Analyzing the Flood Hazard Risk of Rowlett Creek Watershed, Texas Using GIS Technology

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Abstract

Flood hazards have become a major concern globally due to the potential risk they pose to human life and infrastructure. In the Rowlett Creek Watershed in Texas, the risk of flood hazards has been a growing concern, and the need for accurate characterization of flood hazards in the area is critical. The objective of this research was to characterize the flood hazard risk of the Rowlett Creek Watershed in Texas using GIS technology. By integrating multiple factors such as slope, distance to road and stream, flow accumulation, land use, rainfall, water storage, and elevation through a weighted overlay analysis technique, we determined the flood hazard risk in the study area. The majority of the watershed was found to be at high risk of flood hazards, with 54.5% falling in the high to very high-risk category. This study's results can aid in flood hazard management, emergency preparedness, and land use planning in the Rowlett Creek Watershed and serve as a model for other regions. The GIS-based approach utilized in this study can be replicated in other watersheds and regions to assess flood hazard risk and develop appropriate mitigation measures.

Background

Floods are one of the most destructive and costly natural disasters that affect communities around the world. As climate change and urbanization continue to alter the natural landscape, the risk of floods is increasing in many areas, including the Rowlett Creek Watershed in Texas. To mitigate the impact of floods, it is essential to identify the areas that are most vulnerable and to develop effective strategies for managing flood hazards.

Geographic Information System (GIS) technology offers a powerful tool for analyzing and managing spatial data related to flood hazards. GIS can help identify area that are most vulnerable to floods, model the potential impact of floods, and develop effective strategies for mitigating flood hazards.

Objective

The objective of this project was to identify flood hazard risks area in Rowlett Creek Watershed of Texas by applying advanced GIS techniques.

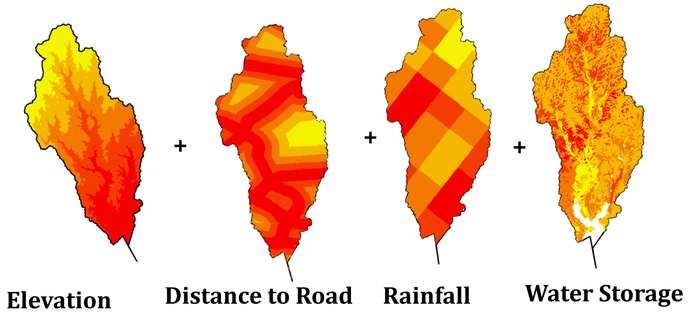
Data

This study uses geospatial data to analyze flood hazard risks in the Rowlett Creek Watershed of Texas. Table below summarizes the data sources for each of the datasets used in e study.

Dataset	Source
Slope	United States Geological Survey (USGS)
Distance to Road	Texas Department of Transportation (TxDOT)
Distance to Stream	USGS
Flow Accumulation	USGS
Land Use	National Land Cover Database (NLCD)
Rainfall	Climate Hazards Group InfraRed Precipitation with Station (CHIRPS)
Water storage	Soil Survey Geographic Database (SSURGO)
Elevation	USGS

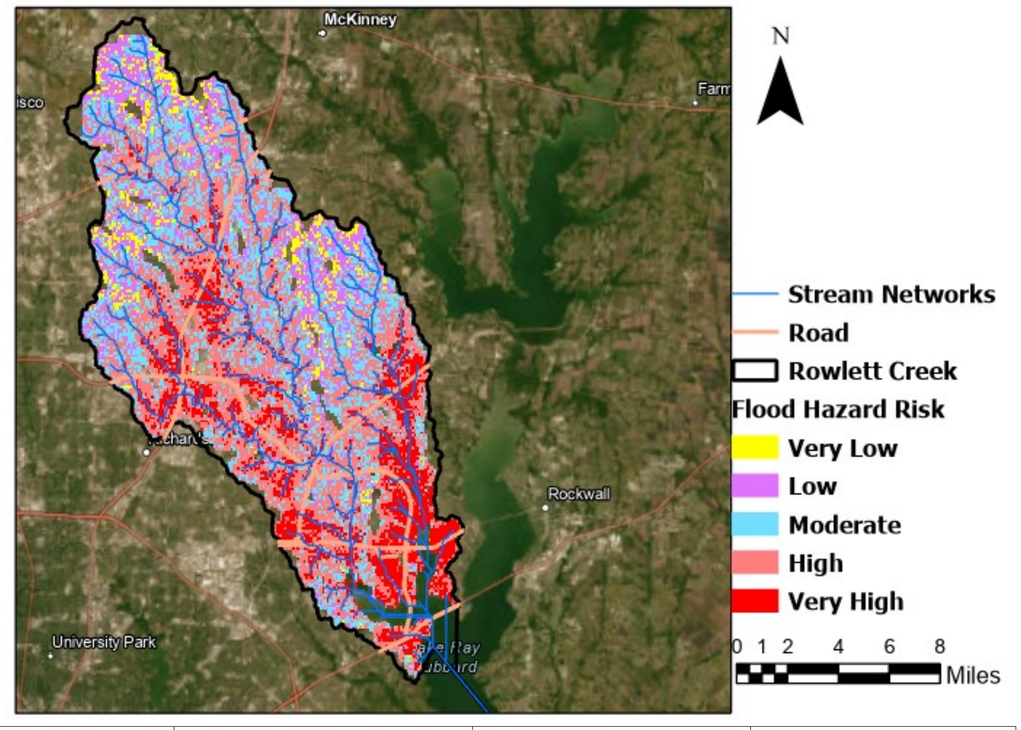
Method

All together eight factor we used to analyze flood hazard risks in the Rowlett Creek Watershed. Flood risk map was generated classifying each factor into five risk categories using the Natural Breaks classification and reclassification method . The risk categories were assigned the following numeric values: Very High, High, Moderate, Low, and Very Low . The study then assigned weights to each factor based on their relative contribution to flood risk. For instance, the slope factor was assigned the highest weight of 23%, while the other factors were assigned a weight of 11% each. The weight were determined based on the literature review. Then as a final steps each flood risk maps were combined based on weight using a spatial analyst tool name weighted sum to create a final flood risk map for the Rowlett Creek .



Flood Hazard Risk Map of Rowlett Creek Watershed

Result



Risk Level	Risk categories	Area (mi²)	Percentage (%)
5	Very High	36.7	17.4
4	High	78.2	37.1
3	Moderate	54.4	25.8
2	Low	30	14.2
1	Very Low	11.6	5.5

Conclusion

The project successfully utilized GIS to analyze multiple factors such as slope, land use, and rainfall to create a detailed flood risk map of the Rowlett Creek Watershed. The resulting map provides valuable information for decision-making and mitigation efforts related to flood hazards in the area. Overall, the study demonstrates the value of using GIS to assess and manage flood hazards in complex natural systems.