

# UNSTABLE SLOPES: POOR URBAN PLANNING AND RISK MITIGATION.

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## 1 INTRODUCTION

Mass movement processes (landslides, flows, rockfalls) pose a critical risk to vulnerable urban areas. Their increased frequency is attributed to natural factors and, crucially, to uncontrolled urbanization on unstable slopes. This study advocates an integrated approach to risk mapping and zoning using modern methodologies to guide mitigation strategies and foster resilient cities.

## 2 HYPOTHESIS

After meticulous debate and intricate thinking, a hypothesis was conceived. The aim of the project regarded how the lack of detailed and professionally certified geotechnical studies influences the stability of slopes and hillsides. Additionally, this includes the risks associated with it in terms of the vulnerability for the communities settled in landslide prone zones located around the northwest sector of the Neuquén City.

## 3 METHODOLOGY

A mixed-methods approach was implemented, structured in three main phases:

### 1. DATA COLLECTION

Geospatial data: Secondary data from Digital Elevation Models (DEMs), geological charts, and land-use databases.

Social data: Primary data from virtual surveys (N = [50]) administered to residents, complemented by local news archives.

### 2. DATA ANALYSIS

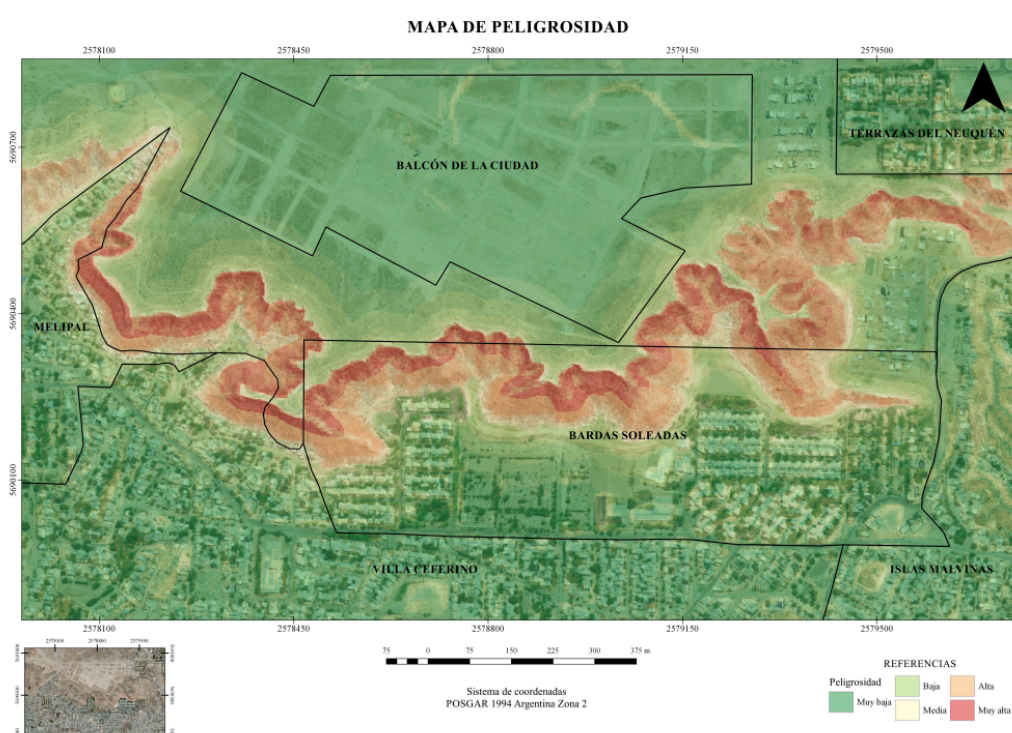
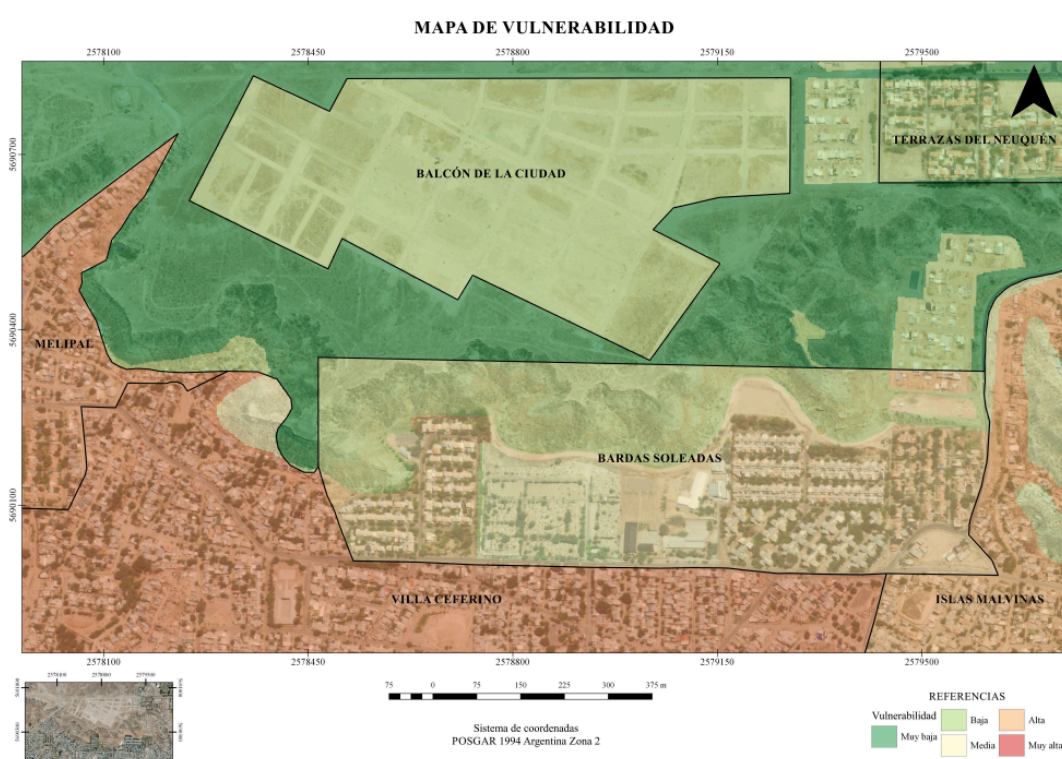
Quantitative: Geohazard susceptibility was mapped using QGIS software. A Weighted Overlay method (Agboola et al., 2024) was applied to slope, lithology, morphology, and land use to identify high-risk zones.

Qualitative: Survey results were analyzed through descriptive statistics to evaluate community awareness and risk perception.

### 3. SYNTHESIS & INTERPRETATION

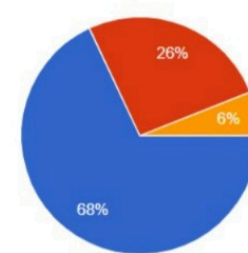
Quantitative maps and qualitative profiles were integrated to build a comprehensive geomorphological risk assessment of the Neuquén bardas area.

## 4 RESULTS



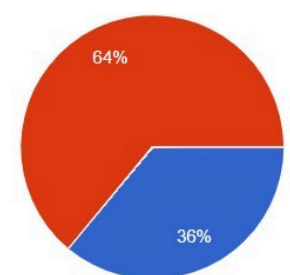
Geomorphological and slope analyses identified steep, erosion-prone escarpments (>26%) as the most unstable zones. Hazard and vulnerability maps highlight Villa Ceferino, Bardas Soleadas, and Melipal as critical areas. Surveys show low public awareness of geological risk—only 36% understand mitigation—revealing a gap between actual hazard and community perception

¿Conoce lo que es la Geología?  
50 respuestas



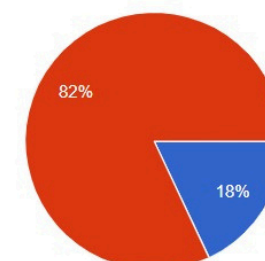
● Si, se lo que estudia y trabaja  
● Si, no se lo que estudia y trabaja  
● No tengo conocimiento sobre Geología

¿Sabe lo que es la mitigación de riesgos?  
50 respuestas



● Si  
● No

¿Alguna vez sintió que su vivienda ubicada en cercanías a una zona de bardas estaba en peligro?  
50 respuestas



● Si  
● No

Fifty residents from northern Neuquén were surveyed. Although 68% claim to know about geology, only 36% understand risk mitigation. Half live near the slopes, yet 82% do not perceive any danger to their homes. This gap between actual exposure and low risk perception highlights the need for greater education and communication on geological hazards.

## 5 CONCLUSION

The evidence from the Neuquén escarpments underscores the critical importance of the professional geologist in infrastructure and urbanization. By identifying factors such as slopes, poorly consolidated materials, and active erosion, geology translates the latent geomorphological risk into hazard and vulnerability maps. The gap between objective risk and low social perception demands that geologists integrate their findings into land use planning and urban planning. This ensures that infrastructure projects consider geotechnical criteria, minimizing the activation of gravitational mass movement processes. The role is key for comprehensive prevention and urban resilience.

## REFERENCIAS

Agboola, G., Hashemi Beni, L., Elbayoumi, T., & Thompson, G. (2024). Optimizing landslide susceptibility mapping using machine learning and geospatial techniques. *Ecological Informatics*, 81, 102583. <https://doi.org/10.1016/j.ecoinf.2024.102583>.

Cascini, L., Bonnard, C., Corominas, J., Jibson, R., & Montero-Olarte, J. (2005). Landslide hazard and risk zoning for urban planning and development. *Proceedings of the International Conference on Landslide Risk Management*, 199–239.

Chen, F., Lin, H., Zhang, Y., & Lu, Z. (2012). Ground subsidence geo-hazards induced by rapid urbanization: Implications from InSAR observation and geological analysis. *Natural Hazards and Earth System Sciences*, 12(3), 935–942. <https://doi.org/10.5194/nhess-12-935-2012>.

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