Part 3

Disaster Preparedness for Response

CHAPTER 20

Military Response to Natural Disasters: The Resilience of Affected Nations

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Abstract

Humanitarian response efforts are difficult to predict because many variables impact the final decision. Previous research on the topic of military assistance has focused on the strength of the cyclone or earthquake as the dominant factor. The kinetic force behind a natural disaster is important, but many other elements influence the request for United States' aid. Resilience factors such as the infrastructure's ability to withstand the disaster impact the nation's ultimate decision to request external help. If their local structures and support instruments are robust enough, assistance will not be necessary. This paper analyzes over 40 years of the United States military humanitarian response; over 300 military operations were reviewed and coded based on the nature of the disaster, the impacted country, Bundhis Entwicklong Hift WorldRiskIndex susceptibility value and FM Global Resilience Index natural hazard risk quality value. The results showed foreign countries will likely request the United States military aid if their susceptibility value was less than 28.8 and their natural hazard risk quality value was less than 37.7. The results of this study will assist the geographic combatant commands in determining future military response requirements.

Keywords: Natural Disaster, Military, Resilience, Humanitarian

1. Introduction

In a previous study, the United States military's response to natural disasters was evaluated by completing a 40-year analysis of humanitarian aid.[1] The results provided geographic combatant commanders the capability to predict government response for future earthquakes, cyclones, and floods. This paper expands on that research by examining the vulnerability of the impacted nations rather than the power of natural disaster. The analysis starts with a historical summary of resilience and its relationship to humanitarian response. Then, military responses are evaluated to determine the impacted nation's exposure and risk, susceptibility and structural vulnerability, and coping capacity. The paper concludes with suggestions for future research. The results of this study will help geographic combatant commanders forecast the need for United States assistance in future natural disasters.

2. Background

Humanitarian response efforts are difficult to predict because many variables impact the final decision. Previous research on the topic of military assistance focused on the strength of the storm or earthquake as the dominant factor. The kinetic force behind a natural disaster is important, but many other elements influence the request for United States' aid. Resilience factors such as the infrastructure's ability to withstand the storm or the government's capacity to assist its citizens all impact the nation's ultimate decision to request external help. If their local structures and support instruments are robust enough, assistance will not be necessary.

A detailed understanding of a community's resilience will shed light on their vulnerabilities and help determine the requirement for external assistance. A 7.4 earthquake in Juba, the capital of South Sudan, will likely require more external support than in The Hague, Netherlands—a similar size city

[1] Chad A. Long, "Identifying the Strength of Cyclones and Earthquakes Requiring Military Disaster Response." International Journal of Environmental and Ecological Engineering 14, no. 8 (2020): 185-189.

with respect to population.[2] The Hague is more resilience based on the original definition, "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationship between populations or state variable."[3] Life in South Sudan would be devastated after the earthquake, as they do not have the infrastructure in place to reduce the impact of the disaster or the emergency response facilities available to aid a population in need. South Sudan is used as an example because this population is particularly vulnerable, which is different from a lack of resilience. South Sudan has an estimated 1.25 million people who are on the brink of starvation often just eating wild plants and dry-roasted cow's blood.[4] Vulnerability is an inherent characteristic of a population that exists pre-event, making them more susceptible to harm.[5] This differs from resilience which is the ability of a population to "respond and recover from disasters and includes those inherent conditions that allows the system to absorb impacts and cope with an event, as well as post- event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat."[6] Resilience takes into account the vulnerability of the population and their ability to control and manage the effects of the event, while vulnerability is an assessment of the population's pre-disaster capabilities.

It is possible to examine a nation's vulnerability through many dimensions such as infrastructure, geography, and demographics. All cities are vulnerable to a nuclear attack, but a 7.0 magnitude earthquake will not decimate all communities. San Francisco sells condos which are designed to withstand earthquakes with magnitudes as large as 8.0 on the Richter scale.[7] Building safety, commonly assessed by the age of the building, number of stories, and construction type, is a vital indicator of the seismic vulnerability of a nation's infrastructure.[8] There are many geographical elements, such as floodplain levels and fault line locations, which impact the risk for a community. The geographic factors do not need to be natural; human-made elements can also be a risk for the populations—such as the levee system failure that caused the flooding in New Orleans after Hurricane Katrina.[9] Demographics are another factor that influence the recovery effort; young children and elderly members in the affected area require unique caregiving which depletes the available labor pool for the recovery effort. These are just a few of the many factors that help define the resilience of a region.

Many different models examine resilience, but only a few compare and index areas around the globe. When examining urban areas, the Rockefeller Foundation funded City Resilience Index is arguably the most robust assessment available. This tool evaluates cities on health and well-being, leadership and strategy, infrastructure and ecosystems, and the economy and society displaying the qualitative resilience performance of the region based on 12 specific goals. Figure 20.1 is a graphical display of the City Resilience for Arusha, Tanzania and Carlisle, Pennsylvania.

When comparing the two cities, it is apparent that Carlisle is much more resilient and that Arusha has a critical gap in comprehensive security and the rule of law. While the City Resilience Index does an excellent analysis of a single urban area, both FM Global and Bundnis Entwicklung Hift (BEH) evaluate the overall resilience of a country. The FM Global Resilience Index has more of a business slant in its evaluation of 130 nations examining economics, supply chain, and risk quality. These three factors are further broken down into four drivers, displayed in Table 20.1. The FM Global Resilience Index ranked Switzerland number one in 2018 for the high quality of its infrastructure, stable political situation, low corruption, and economic productivity.[10] Haiti was on the opposite end of the scale ranking 130 out of the 130 countries evaluated.[11] This nation struggles with limited financial capabilities, massive exposure to natural disasters, and poor

[2] "Population of Cities in South Sudan (2019)," assessed January 17, 2019. http://worldpopulationreview.com/countries/south-sudan-population/cities/; "Netherlands Population 2019," assessed January 17, 2019. http://worldpopulationreview.com/countries/netherlands-population/.

[3] Crawford S. Holling, "Resilience and stability of ecological systems," *Annual review of ecology and systematics* 4, no. 1 (1973): 14.

[4] Sam Mednick, "'Hunger is killing me': starvation as a weapon of war in South Sudan," *The Guardian*, last modified January 10, 2018. https://www.theguardian.com/global- development/2018/jan/10/brink-starvation-south-sudan-equatoria; Mike Pflanz, "A desperate struggle against starvation in South Sudan," *UNICEF*, last modified August 25, 2014. https://www.unicef.org/southsudan/stories_15299.html

[5] Adger, W. Neil, "Vulnerability," *Global environmental change* 16, no. 3 (2006): 268-281.

[6] Susan L. Cutter, Lindsey Barnes, Melissa Berry, Christopher Burton, Elijah Evans, Eric Tate, and Jennifer Webb, "A place-based model for understanding community resilience to natural disasters," *Global environmental change* 18, no. 4 (2008): 599.

[7] Scott Lucas, "181 Fremont goes beyond code, a selling point in wake of Millennium Tower mess," last modified October 26, 2017. https://www.bizjournals.com/sanfrancisco/blog/real- estate/2016/10/creq-181-fremont-millennium-towers-structural-code.html.

[8] B. Sungay, E. Cakti, and M. Erdik. "Discussing vulnerability, capacity and resilience of the community in the face of earthquakes at a microscale." Bogazici University, Kandilli Observatory & Earthquake Research Institute. WCEE (2012).

[9] Douglas Brinkley, "The Broken Promise of the Levees That Failed New Orleans," Smithsonian, last modified September 2015. https://www.smithsonianmag.com/smithsonian-institution/broken-promise-levees-failed-new- orleans-180956326/.

[10] "Resilience Index Executive Summary," *FM Global*, assessed January 18, 2019. https://www.fmglobal.com/~/media/Files/FMGlobal/Resilience%20Index/Resilience_Summary. pdf?la=en.

[11] Ibid.

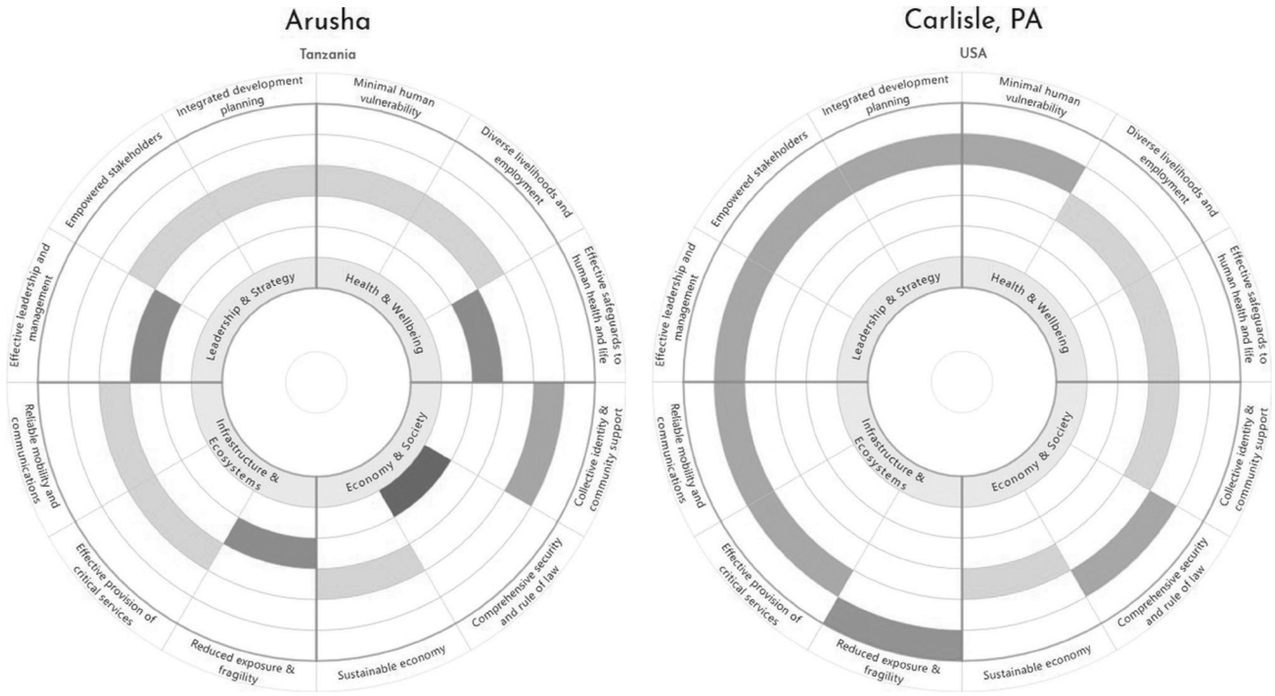

Fig. 20.1 City Resilience for Arusha, Tanzania and Carlisle, Pennsylvania[12]

Table 20.1 FM Global Resilience Index factors and drivers[13]

Economic	Supply Chain	Risk Quality
Productivity	Supply Chain Visibility	Inherent Cyber Risk
Political Risk	Local Supplier Quality	Fire Risk Quality
Oil Intensity	Quality of Infrastructure	Natural Hazard Risk Quality
Urbanization Rate	Control of Corruption	Exposure to Natural Hazards

infrastructure. The resilience of a society is a critical element when determining the requirement for outside assistance following a natural disaster.

The BEH WorldRiskIndex evaluates countries from a more humanitarian perspective. Each state is measured concerning two spheres of influence—natural hazards and societal.[14] The natural hazard sphere assesses a countries risk for future disasters such as drought, earthquakes, and floods. This sphere is also called "exposure" and is the nation's risk based on how susceptible the land is to prospective natural disasters. Haiti has a much higher exposure value than Iceland based on the cyclone activity caused by warm waters and Haiti's proximity to seismic fault lines. The societal sphere examines a nation's vulnerability by gathering data on 27 indicators that describe the society's susceptibility, adaptability, and coping mechanism.[15] Susceptibility is the nation's likelihood of suffering harm following an event. Its major indexes include housing conditions, poverty, the percentage of children and elderly, and economic capacity. Adaptability is the country's long term plans and goals for societal change. The value is calculated by combining scores for gender equality, education, and investment in public health and ecosystem protection. Adaptability has a long-term impact on a society's resilience but is not hugely relevant concerning immediate

[12]"Cities – Qualitative Resilience Profile," assessed January 18, 2019. https://www.cityresilienceindex.org/#/city-profiles.
[13]"How Resilient is your business?," *FM Global*, assessed January 18, 2019. https://www.fmglobal.com/~/media/Files/FMGlobal/Resilience%20Index/Resilience_Graphic.pd f?la=en.
[14]"WorldRiskReport 2018," *Bundnis Entwicklong Hift*, assessed January 18, 2019. https://weltrisikobericht.de/english-2/.
[15]Ibid.

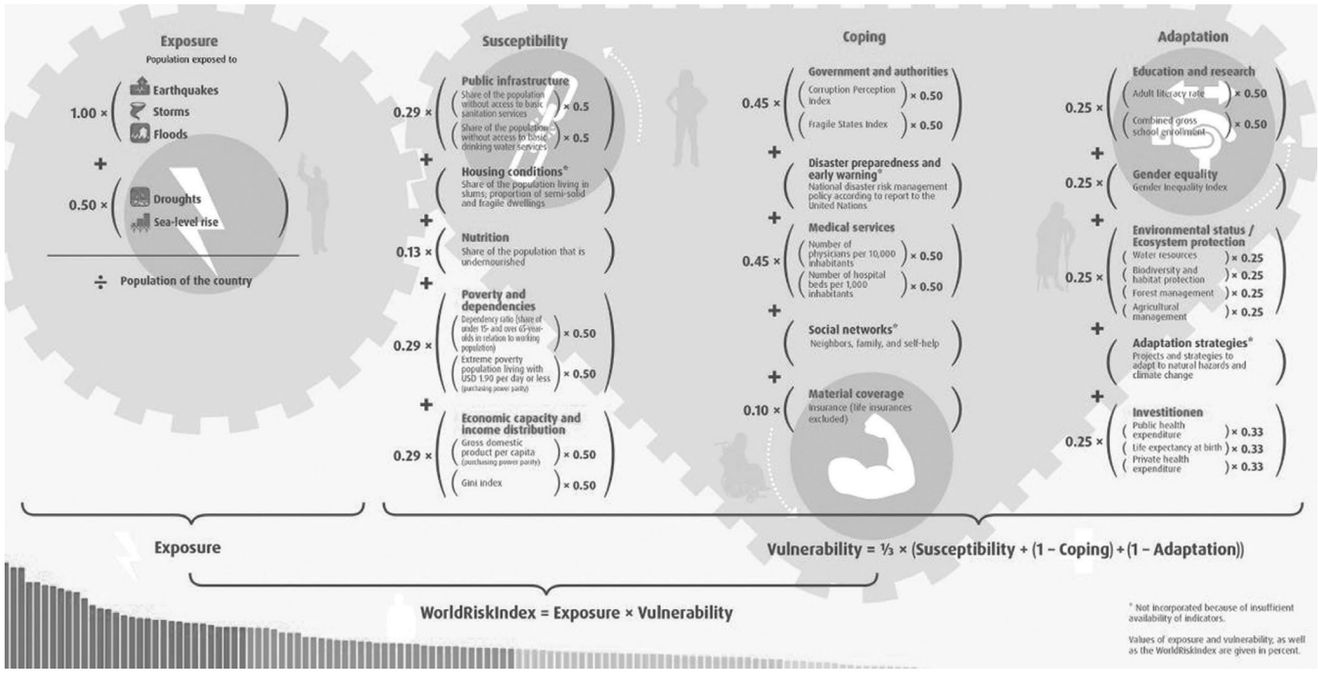

Fig. 20.2 Calculation of the BEH WorldRiskIndex overall risk[16]

natural disaster response. Coping capacity is a community's ability to recover from a catastrophe by quickly mitigating the harmful elements caused by a disaster. The driving factors behind this calculation include the fragile state index score, disaster preparedness, and medical services. The BEH WorldRiskIndex overall value is calculated by weighing and multiplying all the indicators that define susceptibility, adaptability and copying values with the nation's exposure score. Figure 20.2 displays the final value formula including the individual weights for each factor.

A country's resilience is understood by simultaneously examining the foundations that create the society. The government must be stable and generate a culture of ex-ante preparedness in the community, from construction infrastructure to developing regulations that address vulnerabilities. After the disaster hits, the citizens need to be able to quickly cope with the shock and immediately move toward action using existing instruments to channel resources to those in need. To promptly move towards recovery, the businesses must be innovative adjusting where necessary to solve problems and finding ways to get the affected population back to work.[17]

3. Military Response Events

The United States military responded to numerous disasters around the globe ultimately awarding the Humanitarian Service Medal 282 times over the last 40 years.[18] A previous study examined these responses and categorized the disaster events as earthquakes, tropical cyclones, tsunamis, floods, droughts, winter storms, tornados, volcano eruptions, fires, famine and other. The "other" category included all non-natural events, as well as unknown events that had a description that was too vague to be coded. The data from cyclones, earthquakes and floods were examined in more detail. The results of the study are summarized in the following paragraphs.

The United States military responded to 49 cyclone disasters in four different geographic combatant commander's area of responsibility: USNORTHCOM (17), USSOUTHCOM (10),

[17]"Calculation of the WorldRiskIndex," *Bundnis Entwicklong Hift*, assessed January 18, 2019. https://weltrisikobericht.de/english-2/#group

[16]"After The Storm: Recovery and Resilience in the Caribbean," *The World Bank*, last modified October 13, 2017. https://www.worldbank.org/en/news/speech/2017/10/13/after-the-storm- recovery-and-resilience-in-the-caribbean.

[18]"Humanitarian Service Medal (HSM)—APPROVED OPERATIONS," assessed on September 29, 2018. https://prhome.defense.gov/Portals/52/Documents/RFM/MPP/OEPM/docs/HSM%20Approved% 20Operations%20-%202015%2010%2005.pdf.

USAFRICOM (1), and USINDOPACOM (21).[19] The results of the previous study stated that a 125 mph cyclone speed should be used for predicting future responses.[20]

The United States military responded to 26 earthquake disasters in every geographic combatant commander's area of responsibility: USSOUTHCOM (12), USNORTHCOM (4), USINDOPACOM (5), USEUCOM (3), USAFRICOM (1), and USCENTCOM (1).[21] The results of the previous study stated that a Richter score of 7.4 should be used for predicting future responses.[22]

The United States military responded to 42 flood disasters in five geographic combatant commander's area of responsibility: USSOUTHCOM (6), USNORTHCOM (27), USINDOPACOM (7), USAFRICOM (1), and USCENTCOM (1).[23] The average maximum rainfall for each flood was 24.8 inches at an average speed of 0.56 inches per hour. [24] This data did not lend itself to trend analysis, so future flood responses were not forecastable.

This previous study was singularly focused on the magnitude of the earthquakes or storm strength and did not measure the resilience of the nation when considering future response assistance. To better understand the geographic combatant commander humanitarian assistance requirements, resilience is examined from three specific perspectives: exposure and risk, susceptibility and coping capacity, and structural vulnerability.

4. Exposure and Overall Risk

The elements of exposure and risk give a predictive view of the likely requirement for humanitarian assistance. A country that is straddling a seismic fault line has a high level of exposure to upcoming earthquake damage, potentially requiring external support. The BEH WorldRiskIndex captures the exposure level for each country ranking the island nations of Vanuatu and Tonga as the two of the most likely to be impacted by a future natural disaster. They had exposure values of 86.46 and 55.92, respectively, compared to the United States value of 12.15—lower being less exposed.[25] Exposure is an important component of the overall BEH WorldRiskIndex risk calculation. This overall risk value takes into account the nation's location concerning future natural disasters and the society's ability to overcome the impact. Vanuatu is not only the most exposed nation, but it also has the highest overall risk level at 50.28.[26] The United States for comparison has a risk level of 3.42.[27] Table 2 presents the average exposure and risk levels for the nations in each geographic combatant command. The USINDOPACOM had the highest values for exposure and risk—both having an average ranking at the very high level.

Table 20.2 BEH WorldRiskIndex average exposure and overall risk values by the geographic combatant commander[28]

Geographic Combatant Command	Exposure Average/ Median	Overall Risk Average/Median
USNORTHCOM	$12.19^{3}/12.15^{3}$	$3.98^{2}/3.42^{2}$
USEUCOM	$12.07^{3}/11.16^{2}$	$3.70^{2}/2.53^{1}$
USCENTCOM	$9.58^{2}/9.74^{2}$	$4.53^{2}/4.41^{2}$
USINDOPACOM	$25.90^{5}/17.76^{5}$	$12.59^{5}/7.65^{4}$
USSOUTHCOM	$19.24^{5}/17.20^{4}$	$8.73^{4}/7.28^{4}$
USAFRICOM	$14.01^{3}/13.12^{3}$	$8.55^{4}/8.36^{4}$

Note: The superscript number represents the quantile from 1 to 5. Classification 1 (very low), 2 (low), 3 (medium), 4 (high), and 5 (very high).

The very high label is the quartile classification for the most vulnerable 20% of countries.[29] USCENTCOM had the lowest classification for exposure and USEUCOM had the lowest overall risk. When comparing USNORTHCOM and USAFRICOM, it is apparent that the exposure values are similar, both classified at the medium level. Things change when examining the overall risk; USNORTHCOM drops to a low and USAFRICOM increases to a high—showing that the African nations are not very resilient to disasters and would likely need additional assistance if an event occurred.

Next, the nation's requesting humanitarian assistance from the United States government for the last 40 years were examined to determine the exposure and overall risk levels.

[19]Chad A. Long, "Identifying the Strength of Cyclones and Earthquakes Requiring Military Disaster Response." International Journal of Environmental and Ecological Engineering 14, no. 8 (2020): 185-189.
[20]Ibid.
[21]Ibid.
[22]Ibid.
[23]Chad Long, "Military Response to Natural Disasters," Unpublished Paper United States Naval War College, 2018.
[24]Ibid.
[25]"WorldRiskReport 2018," *Bundnis Entwicklong Hift*, assessed January 18, 2019. https://weltrisikobericht.de/english-2/.
[26]Ibid.
[27]Ibid.
[28]Ibid.
[29]Ibid.

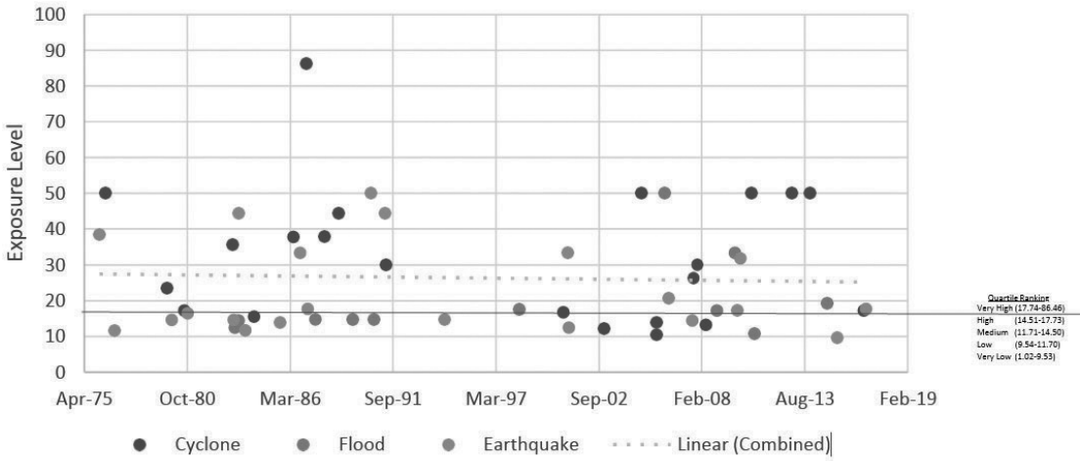

Fig. 20.3 BEH WorldRiskIndex exposure values for United States international response efforts[30]

While it would have been optimal to provide the exposure and risk values for each nation for the year of the incident, the BEH WorldRiskIndex only has records dating back to 2011. For simplicity, the 2018 Index was used to evaluate all countries dating back as far as 1976. The average exposure for a nation in need of assistance was 26.3, putting it in the very high quartile. Figure 20.3 displays the international results for exposure broken down by disaster type. The results are presented without the United States events to give a better picture of the sustainability of the foreign countries impacted. About 80% of the nations that the United States assisted are in the high or very high exposure category making them at risk for future natural disasters. The nation's impacted by cyclones showed the highest level of exposure with an average score of 32.6.

The same analysis was completed on the overall risk of the nation's requesting assistance from the United States. The average overall risk score for a country in need of help was 12.9, putting them in the very high quartile. Figure 20.4 displays the international results for overall risk broken down by disaster type. About 65% of the nations are in the high or very high overall risk category making them vulnerable for future natural disasters. Again, the countries impacted by cyclones showed the highest level of overall risk with an average score of 17.5.

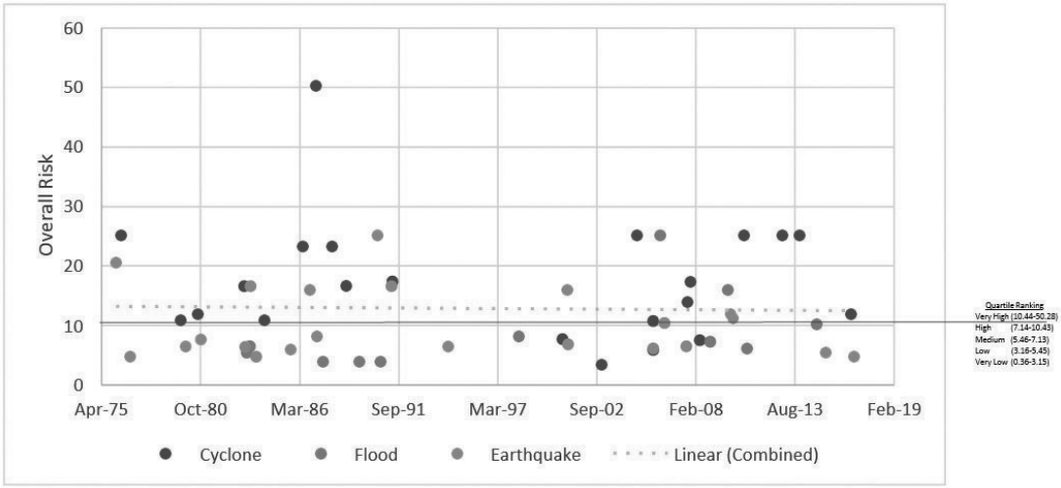

Fig. 20.4 BEH WorldRiskIndex overall risk for United States international response efforts.[31]

[30] Ibid.
[31] Ibid.

5. Susceptibility and Structural Vulnerability

Exposure and overall risk are critical values when determining locations for prepositioning forces, but not as relevant when concluding if a nation will be decimated by a natural disaster and require United States assistance. Two significant factors that drive this are susceptibility and structural vulnerability of the country. Susceptibility is the nation's likelihood of suffering harm following a disaster while structural vulnerability evaluates the nation's infrastructure. Central African Republic had the lowest susceptibility measured on the BEH WorldRiskIndex.[32] With a score of 70, compared to the United States 16.18, the nation is unable to withstand even the smallest natural disaster.[33] Poor infrastructure, excessive poverty, and malnutrition are elements that make a community more susceptible to needing outside assistance if a natural disaster impacted the region.

The susceptibility level of each nation which received humanitarian assistance from the United States over the last 40 years was evaluated. As mentioned previously, it would have been optimal to provide the susceptibility value for each nation for the year of the incident but the BEH WorldRiskIndex only has records dating back to 2011— so the 2018 Index was used to evaluate all countries. The susceptibility levels for earthquakes, cyclones and flood are presented in Fig. 20.5. The results are displayed without the United States events to give a better picture of the susceptibility of the foreign countries impacted by disasters. The average susceptibility value for a nation in need of assistance was 28.8, classifying it in the high quartile.

About 44% of the nations are in the high or very high susceptibility score category making them very vulnerable to future natural disasters. Again, the countries impacted by cyclones showed the highest level of susceptibility with an average score of 34.0. It appears that the average sustainability level is on the rise over the last decade. It is not clear from the results that this trend will continue or if this is just an artifact from using 2018 values for the 40 years of the study. The high susceptibility values for the cyclone nations may be part of the reason that these events received humanitarian assistance 33 times compared to 13 for floods and 23 for earthquakes over the last four decades. The nations of USAFRICOM had the highest susceptibility levels; this region contained 24 of the 25 countries most likely to suffer harm following an event mainly due to poor nutrition and high levels of poverty.

The BEH WorldRiskIndex sustainability factor identifies housing condition as a major component of determining the susceptibility of the community to natural disaster risk but does not provide any specific data on this element. The FM Global Resilience Index is a much better study for researching this component. The Resilience Index examines 12 drivers that range from inherent cyber risk to the rate of urbanization—natural hazard risk quality is the most closely correlated with housing condition. Natural hazard risk quality is defined as "the quality and enforcement of a country's building codes with respect to natural hazard-resistant design (80%), combined with the level of natural

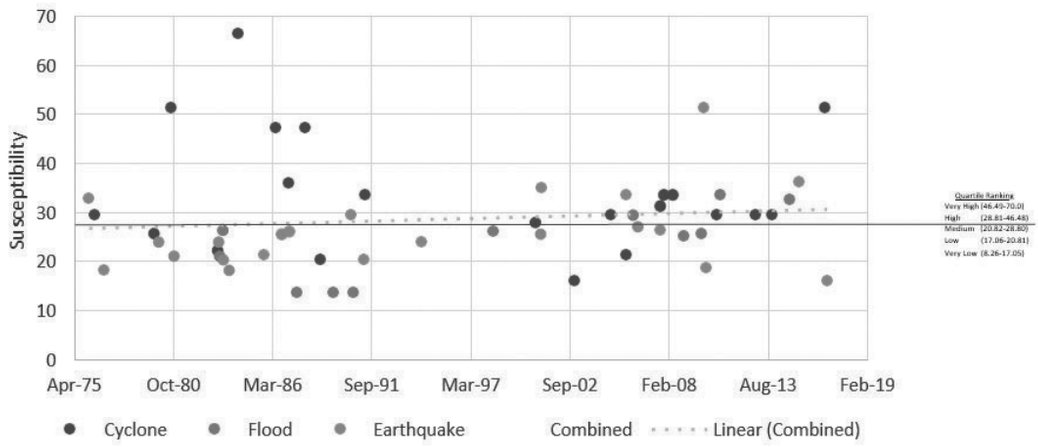

Fig. 20.5 BEH WorldRiskIndex sustainability values for United States humanitarian response to earthquakes, cyclones, and floods[34]

[32] Ibid.
[33] Ibid.
[34] Ibid.

hazard risk improvement achieved, given the inherent natural hazard risks in a country (20%)."[35] This metric gives a detailed analysis of a general structural vulnerability of a country which is turned into a quantitative score from 0 to 100. Iceland had the highest ranking in 2018 with 100 points, and the Dominican Republic was the lowest with a score of 0. The United States received a score of 87, which ranks 19th—tied with Switzerland.[36]

Table 20.3 shows the average natural hazard risk quality score for all the countries in each geographic combatant command.[37] The global average is 37.74, and the median is 24.35.[38]

Table 20.3 Average and Median Natural Hazard Risk Quality Score by Geographic Combatant Command[39]

Geographic Combatant Command	Natural Hazard Risk Quality Score Average/Median
USNORTHCOM	$76.2^{2}/87.0^{1}$
USEUCOM	$66.3^{2}/80.3^{1}$
USINDOPACOM	$29.8^{3}/23.3^{3}$
USCENTCOM	$28.3^{3}/23.0^{4}$
USSOUTHCOM	$16.1^{4}/10.8^{4}$
USAFRICOM	$13.0^{4}/3.8^{5}$

Note: The superscript number represents the quantile from 1 to 5. Classification 1 (very low), 2 (low), 3 (medium), 4 (high), and 5 (very high).

The United States response for earthquakes, cyclones, and floods was then evaluated to determine the average natural hazard risk quality score for each type of disaster. Figure 20.6 presents the structural vulnerability results for the kind of disaster response without the inclusion of United States events. The lower the value, the fewer building codes and less vigilant enforcement of structural laws within a nation. The average structural vulnerability value for a country in need of assistance was 20.3, putting it in the high quartile. Only 34% of the countries are in the high or very high susceptibility score category creating a risk of personal injury in future natural disasters. The nations impacted by earthquakes showed the highest level of structural vulnerability with an average score of 24.0. The mean magnitude earthquake that the United States responded to over the 40 years of the study was 7.3 ML. It is understandable that even countries with stronger building codes would be susceptible to damage after an event of this size, but underdeveloped infrastructure puts the nation's population at significant risk.

6. Coping Capacity

While susceptibility and structural vulnerability give information on a nation's pre-event exposure to disaster, their coping capacity measures the nation's ability to positively react after a catastrophe occurs. A country with a high coping capability will have sound internal processes, appropriate regionally-based equipment, and trained personnel to assist in the recovery effort.

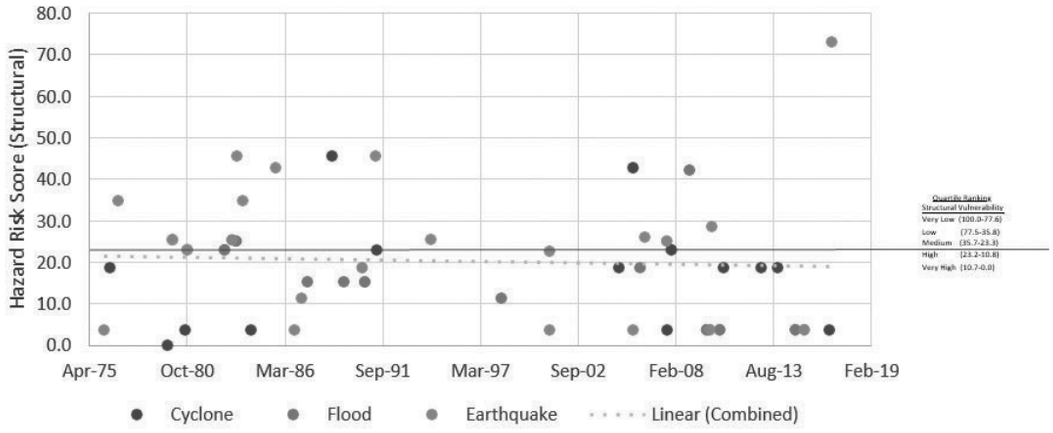

Fig. 20.6 Natural Hazard Risk Quality Score values for United States humanitarian response to earthquakes, cyclones, and floods[40]

[35]"2018 Resilience Index Methodology," *FM Global*, assessed January 18, 2019. https://www.fmglobal.com/~/media/Files/FMGlobal/Resilience%20Index/Resilience_Methodolo gy.pdf?la=en.
[36]"2018 FM Global Resilience Index," FM Global, assessed January 18, 2019. https://www.fmglobal.com/research-and-resources/tools-and-resources/resilienceindex.
[37]Ibid.
[38]Ibid.
[39]Ibid.
[40] Ibid.

Austria, with a BEH WorldRiskIndex score of 35.16, had the best coping capability in 2018— ranking 23 countries over the United States (51.88).[41] Austria has a strong government, robust medical staff and facilities, and systematic insurance process that allows for rapid repair to damaged structures. These elements enable the country to quickly and effectively respond to any disaster that would impact their country. The United States' military response to earthquakes, cyclones, and floods was evaluated to determine the coping capacity for each type of disaster. Figure 20.7 displays the international results for overall risk broken down by disaster type. The chart uses "lack of coping capacity" to keep the classification of 1 (very low) to 5 (very high) consistent in the study. The terms coping capacity and lack of coping capacity will be used interchangeably throughout this paper. A high level of lack of coping means that the nation does not have the processes or personnel needed to respond to a significant natural disaster. The average coping capacity value for a nation in need of assistance was 74.4, placing it in the medium quartile but trending towards high. About 48% of the countries are in the high or very high lack of coping capacity category putting them in jeopardy if impacted by future natural disasters. Examining recent events occurring since 2010, 80% of the nations have been in the high or very high category which is a noticeable increase over the 40-year study.

An additional analysis was completed on the size of the military in the countries needing humanitarian assistance to get a deeper understanding of a nation's coping capacity. It could be assumed that the United States is providing labor assistance because the affected community doesn't have the local ability to support its population. The imbalance of armed forces staffing is relatively extreme between nations. The top five countries all have armed forces that exceed one million personnel, while there are over 36 nations with no standing military.[42] An analysis of armed force staffing was completed for the nations that required United States humanitarian assistance over the last four decades. The World Bank had military staffing levels available as far back as 1985, which was used for events preceding that date—all other responses used the actual number of military personnel for the year of the event. Figure 20.8 presents the results of this analysis without including the United States disaster responses. For presentation purposes, the graph also excluded the Indian earthquake in 2010; India has a military size of 2.3 million. The average military size was 205,000 for all the events, but the median size of cyclone events was 200. It is apparent when looking at the graph that nations impacted by cyclones do not have high armed force staffing levels, especially the first 20 years of the study. Similar to the recent coping capacity results, the hurricane impacted nations showed low resilience and did not have the available forces to assist with a recovery effort. It was surprising that countries with armed forces number over 100,000 needed the United States military assistance. There are many possible reasons these forces were not available to assist with humanitarian effort: forward deployed and not available, not skilled enough to help with recovery, or unable to coordinate travel to the affected area. Foreign military capacity is an area that could be researched in the future, but without more amplifying information armed force size is not useful in forecasting a nation's coping capacity.

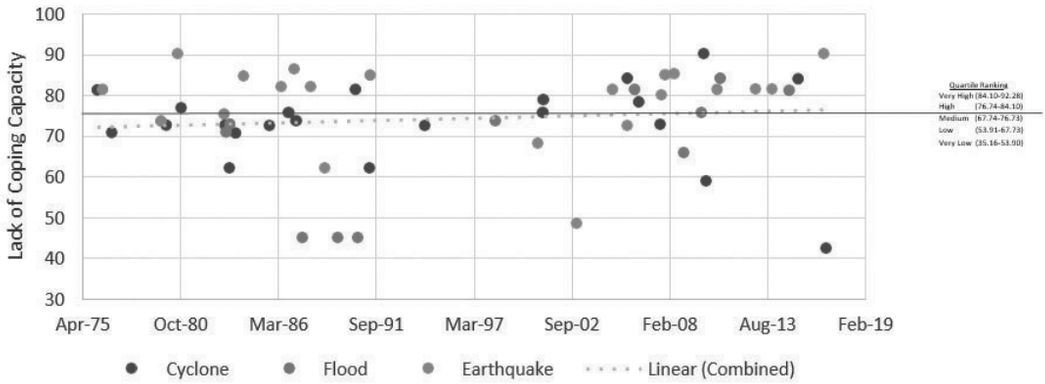

Fig. 20.7 BEH WorldRiskIndex lack of coping capacity values for United States humanitarian response to earthquakes, cyclones, and floods[43]

[41]"WorldRiskReport 2018," *Bundnis Entwicklong Hift*, assessed January 18, 2019. https://weltrisikobericht.de/english-2/.

[42] Amanda Macias, "From Aruba to Iceland, these 36 nations have no standing military," *CNBC*, last modified April 3, 2018. https://www.cnbc.com/2018/04/03/countries-that-do-not-have-a- standing-army-according-to-cia-world-factbook.html.

[43] "WorldRiskReport 2018," *Bundnis Entwicklong Hift*, assessed January 18, 2019. https://weltrisikobericht.de/english-2/.

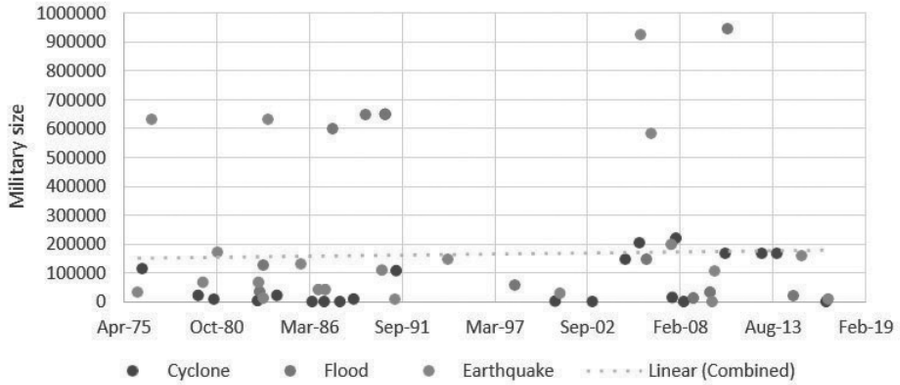

Fig. 20.8 Countries armed force staffing for the United States humanitarian response to earthquakes, cyclones, and floods[44]

7. Future Research

When examining the United States response to natural disasters, the magnitude or power of the storm has been evaluated along with the vulnerability or resilience of the impacted population. Other factors could potentially impact the requested assistance. From this study, it was clear that many nations had large standing forces but still asked the United States for the disaster. What are the characteristics of foreign militaries that do not need assistance—disaster response skill level, availability of the local military forces, or other variables? Other potential research areas include identifying the epicenter of the earthquake or center of the storm in relationship to large populations. Is there a populace size and disaster distance from that disaster survivors that attract United States assistance?

Additionally, the fact that the United States' assistance must be requested from the foreign nations could be examined closer. Maybe the size of the storm or vulnerability of the impacted population has less of an impact on the call for assistance than the relationship between the United States and the affected nation. A study could be conducted on the impacted nation's alignment with the United States to identify if it is a significant factor with the requested call for help.

8. Conclusion

The first United States government response study forecasted that the military would likely be requested for large flood events, cyclones with speeds over 125 miles per hour and earthquakes at magnitudes of 7.4 or greater. This paper expands on that research by examining the vulnerabilities of the nation rather than the natural disaster. The results concluded USINDOPACOM was the most exposed geographic combatant command to future disaster events and many countries in that area of responsibility would not be resilient enough to recover from a catastrophe without assistance. For severe disasters, it can be expected that populations with a sustainability score of 28.8 or higher would likely need external help. If the impacted nations had a structural vulnerability value of 20.3 or higher, they might be overwhelmed by the disaster. Lastly, if the coping capacity of the population is 74.4 or greater, they will probably not be resilient enough to recover from the event without United States assistance.

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