



Landslide Susceptibility in Hill and Bosque Counties, Texas



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Abstract

Landslides are a common and potentially destructive natural hazard, posing risks to infrastructure, ecosystems, and human populations. Central Texas, particularly Hill and Bosque Counties within the Texas Hill Country, is prone to landslide occurrence due to its rugged topography and variable geologic formations. This project assesses landslide susceptibility across the region using spatial analysis techniques in a GIS framework. Multiple datasets were integrated, including Digital Elevation Models (DEMs) to derive slope and flow accumulation, geologic formations, soils (hydrologic and erosion data), and stream networks. Each dataset was reclassified according to relative landslide risk and combined through a weighted overlay analysis to produce a landslide susceptibility map identifying areas of low, moderate, and high risk. The resulting map provides a framework for environmental hazard assessment and can support land-use planning and risk mitigation strategies in Central Texas.

Background

Landslides are a widespread natural hazard that can cause significant damage to infrastructure, ecosystems, and human populations. They occur when steep slopes, weak or weathered geological materials, soil composition, and water interact to destabilize the terrain. In Hill and Bosque Counties, within the Central Texas Hill Country, rugged topography, diverse geologic formations, and active fluvial systems increase susceptibility to slope failures. Heavy rainfall events can further saturate soils, reducing slope stability and elevating landslide risk in certain areas.

Understanding the spatial distribution of landslide susceptibility is essential for hazard assessment and informed land-use planning. Geographic Information Systems (GIS) provide a framework for integrating multiple environmental variables and analyzing their combined influence on landslide occurrence. By evaluating factors such as slope (from DEMs), soil properties, geology, and stream networks, GIS-based analyses allow for systematic identification of areas with low, moderate, and high landslide risk. This project applies a weighted overlay approach to map landslide susceptibility in Hill and Bosque Counties and to highlight the environmental controls contributing to slope instability in the region.

Results

Fig. 1. Landslide susceptibility map of Hill and Bosque Counties. Areas are classified from low (green) to very high (red) risk based on weighted overlay analysis of environmental factors.

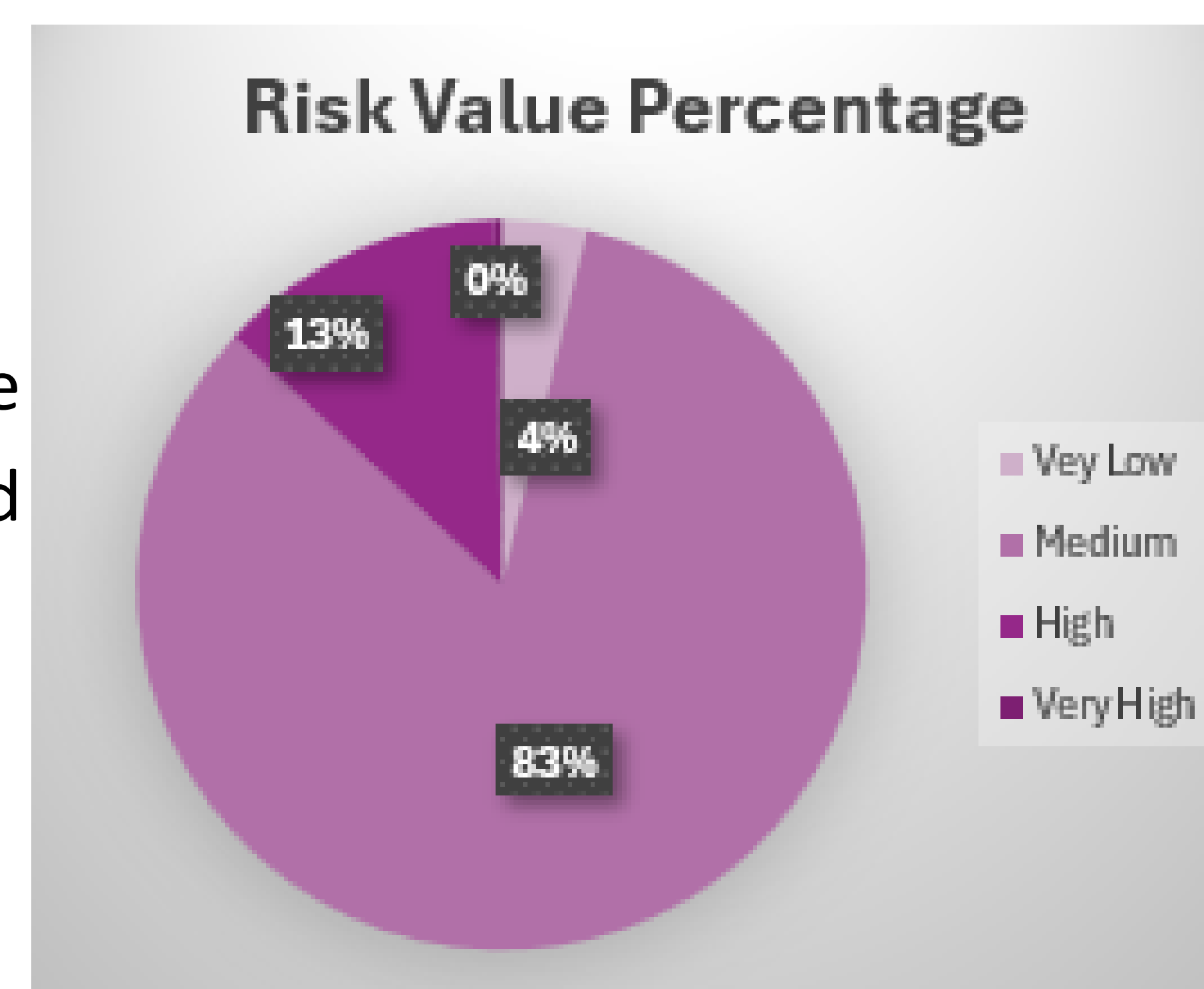
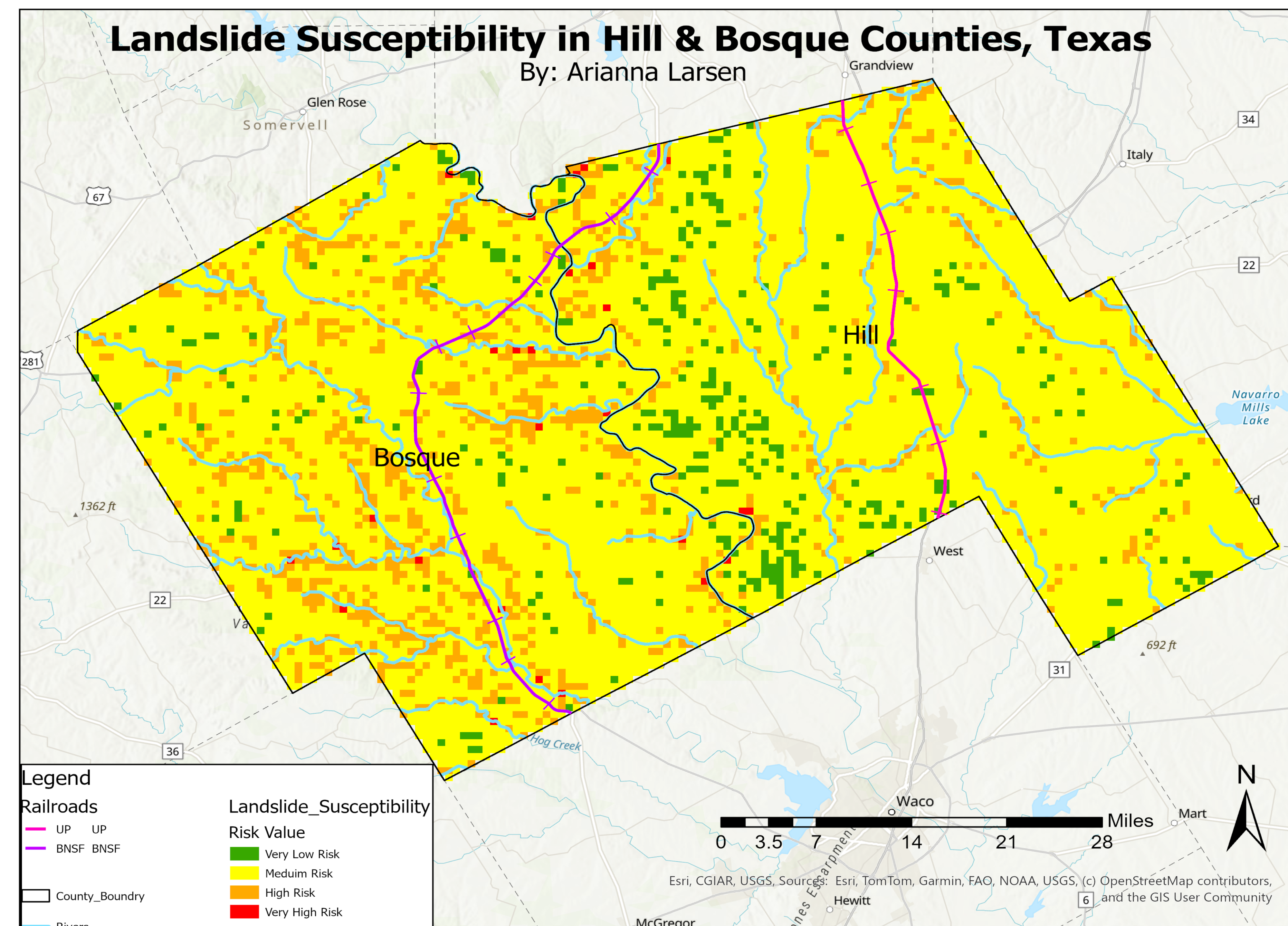


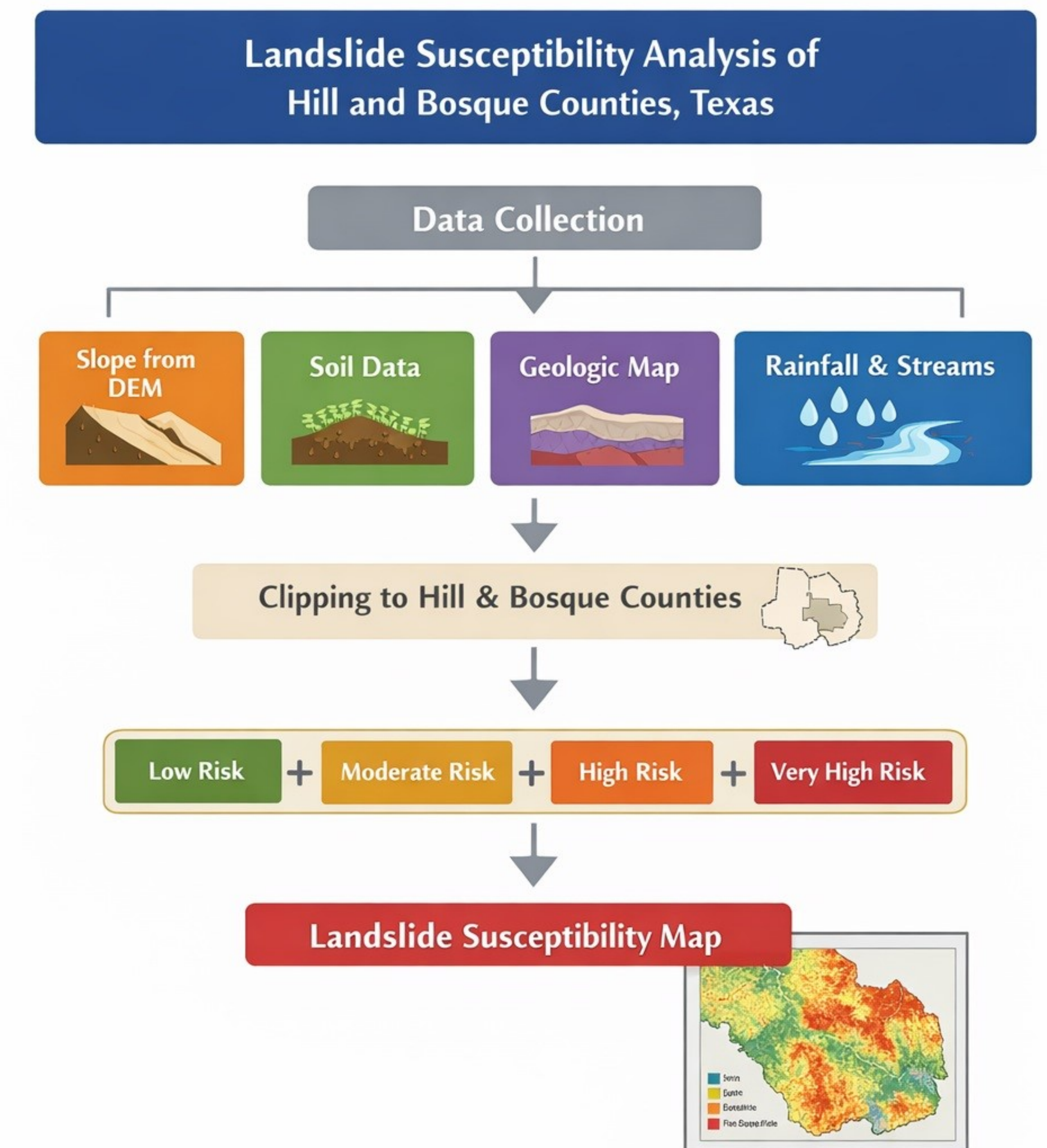
Fig. 2. Proportion of land in each landslide susceptibility class in Hill and Bosque Counties. Most of the study area is classified as moderate risk (84%), followed by high risk (13%) and very low risk (4%), while very high risk areas account for 0% of the total area.

Discussion

The proportion of land in each landslide susceptibility class (Fig. 2) shows that the majority of the study area is classified as moderate risk (84%). High-risk areas make up 13% of the region, while very low-risk zones account for 4%. No areas were classified as very high risk, indicating that extreme instability is not widespread in the study area.

Landslide susceptibility across Hill and Bosque Counties (Fig. 1) shows that most of the region is classified as moderate risk (yellow), with smaller areas of low risk (green) scattered throughout. High-risk zones (orange) are concentrated along river corridors, while very high-risk areas (red) are limited and occur in small clusters.

Methods



Conclusion

- Most of Hill and Bosque Counties are (Fig 1.) low to moderate landslide risk, indicating that the majority of the terrain is relatively stable.
- High-risk clusters occur along river corridors and steep slopes, where water flow and topography increase slope instability.
- Risk patterns reflect the combined influence of slope, soil type, geology, and hydrology on slope stability.
- Very high-risk areas are rare, but identifying them is essential for targeted hazard mitigation, infrastructure planning, and emergency preparedness.
- GIS-based weighted overlay analysis provides a framework for land-use planning, future research, and environmental risk assessment.

References

Esri; NASA; National Geospatial-Intelligence Agency; TomTom; Garmin; Food and Agriculture Organization; National Oceanic and Atmospheric Administration; United States Geological Survey; © OpenStreetMap contributors; GIS User Community.