

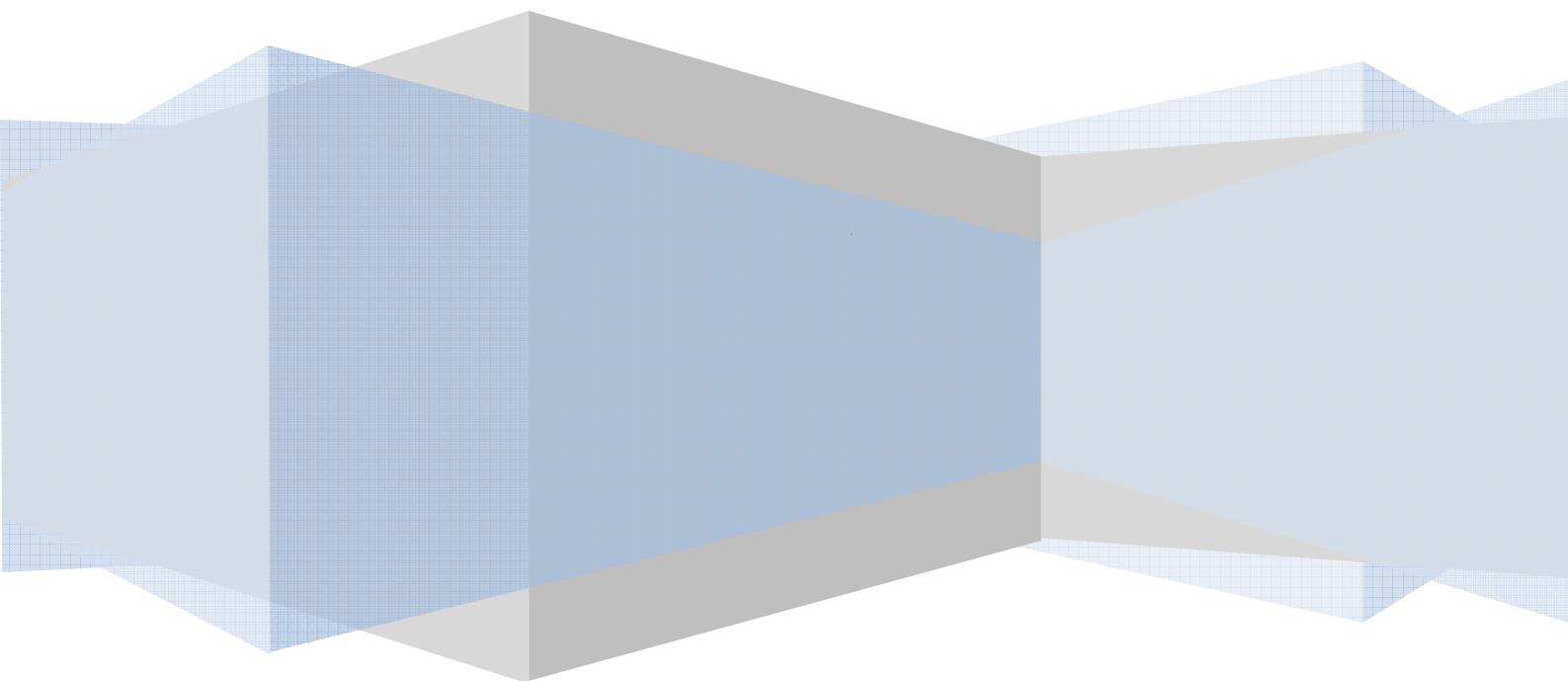
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Environmental Hazard, Vulnerability and Risk Analysis

Through Hazard and Vulnerability Analysis

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1. INTRODUCTION

1.1 AIM

To analyse the probability threat of hazard and vulnerability of disaster in Colombia and thereafter forming a Risk map using ILLWIS.

1.2 Tools:

- a. ILWIS (Integrated Land and Water Information System): ILWIS is an integrated GIS and Remote Sensing application for raster processing. Having been used by many students, teachers and researchers for more than two decades, ILWIS is one of the most user-friendly integrated vector and raster software programmes currently available.
- b. GIS (Geographic information system): A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships.

2. HAZARD

2.1 Introduction to Hazard

A hazard is a situation that poses a level of threat to life, health, property, or environment. The degree of hazard of a certain area depends on many factors. These factors can be observed separately although they affect each other and the area concerned together. Some of these factors are:

- Landslides
- Seismic hazard
- Tsunami hazard
- Volcanic hazard
- Flood hazard
- Erosion hazard by torrential rivers
- Beach erosion and accretion
- Topographic regions

To form a Hazard map of Colombia, we will analyse each of above factors individually and then add their data accordingly.

2.2 PROCEDURE

This process includes four steps:

Step 1: Assigning weight values to the classes of the parameter maps.

Step 2: Renumbering the parameter maps to weight maps.

Step 3: Combining the weight maps into one single hazard map.

Step 4: Classifying the combined weight map into a final hazard map.

After performing these steps in ILWIS software, we obtain a hazard map as shown in *figure 1*.

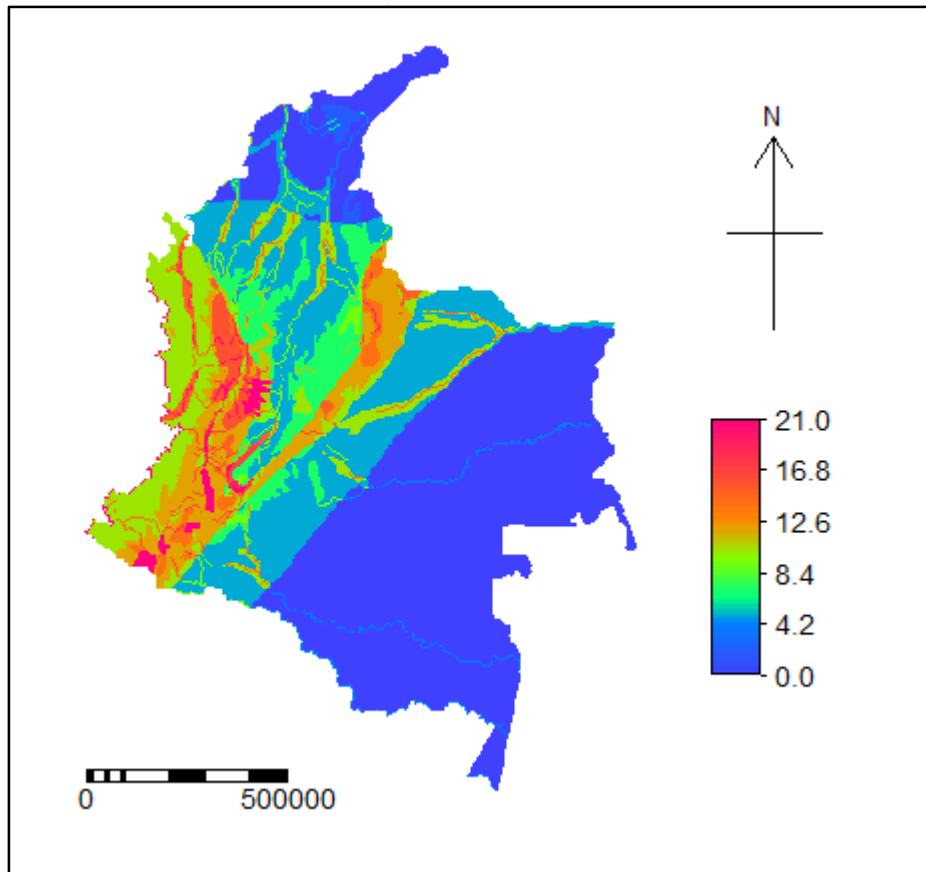


Figure 1: Quantitative Hazard Map of Colombia.

2.3 OBSERVATIONS

As we can observe through *figure1*, threat of hazard is highest in western-central Colombia. This can be interpreted through the fact that this area has high seismic and volcanic hazard which weights relatively higher than most of other hazards. This area is also prone to landslide.

We also observe that eastern Colombia has relatively very low hazard probability.

3. VULNERABILITY

3.1 Introduction to Vulnerability

Vulnerability describes the characteristics and circumstances of concerned region, system or asset that make it susceptible to the damaging effects of a hazard. Vulnerability map is used to estimate the degree of loss to a given set of elements at risk resulting from the occurrence of the phenomenon. Elements which are at risk are population, economy, infrastructure etc.

3.2 PROCEDURE

Steps involved in making vulnerability map are:

STEP 1: Creating a population density map.

Using different data and raster maps of infrastructure, industrial centres, population density etc.

STEP 2: Creating vulnerability map.

By first creating different weight maps are based upon the relative importance of each of the elements at risk with respect to the damage caused by a disaster. Then combining these weight maps to form a single vulnerability map. The output map we get from above steps is shown in figure 2.

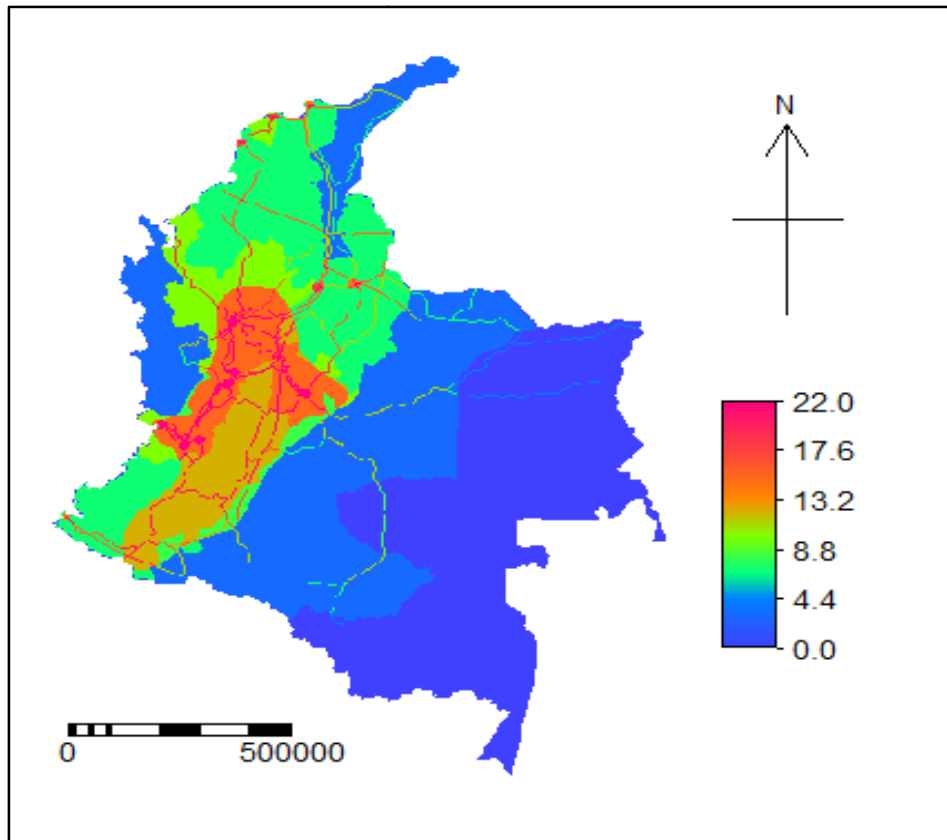


Figure 2: Quantitative Vulnerability Map of Colombia

3.3 OBSERVATIONS

Similar to hazard, vulnerability map also shows that most of the Colombia especially the southern and eastern parts falls under low vulnerability zone. Central Colombia largely falls in moderate and high vulnerability zone consist of western Colombia.

4. RISK

4.1 Introduction to Risk

According to Varnes (1984), risk can be defined as “the expected degree of loss due to particular natural phenomena”. It is the probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through pre-emptive action.

4.2 PROCEDURE

In real projects, the process of making a risk map is very complex. Risk map can be analysed as the multiplication of [costs * vulnerability * recurrence interval of natural damaging phenomenon]. To simplify things, we will ignore the cost and recurrence interval phenomenon in this project.

Therefore we can calculate risk map as a combination of natural hazard and the vulnerability.

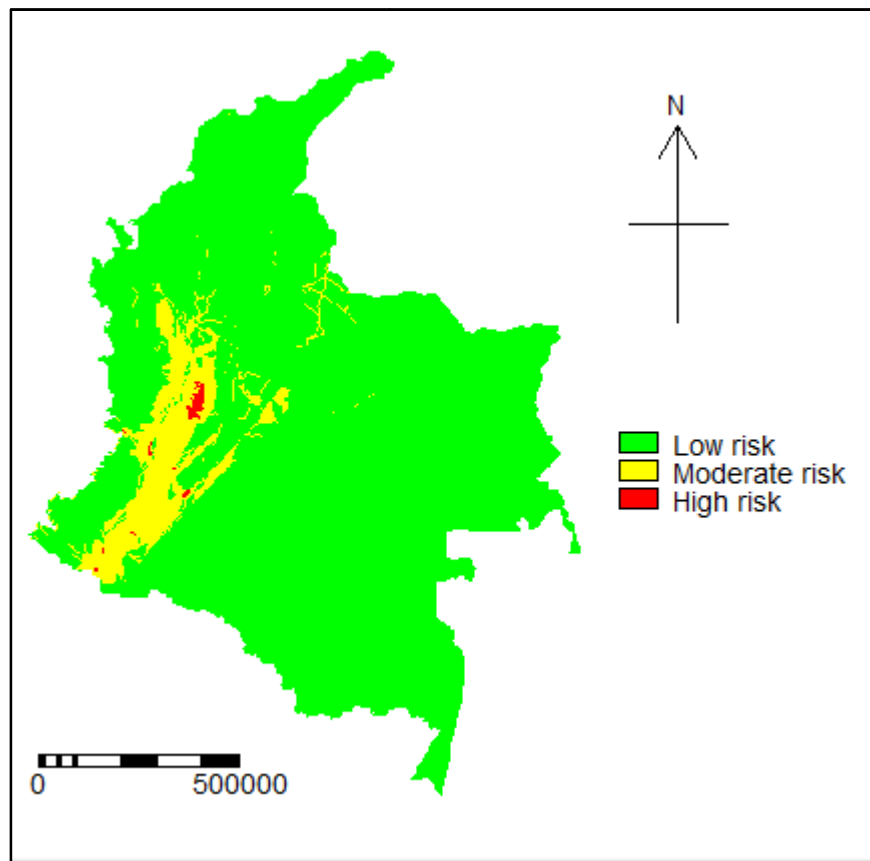


Figure 3: Quantitative Risk Map of Colombia

4.3 OBSERVATION

As we can see in figure 3, despite the area under moderate and high zone in figure 1 and 2 maps, risk map shows almost all area under low risk category. Possible reason for the risk map could be that the area under high hazard has low vulnerability and the area under high vulnerable zone has low hazard risk.