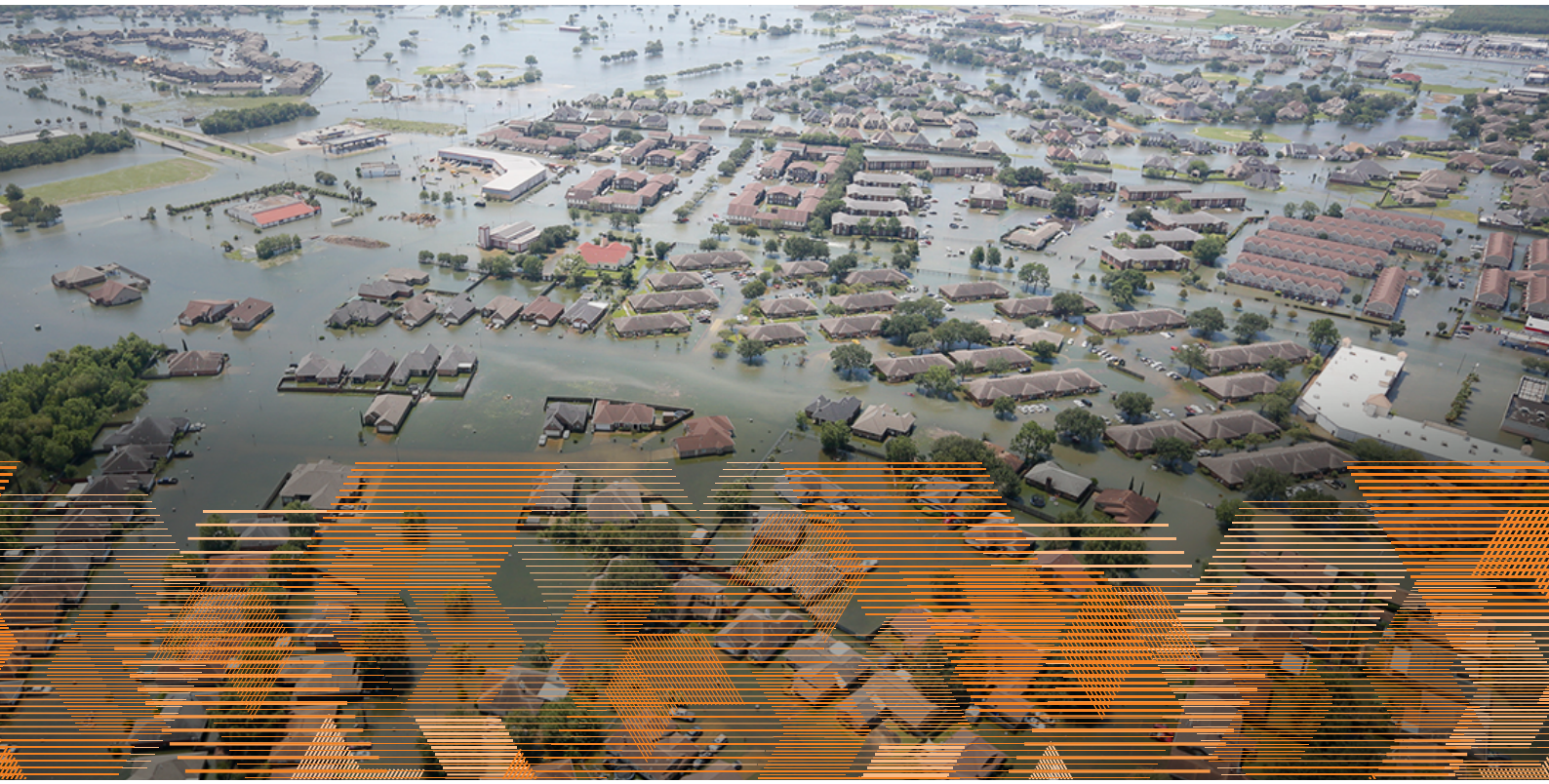
WHITE PAPER

Disaster science in the context of the human death toll and economic burden of natural disasters

Selected analyses from the 2017 report
A Global Outlook on Disaster Science



EXECUTIVE SUMMARY

Disasters destroy and displace lives and cause loss of property and damages to infrastructures. Population increase and climate change have intensified disaster impact, and now more than ever science has a key role to play in disaster management. In this white paper, we examine disaster science scholarly output in the context of the human death toll and economic burden of natural disasters.

While there were over 27,000 disaster science papers published 2012-2016, this represents only 0.22% of the global scholarly output in that period. The publications' geographical distribution is roughly consistent with general patterns: prolific countries overall tend to have relatively large outputs in disaster science. While Asia appears to have a central position in the disaster science field, many developing countries highly affected by disasters worldwide publish few disaster science papers.

This disconnect brings up the issue of knowledge transfer between geographies. Is local research in the countries most affected by disasters needed to effectively reduce disaster risks and impacts? To what extent could international collaboration help? Further analysis is needed, especially to explore the current state of collaboration in disaster science research, and how it might be leveraged for better outcomes

ELSEVIER

Selected analyses from the 2017 report *A Global Outlook on Disaster Science*

1. Introduction

Population increase and climate change have intensified disaster impact, in both human and economic terms. In a global context, disaster management appears in most of the United Nations (UN) 17 Sustainable Development Goals (SDGs).

As advocated in the *Sendai Framework for Disaster Risk Reduction 2015-2030*[1] adopted in 2015 by 187 UN member states, science and technology have an important role to play in in practical risk reduction and in supporting response and recovery after disasters.

With the report *A Global Outlook on Disaster Science*, Elsevier, together with institutional partners and experts, provides a quantitative analysis of disaster science research from 2012 to 2016. The report studies global scholarly output and specific topics being researched on different types of disasters. It also examines disaster science research conducted in 10 individual countries in the Americas, Asia, and Europe. One of the novel analyses presented in the report is the examination of disaster science in the context of the human toll and economic burden of natural disasters, which is also the focus of this white paper.

2. Results & Discussion

Despite the significant impacts of disasters, the 27,273 disaster science papers published globally in 2012-2016 represent only 0.22% of overall scholarly output. These publications' geographical distribution is roughly consistent with general patterns: prolific countries overall tend to have relatively large outputs in disaster science. China and the USA have the largest number of recent papers in the field followed by Japan and the United Kingdom. Beyond China and Japan, other Asian countries are also relatively specialized in disaster science. This is not surprising, given Asia's proneness to disasters.

It is estimated that 1.35 million lives have been taken by natural disasters in the past 20 years[2]. This human toll is unevenly spread across regions, and is particularly heavy in Asia. Country and population size influence the absolute numbers but are not the only factors: Haiti alone suffered nearly 230,000 deaths from natural disasters in 2004-2013. It is also the country that is most affected when deaths are normalized by population size, followed by Myanmar and Sri Lanka. These countries and many developing areas of the world with the heaviest relative human death toll from disasters are however limited in scholarly output in disaster science (see Figure 1).

It is estimated that natural disasters cost USD 250-300 billion per year[3]. They are also unequally distributed, with several large countries heavily affected in absolute terms. When this economic burden is normalized by GDP, Haiti again appears particularly impacted, in second place behind Belize. The top 10 countries on the list are mostly from Africa and Asia, reflecting the heavy economic burden that disasters can have on emerging economies. In fact, many developing areas of the world with the highest relative burden of disaster cost are limited in scholarly output in disaster science (see Figure 2).

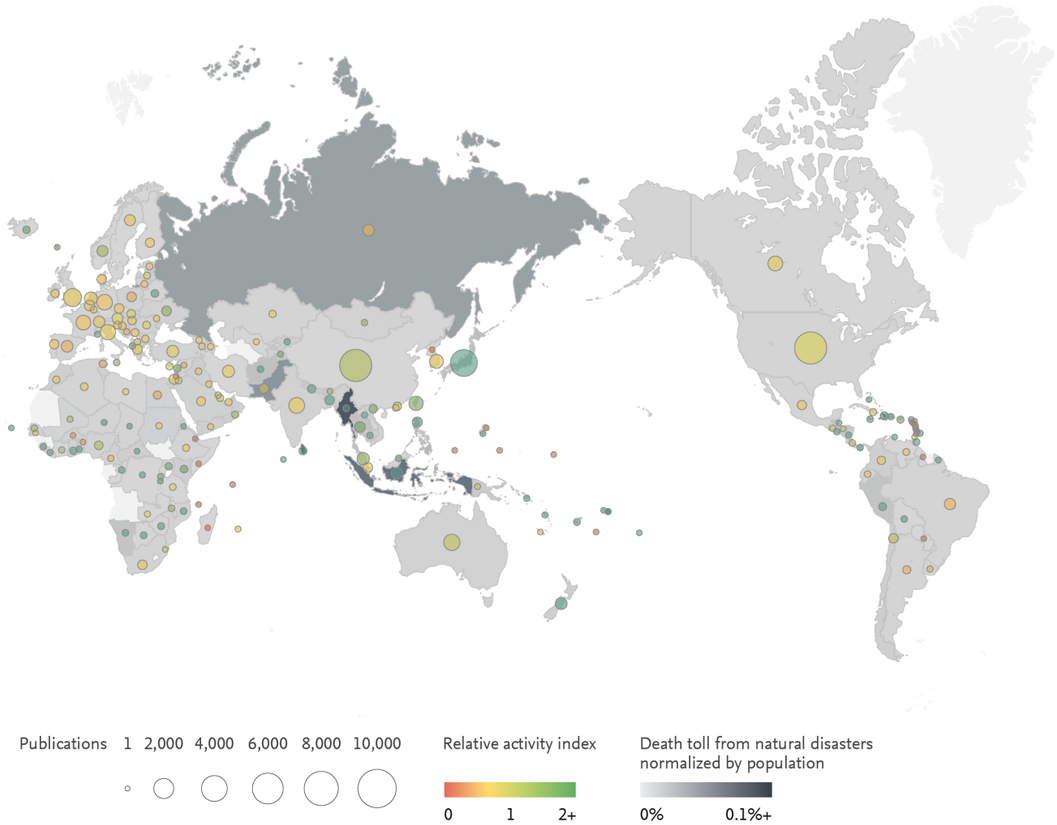


FIGURE 1: 2004-2013 natural disasters death toll as a share of population (shade of country), disaster science 2012-2016 scholarly output (size of circle), disaster science 2012-2016 relative activity index (RAI, color of circle); sources: Scopus®, IFRC 2015 Disaster Report, World Bank, and Taiwan Statistical Data book

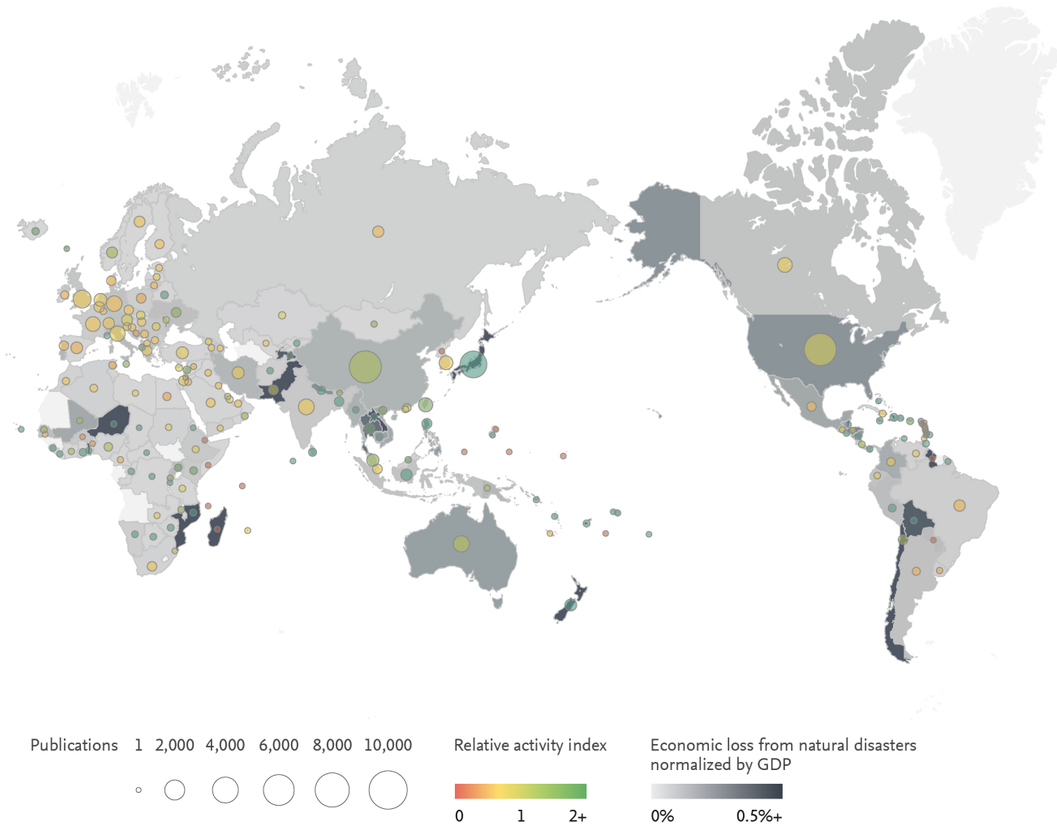


FIGURE 2: natural disasters economic loss, calculated as the most recent available rolling annual average loss normalized to the most recent available annual GDP (shade of country), disaster science 2012-2016 scholarly output (size of circle), disaster science 2012-2016 relative activity index (RAI, color of circle); sources: Scopus®, Global Assessment Report on Disaster Risk Reduction Cycle 2015, and World Bank.

Countries heavily affected by disasters do not appear to conduct more disaster science. Disaster burden, both human and economic, is unevenly distributed. However, the proportion of countries with strong disaster science specialization is higher among countries with a relatively heavy normalized death toll or economic burden than among countries with a relatively low normalized death toll or economic burden.

Countries with the highest death tolls from natural disasters tend to have low scholarly output in disaster science. Conversely, countries with the most disaster science papers tend to suffer relatively low death tolls. These countries also tend to have high economic loss from natural disasters. Countries with the largest scholarly output in disaster science are intensive research nations with high overall scholarly output. One underlying variable in the distribution of disaster science may therefore be overall GDP. Typically, a higher GDP allows larger investment in research leading to more scholarly output. A higher GDP may also result in a resilient infrastructure that can help reduce the human toll, but may also be more complex and expensive, and therefore lead to greater economic loss.

3. Conclusion and future outlook

Despite the consequent impacts of disasters and key role science plays in the implementation of the *Sendai Framework for Disaster Risk Reduction*, disaster science represents only 0.22% of the world's total scholarly output. While Asia appears to have a central position in the disaster science field, many developing countries worldwide are highly affected by disasters but publish few disaster science papers.

This poses the question of the transferability of research results between geographies. Is local research in the countries suffering from the highest disaster burden necessary to effectively reduce disaster risks and impacts and could the gap be bridged through international collaboration?

Collaborations, notably between research-intensive nations and developing nations, can improve disaster science scholarly output and impact. Further analysis is needed, in particular, to explore how collaboration in disaster science research, might be leveraged to help achieve better outcomes for all.

4. Methodology

Disaster science is a complex field requiring expertise across scientific disciplines. To define the field for our analyses, we adopt a keyword search approach focusing on those publications that explicitly adopt a disaster science perspective, while also relying on the knowledge of disaster science experts (listed in the report's Appendix A). A full definition of search criteria is available in the report's separate Appendix D.

In our analysis, a paper or publication refers to an article, review, or conference proceeding indexed in Scopus®. Scholarly output for a country is the count of articles with at least one author in that country, according to the author bylines in publications. All analyses make use of whole counting. For example, if a paper has been co-authored by one author in Japan and one author in the USA, then that paper counts towards each country's scholarly output. Total counts for each country are the unique counts of publications.

To make these scholarly output data more comparable across countries of different sizes and with different resources, we use a relative activity index (RAI) calculated by dividing the share of a country's output relative to the share of the world's output. This indicator therefore represents how concentrated a country's output is in a particular area relative to the world average, and can be used to analyse specialization. For instance, 0.66% of Japan's scholarly output is in disaster science, compared to 0.22% of the global scholarly output. Japan's RAI in disaster science is therefore 0.66/0.22=3.

We use disaster death toll data featured in the *International Federation of Red Cross and Red Crescent IFRC 2015 World Disasters Report*[4]. To make these disaster economic data more comparable across countries, we normalize them by population data from the World Bank and Taiwan Statistical Data book. We also use disaster economic loss data featured in the *Global Assessment Report on Disaster Risk Reduction Cycle 2015*[5] at our experts' recommendation. To make these disaster economic data more comparable across countries, we normalize them by GDP data from the World Bank.

1. http://www.unisdr.org/we/inform/publications/43291
2. United Nations Office for Disaster Risk Reduction (UNISDR). *Poverty & Death: Disaster Mortality 1996-2015.* https://www.unisdr.org/we/inform/publications/50589
3. United Nations Office for Disaster Risk Reduction (UNISDR). *Global Assessment Report on Disaster Risk Reduction 2015.* http://www.preventionweb.net/english/hyogo/gar/2015/en/home/GAR_2015/GAR_2015_6.html
4. http://ifrc-media.org/interactive/world-disasters-report-2015/
5. https://www.unisdr.org/we/inform/publications/42809