seismologists will be called upon to provide the magnitude, location, focal mechanism and other parameters of the earthquake. If a particular class of buildings did poorly in the earthquake, structural engineers might be relied upon to diagnose the failure mechanism. In some cases, the required expertise will be unclear or conflicting. A third set of actors are the emergency managers, members of public agencies, who respond to the earthquake and will typically be mobilized under the authority of political officials, who must be at least titular heads of the response and recovery effort. Finally, there is the public that will be either directly impacted by the event or outside of the impact zone, but close enough to be interested and engaged, and through various organizations, including the news media, assume the important role of observers and potential critics of the progress, or lack thereof, in the government's management of the disaster.

As we have pointed out in previous sections of this paper, slowly occurring disasters are typically defined as something other than disasters and may fall outside the protocols for response to "normal" rapidly occurring events. When slow-onset disasters are recognized,

the disaster cycle, as Olsen points out, must be modified with "pre-recognition" replacing "pre-impact" and "post-recognition" replacing "impact" though response, recovery and reconstruction remain the same [26] (p. 156). While we applaud Olson's recognition that the disaster cycle paradigm must be modified for slow-onset disasters, we feel that response, recovery and reconstruction must be modified as well, particularly the assumption that these phases occur in some systematic manner and have clearly defined beginning and end states. Further, political leaders may or may not acknowledge responsibility for managing and explaining a slow-onset disaster and, to the extent that they do, manage poorly, fail to identify the most appropriate experts, provide inaccurate or inconsistent direction to emergency managers and misinform the public. Unlike most rapidly occurring disasters, slow-onset disasters often involve "tradeoffs" in which preventive measures may have significant negative social and economic consequences making management complex and potentially "no-win" situations for political leaders. Both slow-onset disasters we have dealt with in this paper have required such tradeoffs.

The coronavirus pandemic and global climate change represent complex gradual-onset disasters that have been intensely political in that government officials have struggled, in Olsen's [26] terms, to explain and manage them. As we pointed out earlier, government officials must rely on experts to explain complex hazards. With some hazards, particularly frequently occurring ones like floods, fires, earthquakes and storms, the knowledgeable experts are easily identified and have typically been relied upon in the past. In many cases, these experts are themselves government officials, who are members of science-oriented agencies and provide ongoing advice to government leaders. Slow-onset disasters like the coronavirus pandemic and global climate change present challenges in explaining these complex hazards in that experts may not be readily identifiable, key elements in understanding the hazards may be unknown and clear pathways to effective response may be unavailable. Such disasters may also be rare or sufficiently complex that expertise requires the contributions of multiple disciplines. Both disasters have been difficult for officials to manage and highlight the fact that painful tradeoffs have been necessary for effective response and mitigation. An adequate response has required major changes in large-scale social and economic processes—isolation at home, closure of school and suspension of business activity for the coronavirus and a large-scale transition from fossil fuel energy generation for global climate change.

The coronavirus has proven to be extremely difficult for many political leaders to both explain and manage. Despite warnings from the World Health Organization and awareness of the lethal nature of the disease in January of 2020, US President Donald Trump downplayed the seriousness of the disease, was slow to mobilize a response and constantly questioned and undermined the advice of his own infectious disease experts. Trump had just weathered an aggressive campaign to remove him from office through impeachment, faced a contentious re-election campaign with the election only months away, and the dilemma of a fast-spreading disease with no vaccine and options that meant social and economic disruption through business closures and self-isolation of individuals and families. His response was to deny responsibility and shift the burden of response to the coronavirus to individual states and local governments. State and local responsibility for coronavirus response in the absence of federal government leadership lacked uniformity, put states in competition for vital medical protective gear and equipment and varied from aggressive measures to almost no measures at all. Consequently, the U.S. has experienced the highest death toll in the world, repeated surges of infection and given both poor government response in some regions and a culture of individualism in which many people defied admonitions to wear masks, remain at home to the extent possible, and avoid large gatherings, the development of a vaccine was seemingly the only option for controlling the pandemic. For cases of the coronavirus in selected countries over time, see Figure 4.

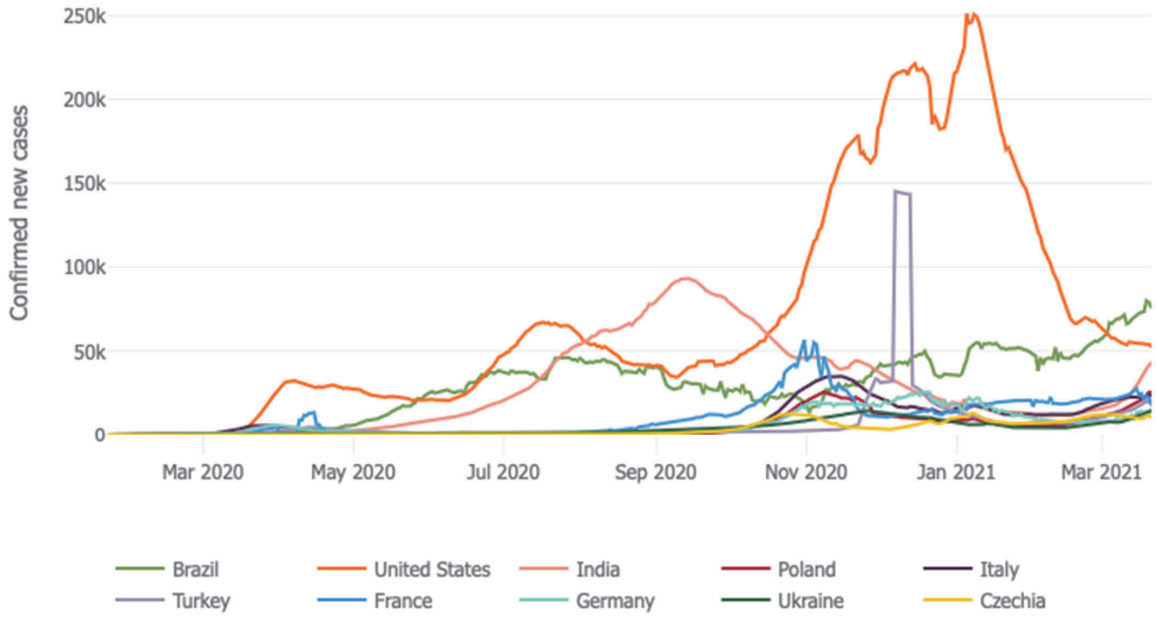

Figure 4. Confirmed cases of the coronavirus in selected nations over time. Source: Johns Hopkins University, Coronavirus Resource Center [48].

In contrast, many nations, particularly island nations, including Japan, have fared better in dealing with the coronavirus based on national leadership, clear and enforceable mandates regarding the suspension of business and in-person education and have more collectivist cultures that are less inclined to demand the right to defy the advice of experts, exposing themselves and others to infection and possible death. Early in the progression of the coronavirus, a program on NHK Japan featured Nobel Laureate Prof. Shinya Yamanaka of Kyoto University, who was tapped for the program on the coronavirus as a medical expert. However, Yamanaka spoke, not as an expert on infectious diseases, which he was not, but as a layperson, who conveyed a sense of the seriousness of the disease and deferred to those who were true experts. For government leaders and the public, this stepping down from expert status by Yamanaka raises important points regarding the interaction between political leaders and subject matter experts. First, it is not always clear in rare slow-onset disasters as to who constitutes an expert and even those who possess expertise may not have all the information necessary to make definitive analyses and recommendations regarding appropriate courses of action. The importance of appropriate expertise in advising political leaders and the public is also reflected in the fact that rumor and misinformation emerge in ambiguous crisis situations to fill any vacuum of authoritative information.

Like the coronavirus, global climate change presents various dilemmas as a political issue. Fundamentally, climate change has not been defined as a disaster, and though it has not on that account become invisible, it has not been treated with the urgency and resolve that characterize hazards, which are so acknowledged. Thus, for political leaders, climate change and the impacts that it has brought about stand as simply one issue among many and may not be of front burner importance. Because climate change has not, at least yet, caused significant impacts in all regions of most countries, it may appear to political leaders as an issue that can be addressed in less than a holistic manner. Management may also be hampered by the necessary sacrifices and economically unattractive tradeoffs associated with major reductions in carbon emissions and conversion from reliance on fossil fuels to cleaner forms of energy. In many nations, including the United States, protecting the fossil fuels industry has prevailed over an aggressive movement to usher in alternate forms of

energy, and the U.S. in 2017 withdrew from the Paris Climate Agreement. For political leaders, identifying experts may also be a challenge since the climate and the changes taking place as a result of global climate change require a multidisciplinary set of specialists. The designation "climate scientist" is nonspecific and, to political leaders, begs the question of who is qualified to make authoritative statements about changes taking place in specific regions and jurisdictions.

Slow-onset events, since they are not regarded as disasters, may be only marginally visible to the public, and their urgency blunted as communities that have not been significantly impacted by them can regard their occurrence as someone else's problem. Even in regions where the frequency and severity of seasonal or other anticipated rapid-onset disasters occur due to global climate change, the gradual ratcheting up of local disasters becomes the new normal. From an emergency management perspective, the contrast between rapid and gradually occurring disasters is even more stark and consequential. In the United States, rapid-onset disasters, once declared as disasters by governmental authorities are met with a wealth of processes and resources to respond and recover. A "declared" disaster that is beyond the response and recovery capability of a local jurisdiction will trigger the implementation of mutual aid pacts, and resources of unaffected jurisdictions will flow to the disaster area. If a disaster is large enough to receive a federal disaster declaration, federal agencies will provide assistance for recovery. In between disasters, jurisdictions from local to federal develop plans, model potential disasters, conduct exercises and provide disaster education to the public. In the United States, state-level emergency management organizations typically have sections or divisions dedicated to the most frequently occurring disasters with specialists, who manage programs and plans, conduct drills and provide educational programs for local jurisdictions and the public. Slowly occurring "non-disasters" like epidemics fall outside the realm of emergency management and are handled by departments of public health or simply not addressed.

3.5. Disaster Victims: Vulnerability

Perhaps the most significant contribution to the study of disasters by social scientists is the detailed understanding of how hazards affect human communities or as Tierney [7] succinctly observes, social scientists, have "focused on disasters, not as physical phenomena, but as social ones" (p. 120). The most consequential bi-product of these analyses over the years has been the knowledge that some categories of people fare significantly worse than others when extreme events occur. While there are many definitions of vulnerability, in our opinion, the most straightforward is that vulnerability consists of "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" [49] (p.11). The capacity to cope, resist and recover from a disaster varies based on factors, including social class, ethnicity, age and gender, as well as non-social factors of geographic location and the built environment. More specifically, disaster vulnerability is often associated with poor people, women, members of racial, ethnic or religious minorities, the elderly and young children, and people with disabilities or chronic health conditions. Lest we assume that vulnerability is an "inherent or intrinsic" characteristic of these groups, Tierney warns that a more nuanced approach is needed in which status disadvantages in disaster situations intersect, with some more salient than others in the specific contexts of disaster [7]. The question that guides our discussion in this section is whether vulnerability in rapid-onset disasters, which constitute the subjects of the bulk of social science disaster research, differs in significant ways from slowly occurring disasters.

Recall that earlier, we quoted Dynes [11], who, in comparing rapid and gradually occurring disasters, observed that slow-onset disasters "involve displaced populations, are predominantly rural, deal with conflict . . . (and) might represent new, previously unseen types of disaster" (p.2). What Dynes had in mind were famines, droughts, epidemics, civil unrest or warfare in predominantly developing nations of the global south. Our emphasis in the quote by Dynes might be better directed at the phrase "and represent new, previously

unseen types of disasters." While global climate change and the coronavirus pandemic are not new or necessarily unforeseen, human-induced climate change is a relatively recent discovery, and a global pandemic had not occurred for a century. Clearly, these gradual-onset disasters are not predominantly rural, nor are they confined to developing nations. Both the coronavirus and climate change affect urban and rural areas and developed and developing nations, are unrelated to warfare or civil unrest, but in the case of climate change, do involve displacement of populations. Keeping in mind Tierney's caution regarding the intersectionality of vulnerability factors, we will now turn to some examples of differential vulnerability in our two gradual-onset disasters.

Although the coronavirus pandemic is ongoing and ultimate outcomes remain unknown, some studies of social vulnerability have been conducted. Karaye and Horney [50], using data from the US Centers for Disease Control (CDC) and employing quantitative methods tested the effects of socioeconomic status (percentage below poverty, percentage unemployed, per capita income and educational attainment), household composition (age, disability, percentage of single-parent households), minority status (percentage minority and English language proficiency) and housing and transportation (percentages of multi-unit structures, mobile homes, residential density, availability of a vehicle and percentage of group quarters). Overall, they found that racial and ethnic minorities, limited English language ability and lack of a high school level education predicted higher coronavirus case counts. The authors noted, however, significant variations within the U.S. in the salience of these factors. For example, as of May 2020, in the states of Washington and Oregon, minority status, language proficiency, household composition and disability were the most salient factors in coronavirus case counts. In the Gulf Coast states, housing and transportation were more predictive of case counts than minority status and language proficiency. In a separate study focusing specifically on disability, Chakraborty [51] employed data on disability characteristics obtained from the 2018 American Community Survey, which define people with disabilities as members of the civilian non-institutionalized population, who reported having serious self-care, hearing, vision, independent living, ambulatory, and/or cognitive difficulties. The author found that people with disabilities, who are Black, Asian, Hispanic, Native American, below the poverty line, under 18 years of age, and female were more likely to contract the coronavirus than people with disabilities, who are non-Hispanic White, above the poverty level, aged 65 or older, and male, after controlling for spatial clustering.

Vulnerability to global climate change would appear at first glance to be mainly associated with a geographic location as the impacts appear to be related to regions where sea level rise threatens coastal communities or areas where climate change has exacerbated the impacts of frequent rapid-onset disasters related to meteorological and wildfire hazards. However, social scientists have noted that vulnerability is not evenly distributed but is "likely to parse the heaviest damages on the most marginalized areas and people, often those who live in low lying delta areas, on small islands, at high altitudes, and in high latitudes" [21] (p.142) [52]. While location is clearly a factor, those who dwell in locations of high environmental hazards are frequently poor, stigmatized or marginalized groups forced to live in hazardous locations as a result of "colonization, housing segregation, forced relocation, isolation and enclosure" [21] (p. 142). In contrast to rapid-onset disasters that may require short-term evacuations, global climate change has required the far more problematic and socially disruptive process of relocation and resettlement. On this point, Oliver–Smith [53] states that "uprooted people generally face the daunting task of rebuilding not only personal lives, but also communities—those relationships, networks and structures that support people as individuals" (p. 124). The disadvantages experienced in resettlement may involve "homelessness, unemployment, marginalization, the loss of neighborhood and community, mental and physical health challenges, and powerlessness" (p.127). These relocation disadvantages are likely to be experienced by people already challenged by historic hardships imposed by class, race or ethnic identity.

4. Conclusions

In the formative years in which disaster sociology was being established, founders like Fritz and Quarantelli were probably justified in conceptually delimiting the field as a means of carving out a niche in an established discipline, which did not address disasters. We feel that it is now time to expand the paradigm to incorporate gradual-onset disasters, the disasters that unfold over periods of months and years and include droughts, famines, epidemics, as well as the current coronavirus pandemic and global climate change. These disasters have claimed millions of lives, destroyed livelihoods, disrupted national economies and required large-scale population displacements. These slow-onset disasters, like those that occur rapidly, have caused extensive, cumulative and permanent damage and imposed significant disadvantages on already socially marginalized groups. The exclusion of gradual-onset disasters from the field of sociology has had consequences in terms of the public visibility of these events, the urgency of public policy to address them and the lack of adequate international frameworks to assure cooperation for those that are global in scope.

We have argued that gradual-onset disasters challenge the conceptual "borders" imposed on the study of disaster and attempted to demonstrate how these borders must be expanded to accommodate a broader conception of disaster. These borders are temporal, spatial, phasing or zoning and positioning. Concepts of social vulnerability, too, must account for a broader set of disadvantages imposed by gradual-onset disasters. We have drawn examples from the two current, gradually evolving disasters that confront our nations and the world. The temporal border must be expanded beyond the parameters of minutes to hours to incorporate disasters that unfold over months, years and even decades. The coronavirus has persisted for over a year at this point, and we know that earlier epidemics have encompassed multiple years. Global climate change has been a process that has spanned more than a century, is cumulative in its effects and may persist for decades to come. Spatial borders must be modified as disasters have become multi-national and global, as exemplified by our two ongoing slowly occurring disasters. The standard sociological model for both the study of disasters and the plans that are intended to address them assume that disasters occur rapidly and pass through phases of response, recovery, mitigation and preparedness and have relatively fixed beginning and end states. Some slowly occurring disasters, particularly epidemics, may display recurring response/recovery cycles that are protracted and persist until treatments are available to end the cycles.

Positioning, which reflects the management of disasters and the roles of various stakeholders, must also be considered in the context of gradually occurring disasters. As we have pointed out, some gradual-onset disasters pose important dilemmas for government leaders due to the difficult tradeoffs necessary to address pandemics and climate change. For many rapid-onset disasters, legal and administrative procedures honed over the course of many disasters and coded into law, facilitate a relatively smooth and efficient response and recovery aided by consensus that these processes and procedures are appropriate. Slowly occurring disasters, particularly those that are rare, lack the legally established foundation for response and recovery and require painful tradeoffs that generate dissensus and conflict, will be particularly difficult to manage. Finally, the concept of vulnerability, so central to sociological analysis of disasters, is perhaps the border with the least requirement for modification to accommodate the addition of gradual-onset disasters into the lexicon of research. While the salience of poverty, race, age, gender, disability and other factors that confer disadvantages vary according to the hazard, these factors also exacerbate the effects of gradual-onset disasters as well as those that occur rapidly. Global climate change may impose the additional burdens of permanent dislocation, resettlement and destruction of habitat to those imposed socially.

In making this argument for expanding the conceptual borders of disaster social science, we join the voices of others who perceive the serious consequences of excluding gradual-onset disasters from the framework for understanding and addressing the pressing

issues brought about by these phenomena. This is not to say that social science alone, or the conceptual changes we have advocated, will make these disasters infinitely more manageable, but they will improve their visibility and perhaps stimulate public policies that improve adaptation and formalize mitigation strategies that will more effectively address their impacts on our communities. The hazards we now face are increasingly global, deadly, destructive and pose ever greater challenges to our resilience as nations and as a global community. We believe it essential to develop the vocabulary to understand them as a necessary step in our collective capacity to effectively respond to and recover from them.

Author Contributions: This paper began as a brief concept paper by K.Y. identifying several "borders" that the coronavirus pandemic transcended if regarded as a disaster. J.D.G. expanded the scope of the analysis to include global climate change, provided a literature review and expanded the analysis to both the pandemic and climate change. Both authors have read and agreed to the published version of the manuscript.

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References

1. Christakis, N.A. *Apollo's Arrow: The Profound and Enduring Impact of Coronavirus on the Way We Live*; Little, Brown Spark: New York, NY, USA, 2020.
2. Morens, D.M.; Folkers, G.K.; Fauci, A.S. Emerging Infections: A Perpetual Challenge. *Lancet Infect. Dis.* **2008**, *8*, 710–719. [CrossRef]
3. Barro, R.; Ursúa, J.; Weng, J. *The Coronavirus and the Great Influenza Pandemic: Lessons from the "Spanish Flu" for the Coronavirus's Potential Effects on Mortality and Economic Activity*; National Bureau of Economic Research: Cambridge, MA, USA, 2020.
4. Faas, A.J.; Barrios, R.; García-Acosta, V.; Garriga-López, A.; Mattes, S.; Trivedi, J. Entangled Roots and Otherwise Possibilities: An Anthropology of Disasters COVID-19 Research Agenda. *Hum. Organ.* **2020**, *79*, 333–3424. [CrossRef]
5. Barrios, R.E. What Does Catastrophe Reveal for Whom? The Anthropology of Crises and Disasters at the Onset of the Anthropocene. *Annu. Rev. Anthropol.* **2017**, *46*, 151–166. [CrossRef]
6. Faas, A.J.; Barrios, R.E. Applied Anthropology of Risk, Hazards, and Disasters. *Hum. Organ.* **2015**, *74*, 287–295. [CrossRef]
7. Tierney, K. *Disasters: A Sociological Approach*; Polity Press: Medford, MA, USA, 2019.
8. Fritz, C.E. Disasters. In *Contemporary Social Problems*; Harcourt Brace: San Diego, CA, USA, 1961; pp. 651–694.
9. Drabek, T.E. *Human System Responses to Disaster: An Inventory of Sociological Findings*; Springer Science & Business Media: Berlin/Heidelberg, Germany, 2012.
10. Quarantelli, E.L.; Perry, R.W. A Social Science Research Agenda for the Disasters of the 21st Century: Theoretical, Methodological and Empirical Issues and their Professional Implementation. In *What is a Disaster? New Answers to Old Questions*; Xlibris: Bloominton, IN, USA, 2005; pp. 325–396.
11. Dynes, R. Expanding the Horizons of Disaster Research. *Nat. Hazards Obs.* **2004**, *28*, 1–2.
12. Petersen, K. Producing Space, Tracing Authority: Mapping the 2007 San Diego Wildfires. *Sociol. Rev.* **2014**, *62*, 91–113. [CrossRef]
13. Ushiyama, M. Relationship between Topography and Victim Caused by Heavy Rainfall Disaster. In Proceedings of the Association of Japanese Geographers, Tokyo, Japan, 24 March 2018; Volume 93, p. 76.
14. Katada, T. *Hito Ga Shinanai Bousai*; Shueisha Inc.: Tokyo, Japan, 2012.
15. Yamori, K. Five Perspectives on a Paradigm Shift in Disaster Studies and Disaster Communication. In Proceedings of the Joint Conference for the 20th Anniversary of the Japan Association for Disaster Information Studies and the 10th Anniversary of the Japan Society for Disaster Recovery and Revitalization, Tokyo, Japan, 26–28 October 2018; pp. 100–101.
16. Geller, R.J. Shake-up Time for Japanese Seismology. *Nature* **2011**, *472*, 407–409. [CrossRef] [PubMed]
17. Mileti, D.S.; Drabek, T.E.; Haas, J.E. *Human Systems in Extreme Environments: A Sociological Perspective*; Institute of Behavioral Science, University of Colorado: Boulder, CO, USA, 1975.

18. Governor's Association Center for Policy Research. *Comprehensive Emergency Management: A Governor's Guide*; Governor's Association Center for Policy Research: Washington, DC, USA, 1979.
19. Staupe-Delgado, R. Progress, Traditions and Future Directions in Research on Disasters Involving Slow-Onset Hazards. *Disaster Prev. Manag.* **2019**, *28*, 623–635. [CrossRef]
20. Hsu, E.L. Must Disasters Be Rapidly Occurring? The Case for an Expanded Temporal Typology of Disasters. *Time Soc.* **2019**, *28*, 904–921. [CrossRef]
21. Fiske, S.J.; Marino, E. Slow-Onset Disaster. *Disaster Disaster Explor. Gap Knowl. Policy Pract.* **2019**, *2*, 139.
22. De Smet, H.; Lagadec, P.; Leysen, J. Disasters out of the Box: A New Ballgame? *J. Contingencies Crisis Manag.* **2012**, *20*, 138–148. [CrossRef]
23. Matthewman, S. *Disasters, Risks and Revelation: Making Sense of Our Times*; Springer: Berlin/Heidelberg, Germany, 2016.
24. Nixon, R. *Slow Violence and the Environmentalism of the Poor*; Harvard University Press: Cambridge, MA, USA, 2011.
25. Barton, A.H. Disaster and Collective Stress. In *What is a Disaster? New Answers to Old Questions*; Xbilris: Bloomington, IN, USA, 2005.
26. Olson, R.S. Toward a Politics of Disaster: Losses, Values, Agendas, and Blame. *Crisis Manag.* **2000**, *18*, 154.
27. Park, H. Development of a Community-Based Natech Risk Management Framework Through the Lenses of Local Community, First Responders and Government. Ph.D. Thesis, Kyoto University, Kyoto, Japan, 2020.
28. Maskrey, A. Revisiting Community-Based Disaster Risk Management. *Environ. Hazards* **2011**, *10*, 42–52. [CrossRef]
29. Wisner, B. Bridging "Expert" and "Local" Knowledge for Counter-Disaster Planning in Urban South Africa. *GeoJournal* **1995**, *37*, 335–348. [CrossRef]
30. United Nations Office for Disaster Risk Reduction. *Sendai Framework for Disaster Risk Reduction 2015–2030*; United Nations: New York, USA, 2015; p. 32.
31. Bolin, B.; Kurtz, L.C. Race, Class, Ethnicity, and Disaster Vulnerability. In *Handbook of Disaster Research*; Rodríguez, H., Donner, W., Trainor, J.E., Eds.; Handbooks of Sociology and Social Research; Springer International Publishing: Cham, Switzerland, 2018; pp. 181–203. ISBN 978-3-319-63253-7.
32. Perrow, C. *The Next Catastrophe: Reducing Our Vulnerabilities to Natural, Industrial, and Terrorist Disasters*; Princeton University Press: Princeton, NJ, USA, 2011.
33. Hewitt, K.; Burton, I. *Hazardousness of a Place: A Regional Ecology of Damaging Events*; Department of Geography; University of Toronto: Toronto, ON, Canada, 1971.
34. Kelman, I.; Stough, L.M. (Dis)Ability and (Dis)Aster. In *Disability and Disaster*; Kelman, I., Stough, L.M., Eds.; Palgrave Macmillan: London, UK, 2015; pp. 3–14. ISBN 978-1-137-48599-1.
35. Wisner, B. *Disability and Disaster: Victimhood and Agency in Earthquake Risk Reduction*; Newcastle upon Tyne; Northumbria University: Tyne, UK, 2002.
36. Tierney, K.; Petak, W.J.; Hahn, H. *Disabled Persons and Earthquake Hazards*; Program on Environment and Behavior Monograph; University of Colorado: Boulder, CO, USA, 1988.
37. Enarson, E.; Fothergill, A.; Peek, L. Gender and disaster: Foundations and directions. In *Handbook of Disaster Research*; Springer: Berlin/Heidelberg, Germany, 2007; pp. 130–146.
38. Bolin, R.; Klenow, D.J. Response of the Elderly to Disaster: An Age-Stratified Analysis. *Int. J. Aging Hum. Dev.* **1983**, *16*, 283–296. [CrossRef]
39. Fordham, M.; Lovekamp, W.E.; Thomas, D.S.; Phillips, B.D. Understanding Social Vulnerability. *Soc. Vulnerability Disasters* **2013**, *2*, 1–29.
40. World Health Organization Coronavirus Disease (Covid-19: Numbers at a Glance). Available online: Covid19.who.int (accessed on 22 March 2021).
41. Saeki, K. The Surprising Fragility of Contemporary Civilization: Recommendations from a Different Perspective (Special Feature). *Asahi Shinbun*, 2020.
42. Lee, H. *Intergovernmental Panel on Climate Change*; World Merteorological Organization: Geneva, Switzerland, 2007.
43. Watson, R.T.; Zinyowera, M.C.; Moss, R.H. *The Regional Impacts of Climate Change*; International Panel on Climate Change: Geneva, Switzerland, 1998.
44. Lindsey, R.; Dahlman, L. *Climate Change: Global Temperature*. Available online: climate.gov (accessed on 22 March 2021).
45. Fakhruddin, B.S.; Blanchard, K.; Ragupathy, D. Are We There yet? The Transition from Response to Recovery for the COVID-19 Pandemic. *Prog. Disaster Sci.* **2020**, *7*, 1–5. [CrossRef]
46. Survey Research Center National Questionnaire Survey on the Novel Coronavirus. Available online: http://www.surece.co.jp/research/3327/ (accessed on 30 April 2020).
47. Survey Research Center Second National Questionnaire Survey on the Novel Coronavirus. Available online: https://www.surece.co.jp/research/3327/ (accessed on 17 February 2021).
48. Johns Hopkins University Coronavirus Resource Center. Confirmed Cases of the Coronavirus in Selected Nations over Time. Available online: https://coronavirus.jhu.edu/ (accessed on 17 February 2021).
49. Wisner, B.; Blaike, P.M.; Blaike, P.; Cannon, T.; Davis, I. *At Risk: Natural Hazards, People's Vulnerability and Disasters*; Routledge: New York, NY, USA; London, UK, 2004; ISBN 0-415-25215-6.

50. Karaye, I.M.; Horney, J.A. The Impact of Social Vulnerability on COVID-19 in the US: An Analysis of Spatially Varying Relationships. *Am. J. Prev. Med.* **2020**, *59*, 317–325. [CrossRef] [PubMed]
51. Chakraborty, J. Social Inequities in the Distribution of COVID-19: An Intra-Categorical Analysis of People with Disabilities in the US. *Disabil. Health J.* **2021**, *14*, 101007. [CrossRef] [PubMed]
52. Fiske, S.J.; Crate, S.A.; Crumley, C.L.; Galvin, K.; Lazrus, H.; Lucero, L.; Oliver-Smith, A.; Orlove, B.; Strauss, S.; Wilk, R. Changing the Atmosphere: Anthropology and Climate Change. Final Rep. AAA Glob. Clim. Change Task Force 137. 2014, pp. 1–144. Available online: https://s3.amazonaws.com/rdcms-aaa/files/production/public/FileDownloads/pdfs/cmtes/commissions/upload/GCCTF-Changing-the-Atmosphere.pdf (accessed on 17 February 2021).
53. Oliver-Smith, A. Sea Level Rise and the Vulnerability of Coastal Peoples: Responding to the Local Challenges of Global Climate Change in the 21st Century. 2009. Available online: https://collections.unu.edu/view/UNU:1861 (accessed on 17 February 2021).

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