Visualizing Billion-Dollar Disasters in the USA (1980–2024)

Team Oldlace
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Introduction

According to the Federal Emergency Management Agency of the United States (2024)[1], the Disaster Relief Fund (DRF), designated for providing financial assistance and relief, is rapidly being depleted due to the increased frequency and severity of disaster events. Resultantly, this financial strain hampers immediate relief efforts and places the country at risk of being under prepared for potential catastrophes in the near future.

To highlight the need for enhanced disaster preparedness, Dottle and Kaufman[2] presented a plot visualizing the total estimated costs and frequency of Billion Dollar Disaster (BDD) events by type from 1980 to 2023. The plot demonstrated the increased frequency of various types of disasters over the years, likely driven by factors such as climate change, along with their escalating financial impact and costs. Coupled with the rapid depletion of the DRF, this underscores the pressing need for the USA to undertake proactive preparations and mitigations to effectively address the growing threat of BDDs.

Previous Visualization

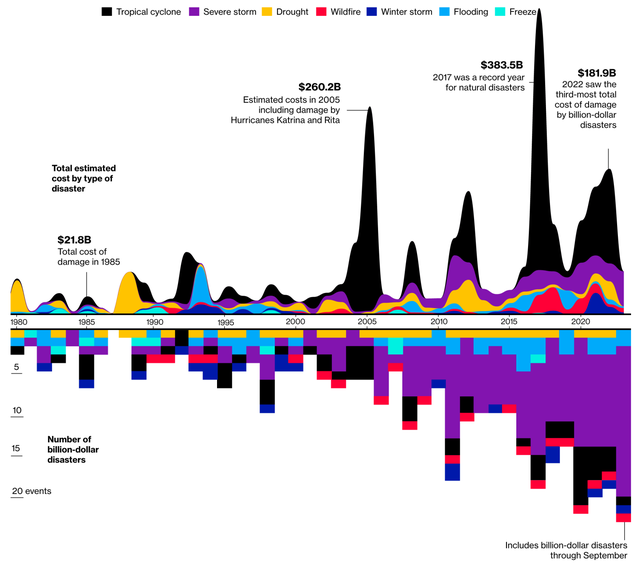

Figure 1: Frequency and Estimated Costs of Billion-Dollar Disasters in the USA by year, published by Bloomberg.

Strengths

- The graph includes a *dual-axis* representation of the frequency and costs of Billion-Dollar Disasters, providing a comprehensive overview of the data with the use of stacked areas and bars.
- It includes *annotated descriptions* on certain data points, enhancing the interpretability of the visualisation.
- The timeline shows *clear trends* over the years, highlighting the increasing frequency and costs of natural disasters.

Suggested Improvements

1. *Split the visualisation into two separate plots* to better highlight the trends in frequency and costs of Billion-Dollar Disasters over the years.
2. *Enhance the colour palette* to improve readability and allow readers to better distinguish between different disaster types, catering to colour-blind individuals.
3. *Group disaster types* together to provide a clearer overview of the data.
4. *Combine time-series data into 5-year intervals* to reduce visual clutter, improve readability and interpretability.
5. *Relabelled axes* to provide clearer information on the data presented.
6. *Changed stacked area chart to line chart* to better show trends over time.
7. *Included annotation for events* to highlight significant rise of cost.
8. *Sorted frequency* and *included trend line* before stacking histogram.

Implementation

Data

- Frequency and estimated cost for each disaster type is obtained from the National Centers for Environmental Information (NCEI).[3]
- Consolidated data with NCEI USA to obtain more detailed information on each disaster specific to the United States.[4]
- Combined individual disaster types into broader disaster categories for better visualisation and capturing of trends.
- Combined data from each disaster category into 5-year intervals for better visualisation of trends.

Software

We used the Quarto publication framework and the R programming language, along with the following third-party packages:

- *tidyverse* for data transformation, including *ggplot2* for visualization based on the grammar of graphics
- *knitr* for dynamic document generation
- *scales* for data transformation and visualization
- *patchwork* for combining multiple plots
- *dplyr* for data manipulation

Further Suggestions for Interactivity

- *Hover-over tool tips* to display detailed information
- *Interactive legends* where users could click to highlight specific disaster types
- *Zoom and pan* to allow users to closely examine selected areas of the visualisation
- *Filtering options* to view specific disaster types or time periods
- *Interactive sliders* to adjust the time range displayed

[1]FEMA. (2024). Disaster Relief Fund June Report. Retrieved from: https://www.fema.gov/sites/default/files/documents/fema_june-2024-disaster-relief-fund-report.pdf

[2]Dottle, R., & Kaufman, L. (2023). Climate Disasters Drain US Emergency Fund, Adding to Government Shutdown Risk. Retrieved from https://www.bloomberg.com/graphics/2023-fema-disaster-relief-fund-extreme-weather-climate-aid

[3]https://www.ncei.noaa.gov/access/billions/time-series

[4]https://www.ncei.noaa.gov/access/billions/state-summary/US

Improved Visualization

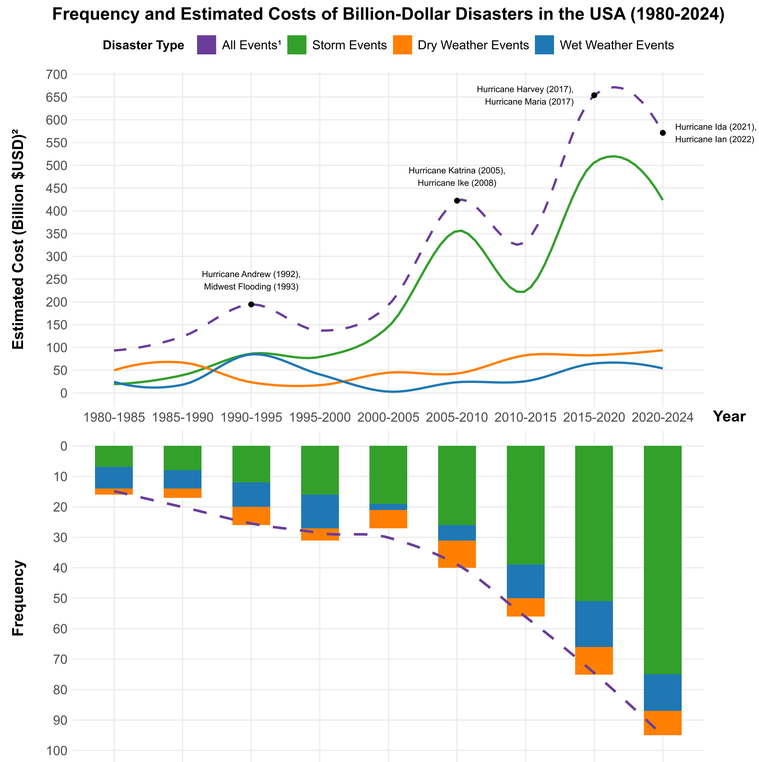

Figure 2: Revised Visualisation of Frequency and Estimated Costs of Billion-Dollar Disasters in the USA by year.

Conclusion

The revised visualization of Billion-Dollar Disasters in the USA improves clarity and accessibility by separating frequency and cost data, enhancing the colour palette, and grouping disaster types. These improvements highlight the increasing impact of the disasters along with the escalating costs over the years. By providing a more detailed and visually appealing representation of the data, the revised visualization conveys the urgency for enhanced disaster preparedness.

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