Landslide hazard zonation in shirin Rood Drainage basin with using Geographic information system, sari, Iran.

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ABSTRACT:

In drainage basins of northern part of Iran, combinations of natural and human factors have caused numerous landslides and a lot of damage due to laudslides. For restricting the activity of landslides are of the main solution is to avoid these regions. For doing this, landslide hazard Zonation map of the area should be prepared and low hazard and high hazard zones should be separated. In this research nine following factors were recognized as effective factors in landslide occurrence: slope, aspect, altitude, rainfall, land use, geology, distance from faults, distance from roads and distance from main drainges. Aftar overlaying landslides distribution map with the map of the above – mentioned factors, it was recognized that aspect and distance from main drainage have little effect on landslide occurrence. Then by considering the other seven factors, landslide hazard zonation of the area was done using two following methods of valuing area accumulation and Index Overlay. The result of this research have shown that in all two methods the regions in which land use changes have occurred seriusly, belong to high hazard zones and inversely, region in which forests have not been destroyed, belong to low hazard zones. After this phase the evaluation of zonation methods was done. For doing this, was used from the methods of accumulation ratio in each of hazard classes. The result of this method has shown that in Index Overlay method, different hazard zones were separated better.

KEYWORDS: Effective factor, Landslide, Zonation, Natural and human factor, Shirinrood drainage basin,

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Introduction:

Increasing of population in developing countries, lead to be used from lands of these countries, more than their production capacity. In addition to none regarding of land use and land use change have been resulted in soil erosion.

Geological, Topographic and Climatic condition of the area and human factors sach as land use changing and road construction are the important factors that have been caused the most landslides in the study area (4).

The investigation of triggering factors on landslides occurrence and landslide hazard zonation based on these factors is the main goals of this research.

Study area :

Shirinrood drainage basin has been located in north of Iran, Mazandaran

Province. It runs from $36^{o}0'30''$ To $36^{o}22'20''$ northern latitude and from $53^{o}27'25''$ To $53^{o}3'18''$ eastern longitude. The area of drainage basin is $708.08(km^2)$. The most of drainage basin area has been covered from forested lands. The annual mean temperature of the terrain in 12.5 ˚c and the annual mean precipitation is estimated 696.7 (mm). The area climate from Dommartan method is humid (5). From geological poit of view, the most of geologic units are related to senozoaek era that for the reason of the existance of marl, sheil and silty stones are susceptible to landslide occurrence (4).

Methodology:

In the primary phases and after the field works and providing different maps, nine following factors Altitude classes, slope, aspect, rainfall, lithology, land use, distance from road, distance from fault and distance from hydrographic network, were determined as primary effective factors on landslides occurrence.

Also, landslides distribution map of the area with doing field works and GPS recording was derived (Fig.1). After this phase all of the maps with using GIS

techniques was analyzed. For doing this was used from Arc/info, Idrisi and Arc /view software and was supplied a data network. Then, each of the primary effective factor maps has been crossed with landslides distribution map in Idrisi software circumstance and earned results was analyzed (1). With doing this work, was determined that two factors, aspect and distance from hydrographic network are not effective on landslides occurrence of the area. Table 1 shows the most and low effect classes of each factor after the final analysis (4).

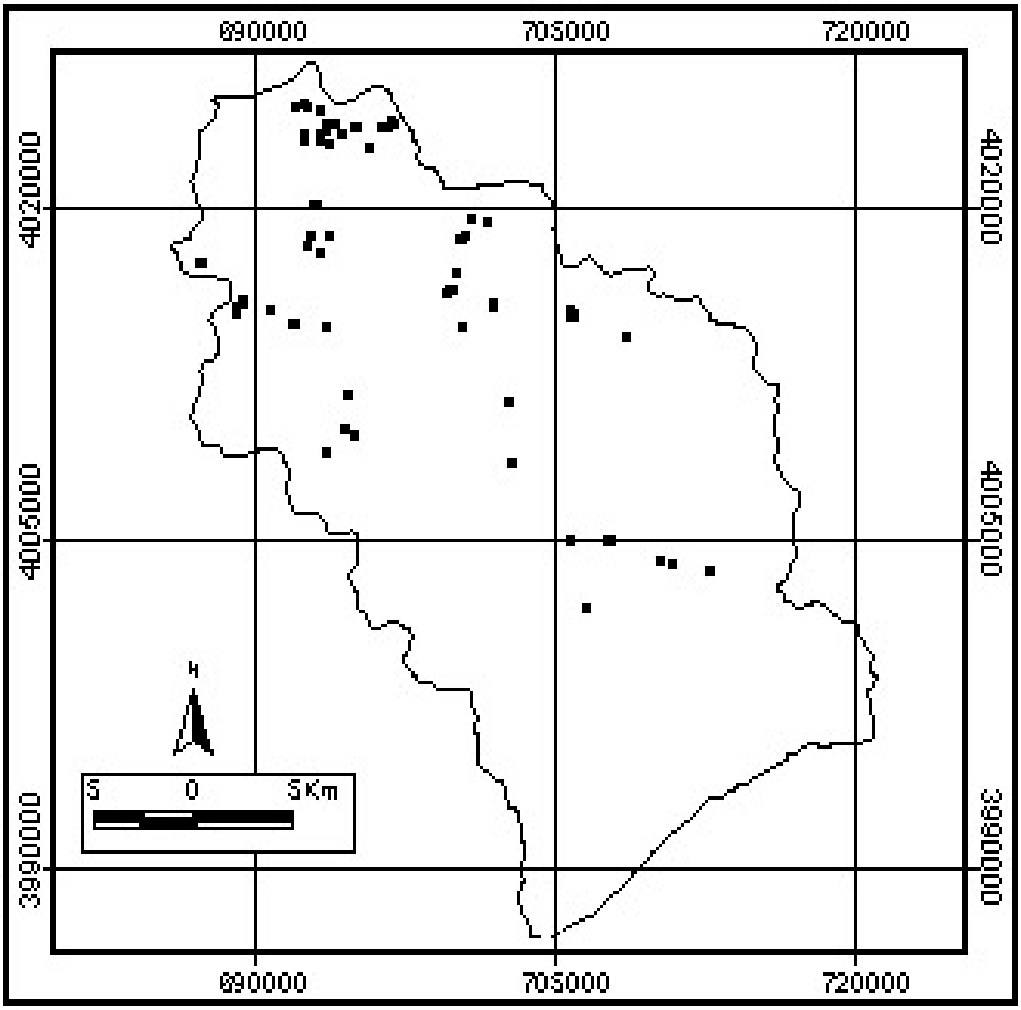

Figure. 1. Landslide distribution map of shirinrood drainage basin

Table 1. The most and low effect classes of each factors

Most effect classes	Low effect classes
Altitude: 300-500 (m) upon sea level	Altitude : > 1150 (m) upon sea level
Slope: 8-15%	Slope : > %45
Gealogy: PL cm (marl and silt)	Geology : The other units
Land use : garden and agronomy mixture	Land use : dense forest
Rainfall : > 950 (mm)	Rainfall : < 650 (mm)
Distance from road : 0-75 (m)	Distance from road : > 500 (m)
Distance from fault : 0-1000 (m)	Distance from fault : > 5000 (m)

Landslides hazard zonation of shirinrood drainage basin:

With regard to seven effective factors that determined, Landslide hazard zonation of the area was done. For doing this, have been used from method of valuing area accumulation.

Landslide hazard zonation with using valuing area accumulation method:

The weight of different classes of each causative factor in this method is derived from equation 1 (2):

$$Wa = 1000(\frac{A}{B}) - 1000(\frac{C}{D}) \qquad (Equ.1)$$

Where:

A: The number of landslides in each class of factors.

B: The area of each class of factors.

C: The number of total landslides in shirinrood drainage basin.

D: The total area of shirinrood drainage basin.

After was derived the weight of different factors classes (Table 2), this weight was generalized to each maps of factors with using RECLASS menue in Idrisi software circumstance (1). Then, was derived landslide hazard zonation map with overlaying of final maps in related to different factors and summing of each pixel values. Finally, the earned zonation map was classified into five hazard zones. For classification of the zonation map, at first was drawn the cumulative curve of pixels frequencies versus the values of pixels in Excel software circumstance and was used of it in classification of hazard zones.

Table 2. The earned weights for factors classes in valuing area accumulation method.

Geologic factor		Land use factor		Rainfall factor		Distance from road factor		Slope factor		Distance from fault factor		Altitude factor	
class	weight	class	weight	class	weight	class	weight	class	weight	class	weight	class	weight
1	94.4	1	-32.2	1	224.3	1	80.4	1	25.4	1	29.4	1	562.4
2	975.5	2	-6.4	2	95.4	2	77.4	2	56.4	2	20.4	2	97.4
3	21.1	3	143.7	3	-44.2	3	44.4	3	29.4	3	13.4	3	21.9
4	-33.9	4	12.8	4	-33.7	4	32.9	4	-27.6	4	-57.6	4	-61.3
5	42.4	5	1089	5	-33.8	5	-6.6	5	-79.6			5	-36.3
6	-67.6	6	-1	6	-66.8	6	-46.6					6	25.8
												7	-70.3
												8	-70.7

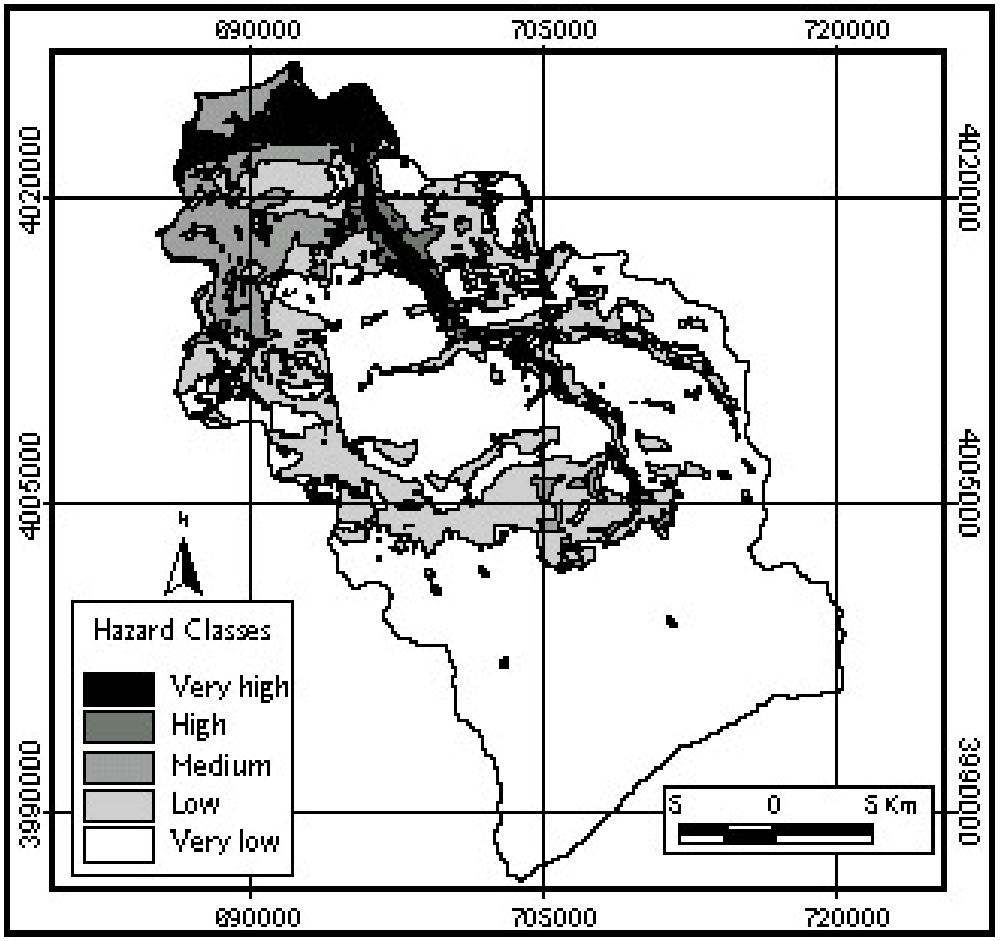

Fig.2. Landslide hazard zonation map using area accumulation method

Conclusions:

Whatever was derived from different effective factors analysis, among nine factors, the aspect and distance from hydrographic network factors, were removed from the research for the reason of weak results. In the past researches about aspect, the north aspect was determined as high hazard region for purpose of mass movement occurrence, but in the study area this factor influenced with human activities such as land use changing and road construction, has been losed its effect so as the southern aspect has the most effect on landslides occurrence in the study area.

Also about land use factor was found that the land use changing has most effect in landslide triggering so as in the areas with dense forest, gradually, with deforestation and changed into dry and irrigated farming and gardens, have been occurrenced many landslides.

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