Project 4: Report of Findings

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Due Date: 4/22/2025

Submitted to: Dr. Kontar, CIVE 202

Introduction

Natural hazards are environmental phenomena that can impact communities and the human environment. With certain risks, the natural hazards can threaten societies; therefore, the team used the National Risk Index (NRI), a measurement conducted by the Department of Homeland Security for the Federal Emergency Management Agency (FEMA), to determine the relative risk of natural disaster events in the United States.

The team leveraged Python coding to sort, organize, and manipulate raw data from these CSV files to create risk analysis in NRI scoring methodology by sensitivity analysis that is contained in the report. We examine and compare two U.S. states, Nebraska and Colorado, using FEMA's definitions and our scoring model. The data used to compare the two states entails the risks of wildfires and the risks of strong winds, both of which are categorized by county within each state.

The NRI defines risk as "the potential for negative impacts as a result of a natural hazard" (NRI). The Risk Index is determined by a specific equation that is calculated based off of a variety of factors, including the expected annual loss and the community risk factor. The equation multiplies the expected annual loss by the quotient of the social vulnerability risk component and the community resilience risk component.

The data analyzed in the following reports consists of the potential risks of strong winds and wildfires within the states of Nebraska and Colorado

Results

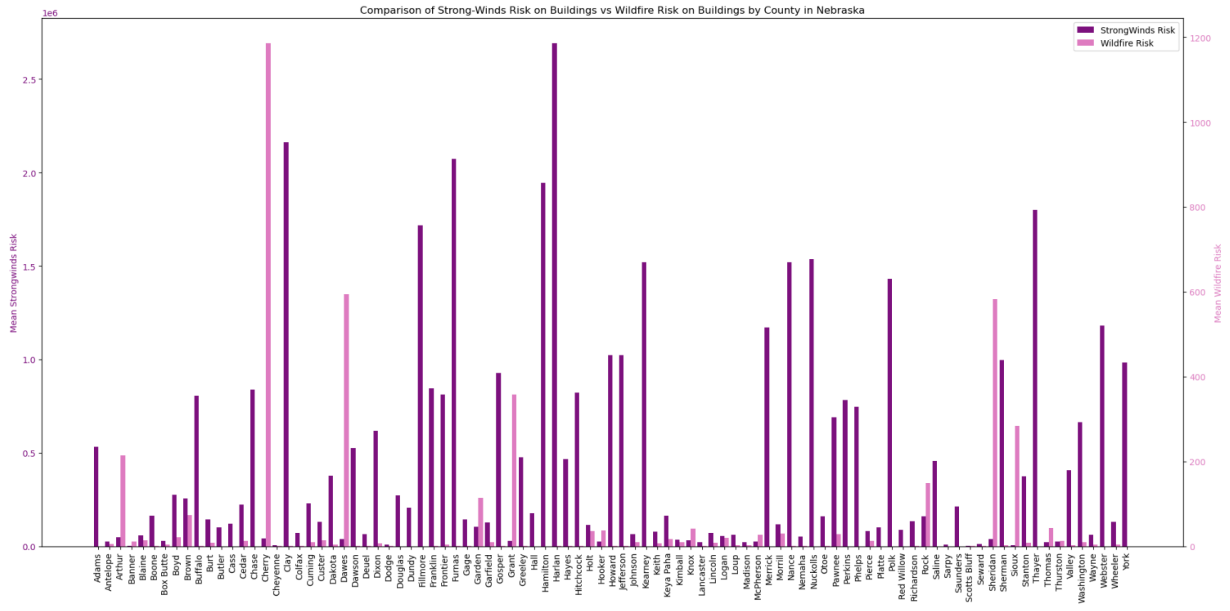

Figure 1. Nebraska Risk Analysis Bar Chart

The figure above shows the bar chart that was created using python code and the data obtained from the NRI website regarding the risks of strong winds and wildfires on buildings in the state of Nebraska—organized by county. The chart shows the leftmost y-axis signifying the mean strong winds risk, the rightmost y-axis signifying the mean wildfire risk, and the x-axis signifying the counties within Nebraska that were analyzed. In the upper right-hand corner of the figure, an index shows that the pink color represents the wildfire risk, and the purple color represents the strong wind risk. From the data presented, it is noticeable that there is an outlier for wildfire risk for the county of Cherry, where the possible risk is significantly higher in this area of Nebraska than the rest of the counties on the graph. The county with the highest strong wind risk is Harlan, and although the risk is much higher for the county of Harlan, it is not as extreme of a gap compared to the outlier within the risk of wildfires for Cherry County. The data shows that there is not necessarily a relationship between the risk of strong winds and the risk of wildfires as there does not seem to be a significant correlation. For the state of Nebraska, it is quite evident that the risk of strong winds is significantly higher than that of wildfires. This is important to consider when looking at investing into resources to mitigate disasters in the future, as it would be more beneficial to provide funding about sources that can help communities combat the struggles and threats that come with strong winds. However, since the data is categorized by county, rather than the state as a whole, the specific risks that each county faces become evident and the counties that are outliers in regard to wildfires can be accounted for and provided with accurate funding and resources based on their specific needs.

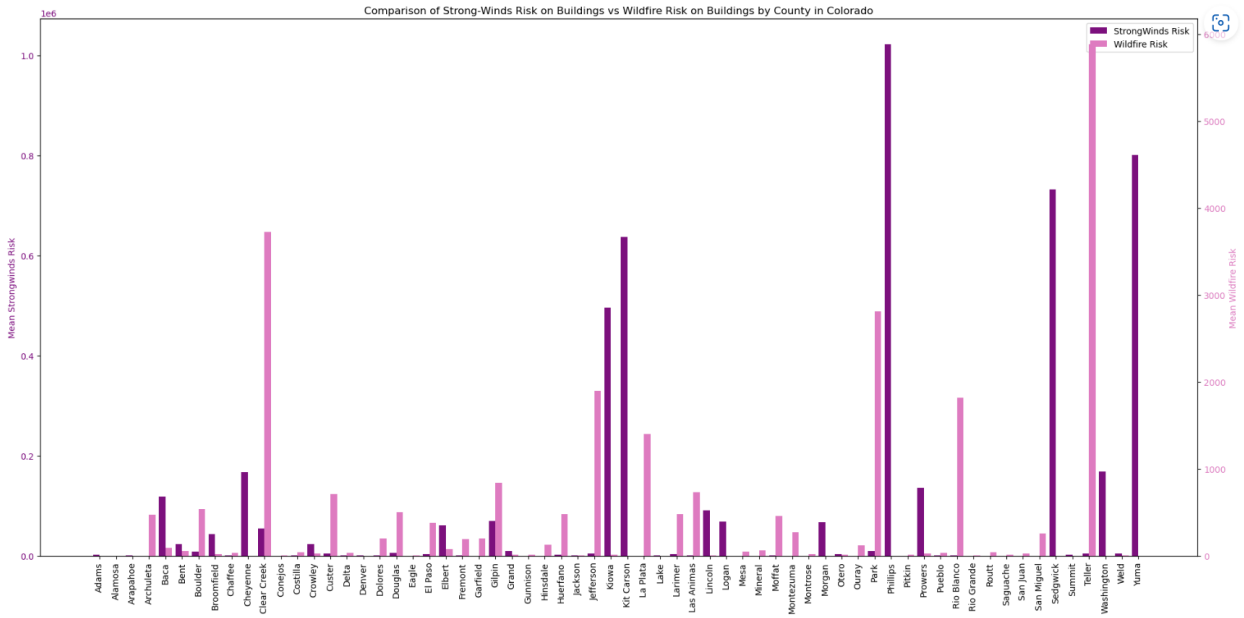

Figure 2. Colorado Risk Analysis Bar Chart

The figure above shows the bar chart that was again created using python code and the data obtained from the NRI website regarding the risks of strong winds and wildfires on buildings, but this time in the state of Colorado—again organized by county. The chart similarly shows the leftmost y-axis signifying the mean strong winds risk, the rightmost y-axis signifying the mean wildfire risk, and the x-axis signifying the counties within Colorado that were analyzed. The upper right-hand corner of the figure again contains an index showing that the pink color represents the wildfire risk, and the purple color represents the strong wind risk. The data presented reveals a significantly high risk for wildfires in Teller County compared to the rest of the Colorado counties. For strong winds risk, Phillips County has the highest risk, with a couple other counties following closely behind. Like that of Figure 1, Figure 2 does not necessarily show a clear relationship between the risk of strong winds and wildfires. Figure 2 presents data that shows the possible risk for strong winds and wildfires to be relatively even within the state of Colorado. The data is somewhat random, and there are both high and low risk values for the counties in Colorado regarding the threat of strong winds and wildfires, which tend to be extreme in either relevant direction of the scale for each risk.

Conclusion

The risks analyzed above play a big role in understanding the threats that many communities are faced with, and disasters can be mitigated in the future. In creating an affective analysis for the risks associated a specific area, in this case—within the counties of Nebraska and Colorado in the context of strong winds and wildfires, it is important to look at the factors that influence the potential risk and how it can affect a community in the long run.

Social Vulnerability is a prominent factor when calculating a risk score. This entails the susceptibility of a certain group of people when it comes to disasters. Not only does this entail how much damage could be inflicted, but also how the damage could affect the community in question. This vulnerability is determined by looking at the community and how severe the impacts of a disaster could be on the community as a whole, in comparison to surrounding communities as well as the nation as a whole. The higher the Social Vulnerability score is, the higher the National Risk Index will be.

Not only is the Social Vulnerability score important for calculating the NRI, but so is the Community Resilience score. The damage inflicted on a community can be combatted by the resilience of said community. Resilience encompasses the idea of a community's ability to bounce back effectively and efficiently after a natural disaster occurs. This score is determined by analyzing a community's or area's resilience and comparing it to surrounding communities as well as the nation as a whole. The higher this score, the lower the NRI will be.

Within the context of economic stability, the expected annual loss is another factor when determining the NRI and is a more quantifiable factor. This value deals with the total economic loss of a community due to natural hazards each year and is calculated by multiplying the exposure by the annualized frequency by the historic loss ratio. The exposure deals with the buildings, population, and agriculture exposed to a specific natural hazard; the frequency deals with the frequency of a natural hazard in each area; and the historic loss ratio represents the percentage of the exposed buildings, population, and agricultural values expected to be affected in each area. This is a predicted value and directly affects the NRI, as the higher the expected value is, the higher the NRI will be.

Each of the previously stated factors plays major roles in the NRI of a community. Although these factors can give a relatively accurate estimation of the potential risks a community may face in the realm of natural hazards, there may be biases present that could influence the risk scores and overall NRI of a community. Potential biases within risk definitions may include an overemphasis on high-impact disasters, a lack of accounting for local factors within a community, or even disproportionate ethical considerations.

When looking at the threats that natural disasters pose, it is easy to go straight to large-scale disasters and overlook the less significant disasters that certain communities may endure. This can cause an inaccurate risk assessment and leave those communities facing less significant disasters with insufficient aid that could heavily affect the well-being of the community in the long run. When only high-impact disasters like major hurricanes or tornadoes are prioritized in high-risk areas, it can leave communities that face low-impact disasters with inadequate aid if something were to happen, like a once-in-a-lifetime major flood or uncontrollable wildfire. Not only is it important to consider the disasters that have both high and low impact, but it is also important to consider local factors that may affect a community in the face of natural disasters. Political policies and social discrepancies are two factors that may have heavy influences in a

community's vulnerability but can often be left unaccounted for. When a community has certain political limitations, aid can be limited as well. Policies within an area are important to consider when distributing aid based off estimated risk, and if there is a bias that leaves this unaccounted for, the community can suffer when it comes to enduring the implications of a natural disaster or hazard. Similarly, it is important to fully understand the stability of the social capital of a community in order to accurately determine the severity of the risks and threats a community may face. When communities are inaccurately assessed and the social factors are overlooked, risk analysis becomes unreliable and inadequate funding can be distributed, again causing long-term repercussions.

It is important to mitigate biases because a community can greatly suffer when they are in effect. In the context of natural hazards, it is imperative to account for every little factor that may affect a community in order to adequately distribute aid.

References

Understanding scores and ratings. Understanding Scores and Ratings | National Risk Index. (n.d.). https://hazards.fema.gov/nri/understanding-scores-ratings