# LANDSLIDE SUSCEPTIBILITY ASSESSMENT IN ACTIVE SEISMIC ZONE —WITH A CASE STUDY OF WENCHUAN

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## 1. INTRODUCTION

The Ms 8.0 Wenchuan earthquake, occurred on 12 May 2008 in Sichuan Province, caused enormous property damages and human casualties. Right now, the secondary disasters caused by strong earthquake, especially landslides, have drawn much attention in the affected area. For this reason, it is necessary to research on susceptibility assessment in Wenchuan which is helpful to decrease landslide damage during recovery.

Recent investigators have suggested that statistical (rather than physically based) approaches that correlate numerous factors with landslide occurrence are best suited. However, most of researches are focusing on rainfall triggered landslides which are different from earthquake influenced landslides. In the present study, Wenchuan County, the heavily affected area in the earthquake, was selected as the study area (Fig.1). The main target is to analyze the correlation of landslides with influencing factors and evaluate the landslide hazards in the study area with Geographic Information System (GIS), Remote Sensing (RS), information method and logistic regression models.

## 2. METHODOLOGY

### 2.1 Data preparation

Topographical, geological data and satellite images were collected, processed, and constructed into a spatial database using GIS and image processing. Seven landslide occurrence factors were selected as: elevation, slop, aspect, lithology, seismic intensity, distance to faults and rivers. Besides, landslide locations map in the study area were generated through methods of information extraction based on analyses of characteristics of earthquake-induced landslides and field surveys.

### 2.2 Relationship between landslides and landslide-related factors

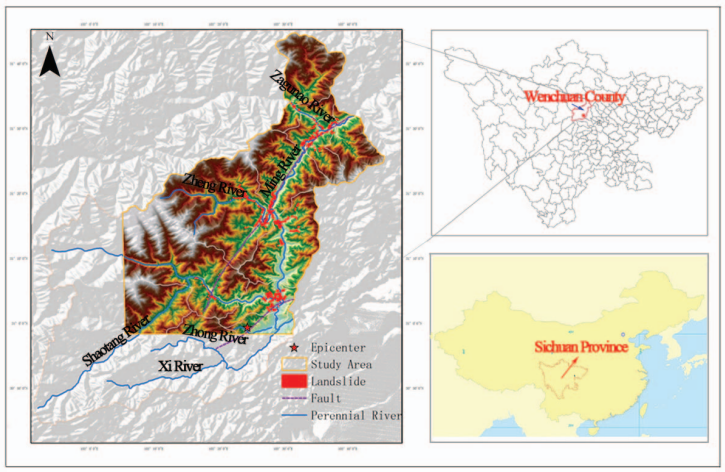


Fig. 1. Location map of the application site of the study

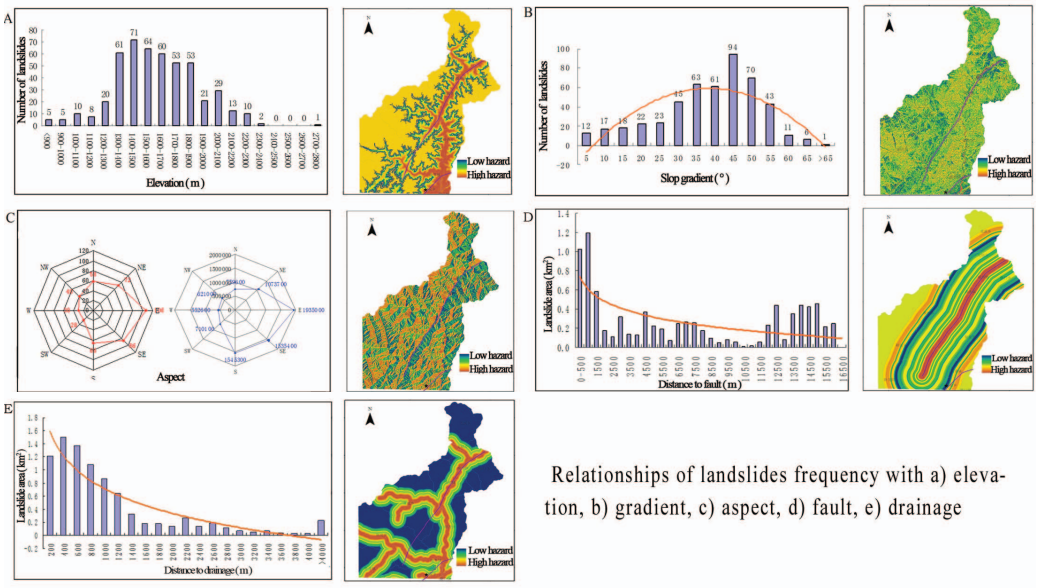


Fig. 2. Relationships of landslides frequency with factors

A spatial relationship between a landslide location and each landslide-related factor was derived (Fig. 2).It can be concluded that the landslides density particularly correlates with all these seven factors.

**2.3 Weight determination**

(1) Information value model

Generally, the information value can be work out using this equation [1]:

$$I(x_i, L) = \ln \frac{N_i / N}{S_i / S} \qquad (1)$$

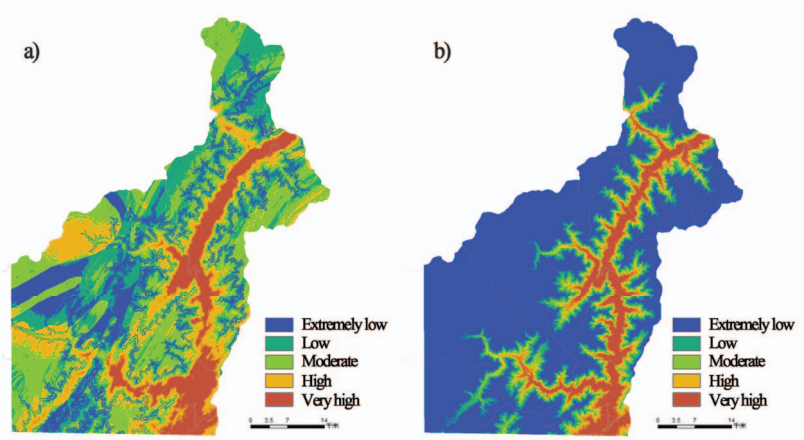


Fig. 3. The landslide susceptibility map by a) information value model; b) the logistic regression model

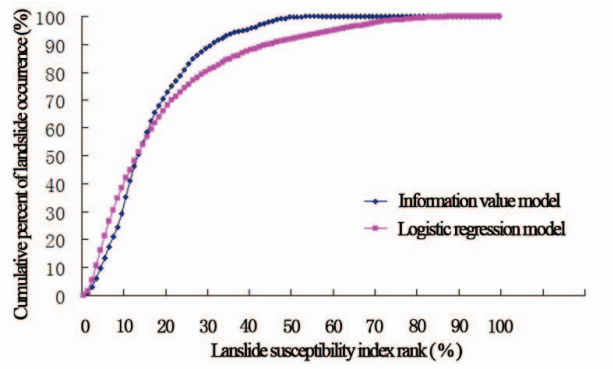


Fig. 4. The relation between cumulative percent of landslide occurrence and susceptibility index rank

Where $I(x_i, L)$ is the information value provided by variable $(x_i)$; $S$ is the sum of cells in the region; $N$ is the number of cells having landslides; $S_i$ is the number of cells having the same factor $x_i$ and $N_i$ is the sum of cells having landslides in these $S_i$ cells.

(2) Logistic regression model

$$P = \frac{e^{\beta_0+\beta_1 x_1+\ldots+\beta_n x_n}}{1+e^{\beta_0+\beta_1 x_1+\ldots+\beta_n x_n}} \tag{2}$$

Where $e$, $\beta_0$, $\beta_1 \cdots$, $\beta_n$ are constant[2].

## 3. RESULT

Using the information value and logistic regression models respectively, the probability predicting the potential landslide occurrence can be calculated. Based on this, the study zone was ultimately categorized into five classes, specifically, “extremely low”, “low”, “moderate”, “high” and “very high”.

In order to estimate the landslide susceptibility analysis result in detail, the known landslide locations were used to overlay on the landslide susceptibility maps. The comparison results have been shown in fig.4, which indicated that both models have high accuracy. In detail, the landslide susceptibility map produced using logistic regression model seems to have about 5% higher percentages of landslides than the information value method in very high zone. However, in other zones, the result using value information models are found to be a bit more realistic (average of 4.2%).

## 4. CONCLUSION

In the present study, two probabilistic and statistical approaches for estimating the susceptible areas of study area of Wenchun County were applied and tested. The result has been proved to reflect closely the spatial distributions of landslides in the study area. It can be concluded that logistic regression model has more accuracy.

Furthermore, seven factors controlling landslide occurrence in the study area have been taken account into the susceptibility assessment, including elevation, slop gradient, aspect, lithology, seismic intensity, distance to faults and rivers which have been proved to have correlation with landslides occurrence.

## 5. REFERENCES


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