Landslide Hazard Investigation in Saqqez – Marivan main road in Kurdistan province

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Abstract

One of the processes of slope that occurs every year in Iran and some parts of world and cause a lot of criminal and financial harms is called landslide. The aim of this research landslide hazard susceptibility mapping using information layers and effective factors in landslide hazard using GIS. Distribution landslides map to prepare by using aerial photography and field study. Information layers such as: slope, aspect, elevation, litho logy, land use, distance of drainage, distance of road, distance of fault and precipitation identified effective factors landslide hazard in section of saqqez-marivan road in watershed saqqez, relevant maps digited in GIS environment and used for analysis risk zones. The relationship between the factors and the landslides were calculated using frequency ratio, one of the probabilistic models. Then landslide hazard susceptibility map was drawn using frequency ratio. As a result, showed that the identified landslides were located in the class low (4.26%), moderate (52.48%), high (31.65%) and very high (11.62%) in Susceptibility zones.

Key words: *Landslide zoning, GIS, Frequency ratio model, Landslide susceptibility Index, watershed saqqez.*

1. Introduction

Landslide is one of the natural disasters that create social – economic damages. Although absolutely economic damages rate resulted in landslides higher in the development countries, but by made researchers from UNDRC for almost developing countries, these damages are one or two percent of their national gross production [8]. Therefore, it is able tell that the developing countries relating tolerate the high damages both economic and body security aspects. This matter is confirmed the emergency of management of natural disasters in these countries. In Iran take place several natural disasters such as earthquake, flood and landslide by reasons such as litho logy, topography and climate reasons. Approximately half of this country area is mountains and it have rapid slopes, shaking, existing active faults and rainfall caused that every year. In the mountains regions take place various landslides and create interesting considerable damages to human and natural environment. This investigation performs in the part of Saqqez watershed in part of Maryvan –Saqqez main road. This investigation research is want that identification the sensitive landslide area by use of Frequency ratio model until by identification this region, performance measures for control rationale in the region. And prevent of capital and energy waste. Different methods have been used for zonation hazard landslide in the different part of world. Containing: Statically methods[1], [11], Frequency models [9] ,[7]and Intelligence models such as Fuzzy logic [15], [2],.In this research has been used of Frequency ratio model in order to preparation landslide sensitivity map in the Saqqez watershed.

2. Case study

Study area characteristic study area is Zagros Mountains chains in central region in Kurdistan province. Case study area is related road between Maryvan and Saqqez cities with width 119225.9 Km^2 in western section of Zarina watershed. This region spaced between geographical longitude 45˚26′ 36″ until 46˚ 26′ 46″ eastern and latitude 35˚ 59′ 22″ until 36˚ 23′ 42″ northern. A maximum elevation in region is 3290 meter and minimum 1200 meter. The case study road (Saqqez – maryavan) paced in Zagros reverse fault by aspect litho logic and tectonic zone boundary (cracked zone) and Sirjan Sanandaj zone (Figure 1).

3. Material and Methods

In this study has been used of particular tools and materials in the respect of exiting methodology in geomorphology and accomplishment researches in this field and particularly in related to hillside movement.

1. Topography maps with scale 1:50000 Saqqez, Hasan salaran, Bardarasha, Chenara, Maryvan.
2. Geological maps with scale 1:25000 Saqqez and maryvan.
3. Land use map with scale 1:250000 kurdistan province.
4. Basin aerial photos with scale: 1:20000 survey organizations and with scale 1:55000 army geographical organization.
5. Landsat satellite images 2002 year sensor ETM+ of Iran space organization with resolution 30 m.
6. Preparation reference maps and maps scan in order to entrance to computer.
7. Maps georefrence and maps mosaic by using Pci- Geomatica software.
8. Operative maps digitizing by using ILWIS software.
9. Interpretation of phenomenon and identification of some Restrictions and comparison surveys with satellite images by using Pci-Geomatica and ILWIS software.
10. Maps overlay by using Arc view and GIS software.
11. Preparation of final zonation maps.

4. Results and Discussion

Final purpose of this study is preparation of sensitivity maps landslide hazard. First step is necessary date collection in order to evaluation of this phenomenon. First we evaluate theory framework. Thus by using of topography map with scale 1:50000 region in ILWIS environment digitizing that prepare DEM[1] map (100 meter counter round), thus made evaluation category map, slope and slope aspect by using of DEM. Geological map extracted of geology organization and land use in formation layer by using ETM+ satellite images 2002 year. By using area aerial photos, occurrence landslide and susceptible area and suspicious to landslide in region is identification and thereby almost landslide by reason low dimension sample appearance with adjacent hillside, don't recognition in aerial photos. So for completion in formation all available landslides is observed [12],[10]. For appointment landslide relationship with ingredient operative in outbreak it and so for preparation sensitivity map to landslide hazard in area, utilize units for purpose of base and observations

1 . digital elevation model

base. by using ILWISE software, preparation operative maps such as: slope, slope aspect, elevation, litho logy, land use, road distance, fault distance and drainage distance and incorporation with landslide scatter map.(fig.,3 to 6). Therefore, denoted Weight of landslide outbreak effective ingredient. First appointment slip pixels percent and slip without by using GIS and finally, calculate Frequency ration for any of ingredient and relation to classes it by using frame 1.so calculate sensitivity index of slip hazard by using frame 2.[11]

FR = A. B

A: slip pixels percent and B: slip without pixels percent

LSI = Fr(Sl)+ Fr(As)+ Fr(El)+ Fr(Li)+ Fr(LU)+ Fr(DF)+ Fr(DD)+ Fr(DR)

LSI: sensitivity index of landslide hazard, SA: slope aspect, S1: slope, E1: elevation, Li: litho logy, Lu: land use, DF: fault distance DD: drainage distance, DR: road distance and Fr: weight of operative ingredient in landslide outbreak, if Fr>1 operative ingredient correlation to slip is very high and if Fr<1, this correlation is very weak.

Finally, occurred slips percent maximum in 15 -30% slope. So 30-50 % slope class was preference second degree. In low slope, usually resister forces like fiction, soil and hillside materials is more than motive forces like gravity force. in very high slops too, not aggregation that author landslide outbreak, in result, (20-30) medium slope was show landside scale maximum that accordance with Faiznya et al (2001)., Fatemi aghda et al(2003)., Shadfar et al (2005) results [16]. Slope aspect scrutiny results were shown that has been in occurred landslides percent maximum in that area in western and northern aspects. Was shown elevation class scrutiny that occurred slips 68% in 1500-1800 meter elevation. Was shown study basin litho logy that occur EKtv stratum (76.1%) that are incorporation of Sileston, Shil, sand stone, kenglomera that are sensitizing to mass movements and erosion that accordance via Naji (2006)[13] ., Pourghasemi et al (2008)., Mahdavifar and Uromchiy (2000) [17] ., Davis and Ohlmacher (2003) that symptomatic is to Shil and Silt high sensitivity to slip[14] .Was shown fault distance, drainage distance and road distance that have been occur landslides percent maximum in 200-300 meter distance of fault and road so in that 100 meter distance of drainage that was speculated in regularity 72.05%, 33.78% and 34.89% of occurred slips that are correspondence with Pourghasemi et al (2008), Duman et al (2005)[4] ., Lee (2007) results., on the basis high correlation of landslide outbreak with road and drainage distance proximity. In viewpoint of land use, have been occur landslide maximum in medium pasture. In finally, have been occur in 300-400 millimeter class in viewpoint of rainfall.

Final map of sensitivity zonation to landslide hazard of saqqez watershed with Frequency ration method is shown in figure 8.

5. Discussion

In this research, landslide hazard zonation done in saqqez watershed by using Frequency ration method. The results are showing that zonation accuracy by using of Frequency ration method is very important in because of attend to membership value of per operative in final zonation landslide in done disasters of landslide predict so, proximity 4.26% of area lands is low hazard class, 52.48% it is medium hazard class, 31.65% it is high hazard class and 11.62% it is very high hazard class. Landslide zonation map comparison with landslide scatter

map is reason on befit this model for landslide zonation in area. In total, Study area is wealthy high potential for landslide outbreak.

6. References

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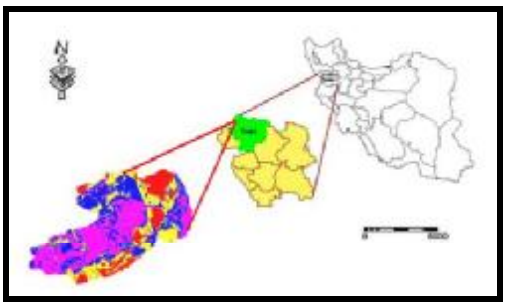

Fig 1. Geographical position of study area

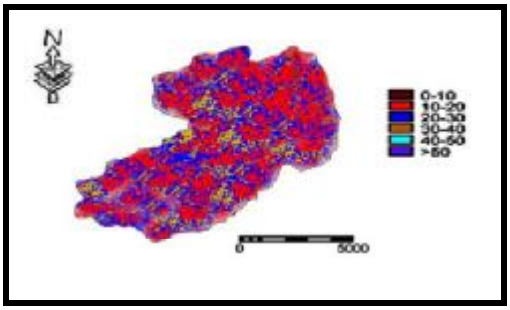

Fig 2. Slope map of study area

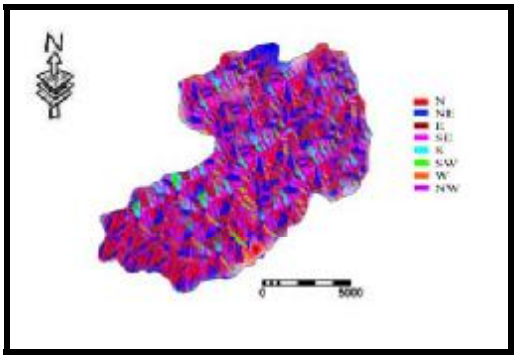

Fig 3. Slope aspect map of study area

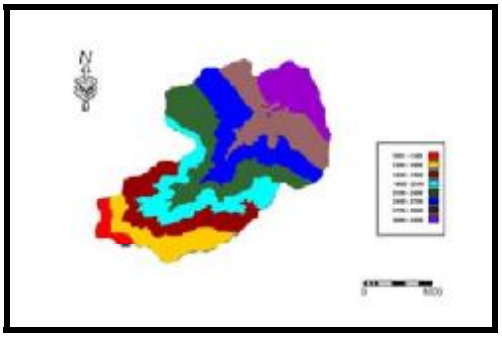

Fig 4. Elevation classes map of study area

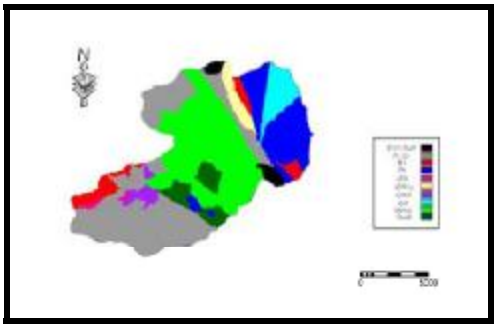

Fig 5. Litho logy map of study area

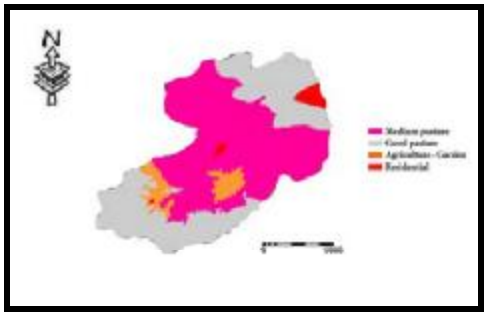

Fig 6. Land use map of study area

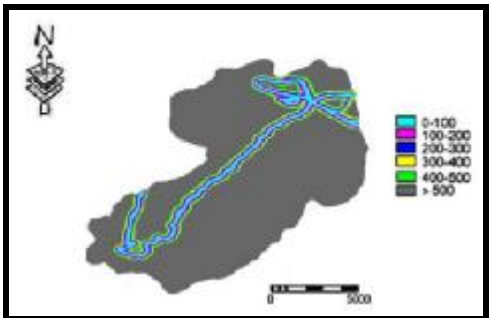

Fig 7. Road distance map of study area

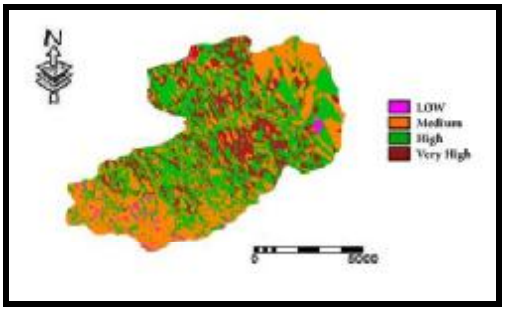

Fig 8. Sensitivity map to landslide hazard of study area

Conclusion