Final Project: Natural Disasters from 1900 to 2021

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Introduction:

Natural disasters are a major concern around the world, given the devastating social and economic impact it can cause to nations. Understanding how disasters evolve across time, its effects in different parts of the world and what kind of disasters are more regionally common or have a greater impact can help coordinate governments and implement specific plans to mitigate damages caused by them (disaster relief programs, vaccination campaigns, changing building codes, etc) and prepare their citizens better in the event of one (education, alarms, fire drills, etc). For this reason, The main goals of this data report will be to: (1) Show the frequency and indirect measures of disaster impact through death tolls and number of people affected per disaster types, (2) Investigate any patterns or trends in natural disasters that might have emerged from 1900s to 2021 in terms of death tolls and frequency of disasters, (3) explore potential regional differences in the frequency and kind of natural disasters and (4) visualizing the amount of people affected by disasters in each country to have an idea of where more resources should be allocated.

Data Description:

The data used in this analysis (titled "All Natural Disasters 1900-2021/EOSDIS") was obtained from Kaggle, a publicly available data repository, the original sources comes from NASA's Earth Observing System Data and Information System (EOSDIS) and the International Disaster Database (EM-DAT). The data has 16126 observations and 45 variable columns. The

observations include natural disasters worldwide. From this data set, I extracted the following variables of interest: Year, Disaster Subgroup , Disaster Type, Country, Region, Total Deaths and Total affected. Unfortunately, the kaggle version used did not include specific descriptions for their variables, therefore definitions were based on intuition and for Disaster classification variables (**Disaster Subgroup** and **Disaster Type**), definitions provided here were based on a pdf document from the Common accord Center for Research on the Epidemiology of Disasters (CRED) and Munich Reinsurance Company (Munich RE), which I have attached separately with the submission of this report. Complete definitions are provided for each Disaster Subgroup and Disaster type in this separate document. **Table 1** shows the main definitions of the variables used in this report.

Table 1: Main Variable Descriptions

Variable	Description
Year	natural disasters from 1900 to 2021
Disaster Subgroup	sub-groups of natural disasters have been defined: geophysical ,meteorological, hydrological, climatological and biological.
Disaster Type	Description of the disaster according to a pre-defined classification
Country	228 country(ies) in which the disasters occurred
Total Deaths	Number of people confirmed dead and number missing and presumed dead
Total Affected	Number of people affected by disaster either by injury, homelessness or in need of immediate assistance during emergency (for example evacuations)

Results:

The summary table below (**Table 2**) provides the disaster counts, total reported deaths and total number people affected by disaster type from 1900 to 2021. From this table, we can observe that the most common disaster type seem to be floods followed by storms. The deadliest disasters are drought, followed by epidemics. There were 3 events that happened only once, an asteroid impact that happened in Russia (Eastern Europe Region), a very odd fog incident that caused 4000 deaths and a single animal accident that resulted in 12 deaths. This means that we should emphasize education, training and preparedness for floods, storms, epidemics and droughts using different policies targeted to the general population. Although some disasters are less common and not as deadly, it still affects several people. For example even though nobody was reported dead due to insect infestations, the amount of people affected was fairly high, for disasters that are less common, perhaps training and funds should be allocated to particular citizens located in areas where those disasters are more prone to happen (e.g. farmers whose livelihoods might be devastated by insect infestations).

Table 2: Total disaster counts, deaths and amount of people affected by disaster type

Disaster Type	N(%)	Total Deaths	Total Affected
Biological			
Animal accident	1 (0.06 %)	12	5
Insect infestation	96 (6.01 %)	0	2802200
Epidemic	1501 (93.93 %)	9616245	49613800
Climatological			
Glacial lake outburst	2 (0.16 %)	250	24
Wildfire	471 (37.89 %)	4570	17961008
Drought	770 (61.95 %)	11731424	2798224434
Extra-terrestrial			
Impact	1 (100 %)	0	301491
Geophysical			
Mass movement (dry)	48 (2.58 %)	4644	27534
Volcanic activity	265 (14.27 %)	86834	9915975
Earthquake	1544 (83.14 %)	2342188	203101080
Hydrological			
Landslide	776 (12.26 %)	67112	14655730
Flood	5551 (87.74 %)	6993561	3891125099
Meteorological			
Fog	1 (0.02 %)	4000	0
Extreme temperature	603 (11.82 %)	193417	103635513
Storm	4496 (88.16 %)	1401367	1232318278

To investigate the changes and trends seen across time for different disasters, two figures were created. In **Figure 1** we present a time series plot for each of the natural disasters subgroups (biological, climatological, extra-terrestrial, geophysical, hydrological and meteorological). From 1900 to 2021, we observe a drastic increase in the frequency of all natural disasters across the globe since the 1950s. Notably, hydrological (e.g. mudslides, floods, tsunamis, etc.) and meteorological disasters (i.e., severe weather disturbances such as cyclones and hailstorms) display a greater increase in frequency than other disaster subgroups. Climatological disasters have increased at a lower rate than the other two but this might be because these type of disasters are caused by long term processes that are seasonal in nature and that may encompass several decades by definition , meaning that it may take longer to notice drastic changes and that even when their counts are lower, they could be more significant and not be less worrisome. For example droughts are classified as climatological and are the deadliest according to our data. These disaster subgroups are often associated with human triggered climate change. Hydrological, Meteorological and Climatological disasters are associated with human activity driving climate change and global warming. Around the 2000s, we also see

a spike in biological disasters corresponding to an increase in viral and bacterial epidemics. Biological disasters such as epidemics are also linked to human activity such as transmission through local and global traveling, interfacing with wild animals more often as we encroached their habitats and drug resistance through the misuse or overuse of antimicrobial drugs.

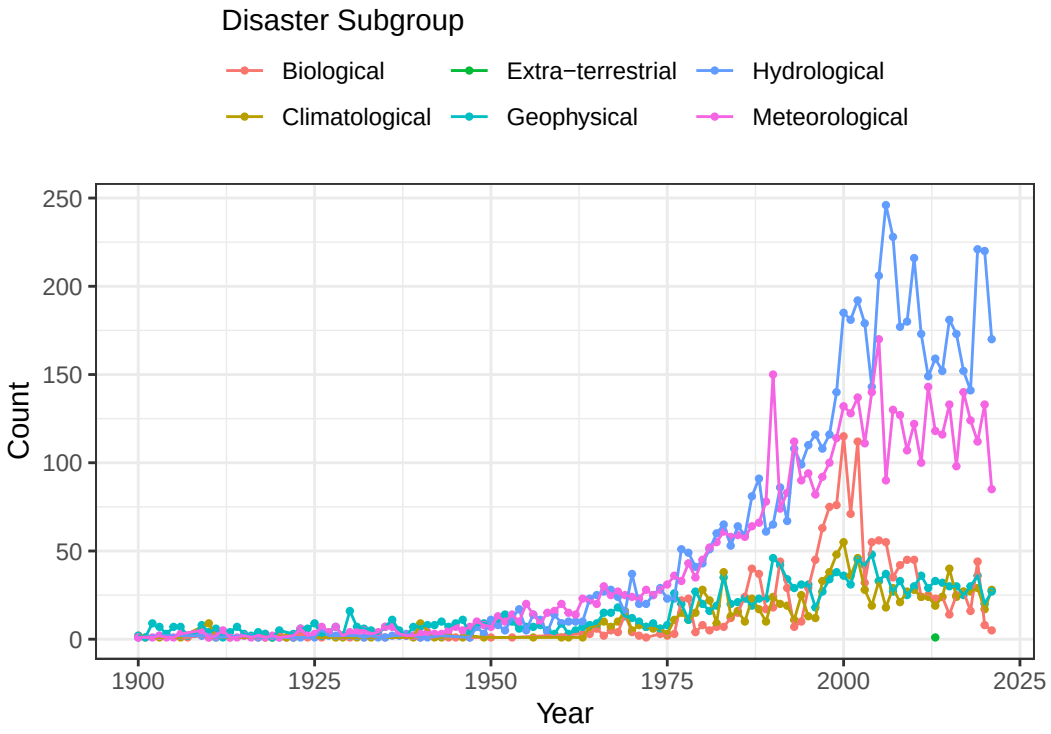

Figure 1: Frequency of natural disasters increased throughout the years

In **Figure 2**, we observe that death counts associated with natural disasters for 12 decades starting from 1902 to 2021. In spite of the increase in natural disasters frequency, the amount of deaths reported each decade has been decreasing. In terms of the proportions of deaths per disaster type, deaths caused by epidemics, floods and drought were more common in the early 1900s. This suggests that humans have grown more adept at surviving these types of disasters over time. In particular, epidemics were a major cause of death in the 1900s and have then decreased throughout the decades, this coincides with developing improvements in medicine and sanitation in the 1920s. From 1922 to 1971, we see that most deaths were due to floods and droughts and in more recent decades the proportion of deaths due to earthquakes were higher (1972-1981 and 2002-2011).

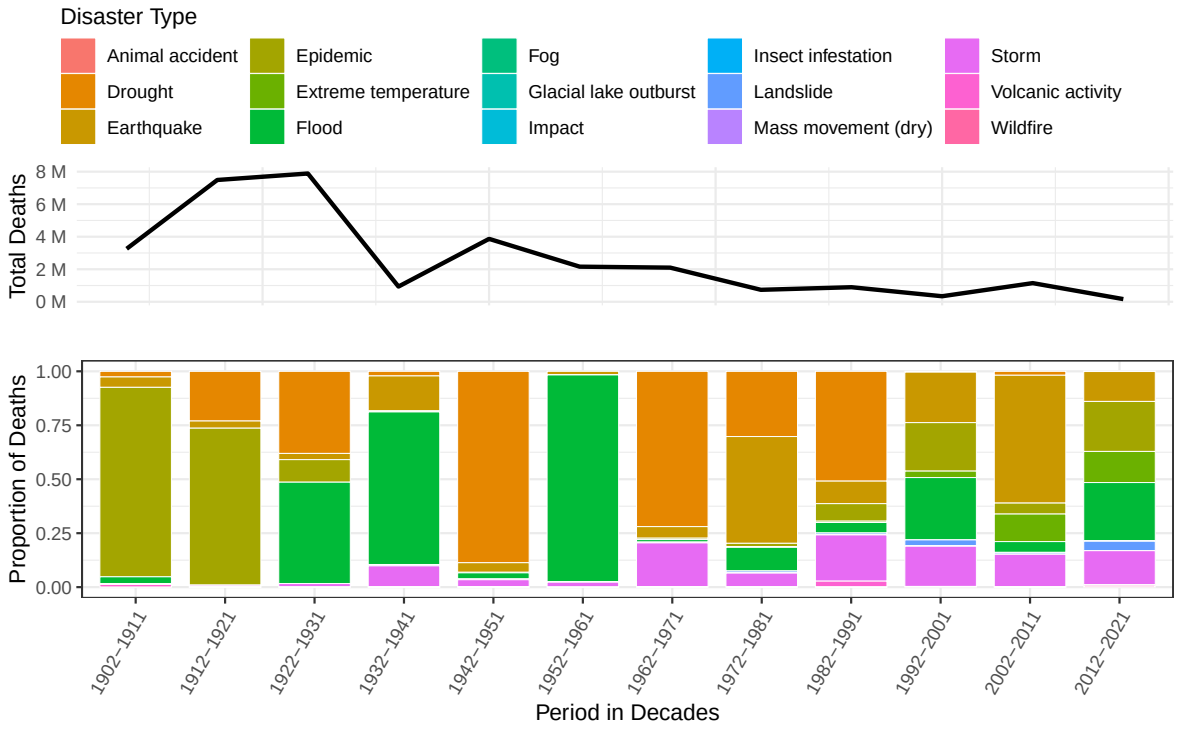

Figure 2: Number of deaths in millions decreased over time but causes of death differ by disaster type across decades

To explore whether certain regions of the world are more prone to certain subgroups of natural disasters than others, **Figure 3** displays bar plots for the number of disasters by disaster subgroup for all regions. Eastern, South-Eastern and Southern Asia are the regions more prone to natural disasters in general, but particularly hydrological and meteorological disasters. In comparison to other regions within the Asian continent (Central and Western Asia), the South Eastern side of Asia is surrounded by the Pacific and the Indian ocean, which are know to be more disaster prone (unfpa) This region also experiences higher proportions of geophysical disasters (earthquakes and volcanic activity) given the Pacific Ring of Fire, increasing the likelihood of earthquakes and tsunamis that severely affect several island nations in the area. The next big set of disasters seem to cluster in South and North America. In terms of proportions, hydrological disasters (Landslides and floods) are more common in South America than in North America, but the reverse is true for Meteorological disasters (storms, extreme temperatures), this might be due to the fact that the southern part of America has more oceans, while the north has more landmass. The African continent has the Eastern and Western regions experiencing more disasters than the central and northern parts, and they also tend to experience higher rates of epidemics.

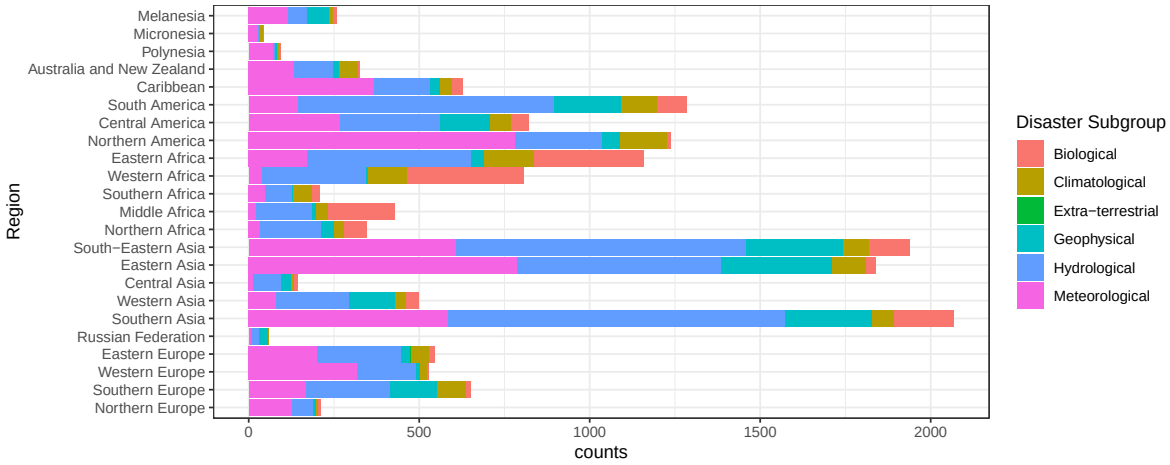

Figure 3: Regional differences in death rates

For our final visualization, **Figure 4** displays a map showing the amount of people affected by natural disasters by country. In this visualization 2 countries ("Saint Kitts and Nevis" & "Tuvalu") were excluded from the map as i was not able to find a match from our data set to world map used for this visualization. China and India have the biggest amount of people affected by disasters this is also consistent with our previous graph showing that Southeast Asia has a larger number of natural disasters. On the other hand we can see that towards the northern central area of the globe (Europe, parts of the Mediterranean and northern Africa) have less people affected by disasters. In the Americas, Brazil and the US seem to have more people affected than other countries in the continent.

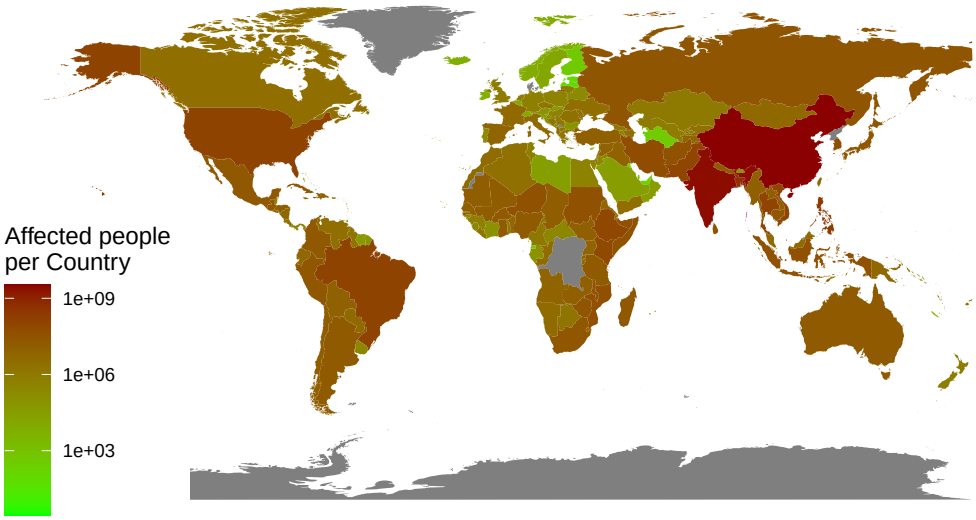

Figure 4: Total People Affected by Country

In conclusion, the four visualizations shows us that all disasters have increased overall from 1900 to 2021, with Hydrological and Meteorological disasters at a more alarming rate than other subgroups. Despite the increase in number of disasters, the fatalities have overall decreased as well as the proportion of deaths by epidemics for the last 12 decades. The last 2 graphs shows us that natural disasters do not occur at the same frequency nor do they affect all regions and countries of the world equally, as we discovered that South Eastern parts of Asia contain the most affected countries. However, i would point out that despite differences seen in number of people affected by disasters, it might have been better to look at the rate of disasters per population in a country, because it could be simply that since China and India have large populations there would be more people affected, regardless, it still means that these countries might need more international aid and attention. Finally, future analysis could potentially include different metrics of pollution to investigate the relationship between different pollutants and natural disasters.