

Factor of landslide occurrence in Govijeh bell basin with techniques GIS and RS

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Abstract: Landslide in Iran is a natural disaster, Annual losses of life and property in the country. If the probability of a sometimes make the other natural disasters, Potential occurrence of landslides in the country should be considered at any time. The slopes of the mountainous areas including dynamical systems are in a state of equilibrium Results As long as the material conditions change and their balance is not stable enough to be forces of natural and human of the balance of the leading and by reducing the a collapse in the stability, Range of motion emerge. Statistics show that every year a significant number of landslides occurring in most regions of Azerbaijan and share this part of the country is more than the rest of the loss of life a lot of financial bring. However, due to the large amount of damage, which brings economic, financial and scientific study of geological phenomena using modern techniques GIS In order to consider measures to reduce risks and losses of the important goals of this research. Therefore, this study aimed at understanding the factors influencing the occurrence and to provide guidelines for the prevention and management that is necessary.

Key words: Landslides; GIS; Govijeh Bill; Tabriz

1. Introduction

The occurrence of landslide prone areas is one of the major muscles that human societies are facing the most part. Thus creating a regional strategy for the protection of human and natural resources And reduce damage from occurring essential for achieving sustainable development goals and to provide a suitable model and zoning map of the landslide hazard in the planning and management The study area is competent centers helpful lead. Therefore this study tries to investigate the factors influencing the occurrence of landslides in the Govijeh Bell basin in Tabriz, an important step to take to help manage this phenomenon in the study area.

Because of the topography and climatic conditions of the region, Azerbaijan is one of the critical areas of mass movement is risky .Statistics show that every year a significant number of landslides occurring in most regions of Azerbaijan and share this part of the country is more than the rest of the loss of life a lot of financial bring them. However, due to the large amount of damage, which brings economic, financial and scientific study of geological phenomena using modern techniques of GIS in order to consider the necessary arrangements in order to reduce the risks of damages of the important goals this research. Therefore, this study aimed at understanding the factors influencing the occurrence

and to provide guidelines for the prevention and management is necessary.

The overall objective of this study was to identify factors influencing the occurrence of slope movements, identification of vulnerable and unstable in Tabriz Govijeh Bell with GIS technique in different dimensions.

2. Literature

The first studies on the occurrence of landslides in Italy, France, Czechoslovakia and the United States began (Alimoradi, 1389). Of the Early 1970, Most Of the Scientists With the Applying Methods Different Including System Information Geographic, multi-criteria decision-making models and methods of weight Ratio To the Evaluation Risks Landslide And the Preparation Map Distribution Space The Phenomenon Action Have (Nefeslioglu et al., 2008). In Iran, this study very little until late 1360, but from 1369 onwards due to the earthquake, landslide Roudbar and environmental implications of the studies was really started in earnest (Alimoradi, 1389); And of late 1380 due to the advancement of technology and techniques of GIS, remote sensing, gravimetric methods, statistical and decision making several Rob started the process of developing criteria and in recent years have reached a high degree of validation and verification.

Behniyafar et al. (1388) using the AHP and the probability of occurrence of landslide hazard zone of the basin Kong and maps obtained from both methods can be compared. The AHP method to the possibility of greater adaptability in line with the

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findings of the survey and interpretation of the GIS landslide basin.

Individual Hatami et al. (1391) use the AHP and GIS techniques and factors influencing the occurrence of landslide hazard zone Khorramabad city in terms of the event, and finally the model of landslide hazard zone in map shall be prepared and presented. The results show that among the factors, sub away from the road, away from watercourses and drainage density, with weights 2043/0, 1717/0 and 1545/0 as the most important factors in causing landslides in the study area identified have. Based on the model, about 51/25 percent (8/1603 km) from the city of Khorramabad area has a very high risk (17.6%) and high risk (34/19 percent).

Hossein et al. (2010) with Use GIS and mapping techniques and considering the factors in the occurrence of landslides, landslide against the resistance of each of the factors to consider, consider, and they mentioned that the resistance of elements as most important factor in the occurrence of landslides and landslide action in areas where the ground is low resistance occurs.

3. Study area

The Basin study area Govijeh Bell Tabriz is located in Eastern Highlands region Ahrazrbayjan. The catchment area of about 064/78 kilometers wide range of mathematical position 38 ° 20 'to 38 degrees 28 minutes north and longitude 46 degrees 46 minutes and 46 degrees 58 minutes east are extensive Fig. 1.

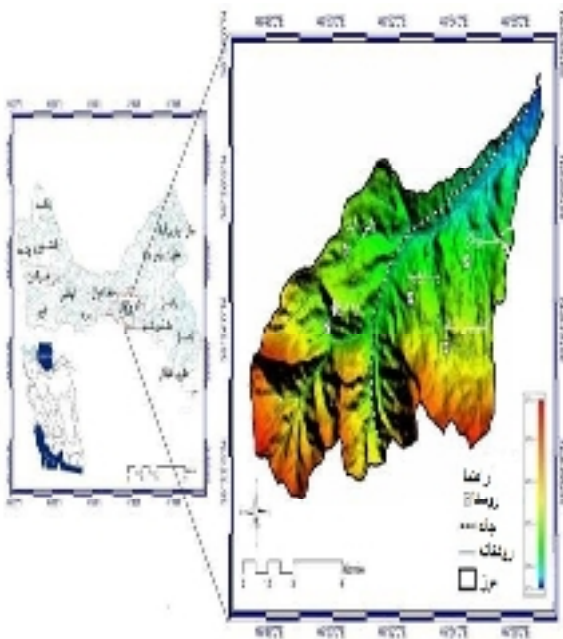


Fig. 1: Location Area

4. Method

In this study, considering the characteristics of geology, geomorphology,

hydrology, climate, human factors and environmental studies and comparative studies, 15 variables and 80 classes for landslide hazard zone Govijeh Bell basin was designed Tabriz. Preparation of the data layers required for the zoning in Arc GIS software was performed as follows: First, the Digital Elevation Model DEM of the output, and then based on natural failures in the highlands region, the 5 classes' height was classified. Layers of slope and aspect were taken from the Digital Elevation Model. Layers of density and distance from drainage, Density and distance from roads, and the density and distance from settlements through digital layers major and minor rivers, roads, urban and rural settlements from the topographic maps of 1: 50,000 was prepared area. Layers of density and distance to fault, lithology and land use were digitized from the major and minor faults and material of the geological map 1: 100,000 area, and land use map and Google Earth images were taken. Layers of high temperature and rainfall, temperature and precipitation of the relationship between the height and the kriging interpolation were drawn. Finally, by combining layers of software Arc GIS, spatial analysis and modeling of the study area were engaged in the event of landslides. Finally, to confirm the findings and the zoning map was evaluated by comparing the observed and calculated values of landslides and accuracy of the model.

Natural factors involved in the study area can be divided into several parts: the lithology (material), density and distance to fault, density and Distance River, rainfall, temperature, elevation, slope and aspect. Parameters such as density and distance from the road and away from residential density and land use can also be considered as a subsection of the human factors. To compare the occurrence of landslide area Govijeh Bell layers were prepared in the Arc GIS software. Prepared on the base map layer parameters information such as maps, topography, geology, land use, Google Earth satellite images, etc. is the Digital Elevation Model. The layers are based on normal failures that existed in the area was divided into 5 classes in all these layers contains 15 factors and 80 classes respectively.

4.1. Lithology of the study area and its effect on Landslide

Gender formations and physical properties and chemical stability and instability of the importance of play. Therefore, knowledge of the area Sunday and sex Govijeh help but be effective in achieving this goal. For this purpose, numerical layer lithologic units based on geological maps 1: 250,000 and Ahar were prepared according to the characteristics of the material was classified into 6 classes which are 2 forms.

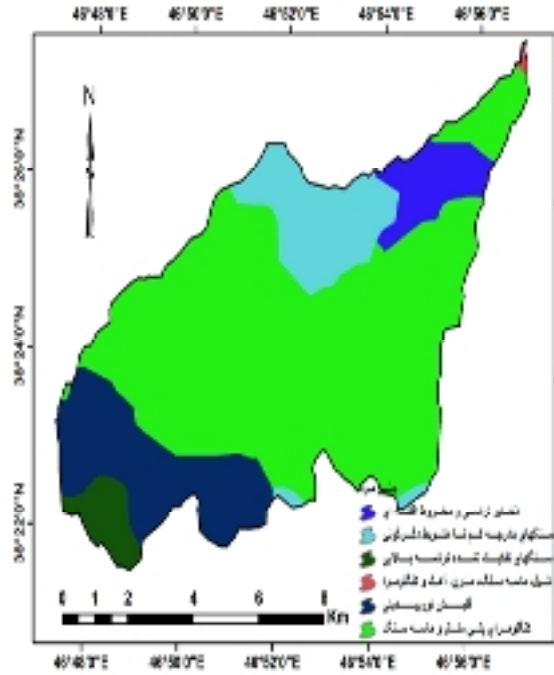


Fig. 2: Map of the basin lithology Govijeh Bell

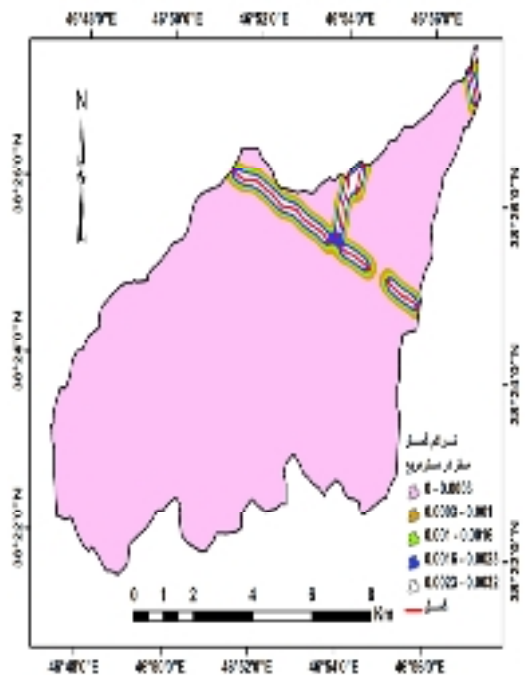


Fig. 4: Distance from the fault

4.2. Density and distance from the fault zone and impact studies in landslide

Several faults and fractures are caused by the performance of the major faults in the study area North West of Iran and Azerbaijan is. The regional tectonic faults with mainly north-west of the southeast. For this purpose, numerical layer fault zone based on geological maps 1: 250,000 Ahar was prepared and given to the effects of faults in the landslide, fault distance and density parameters to evaluate the performance of the fault in the landslide, but determined Govijeh digital layers are drawn. At the end of the layers due to natural failures in the region was classified into 5 classes and evaluated. Forms 3 and 4 contain the features and specifications of parameters, density and distance from the fault area to be studied.

4.3. Density and distance from river and its impact on the Landslide

Govijeh Bell drainage basin area using digital elevation model with Arc hydro in Arc GIS software tools for mapping and data layers were obtained. With regard to the effects of the waterways in the landslide, the distance from stream and compression parameters to evaluate the performance of the river in the landslide of Bell to determine the layers of the digital Govijeh was drawn. At the end of the layers due to natural failures in the region was classified into 5 classes and evaluated. Figs. 5 and 6 contain the characteristics and parameters of density and distance from the drainage basin characteristics are studied.

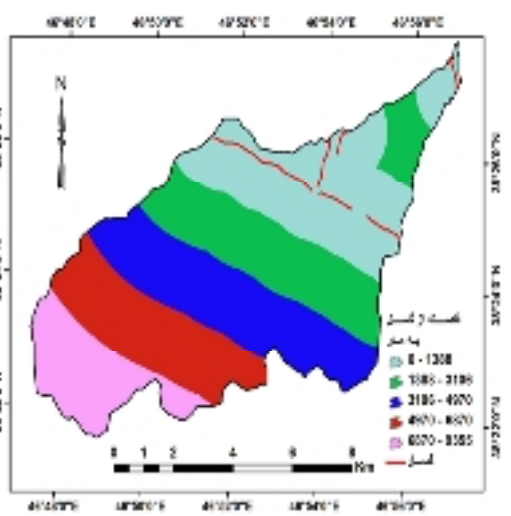


Fig. 3: The fault density

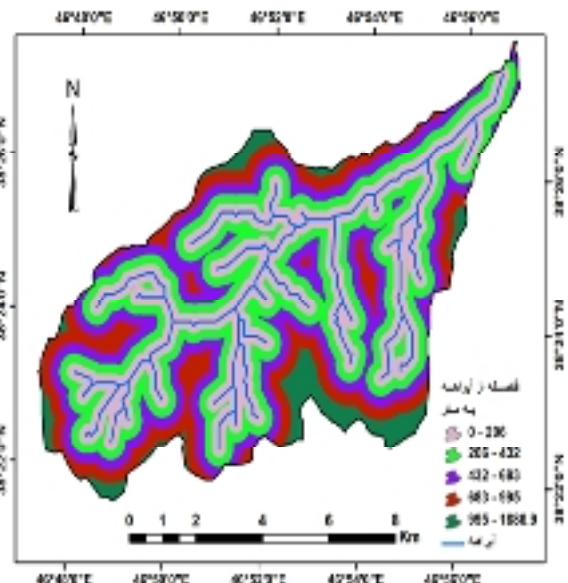


Fig. 5: The distance from stream

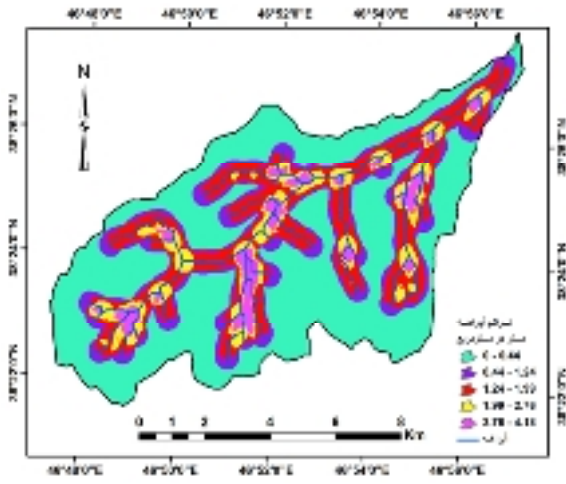


Fig. 6: Channel density

4.4. Studies of the impact of rainfall and landslides

To achieve the goals of the relationship between altitude and rainfall precipitation map area (Equation 4-1) and DEM, which was drawn with respect to the normal failures that exist in the region evaluated in 5 classifications and took? 7 include the features and specifications of basin shape parameters are studied.

$$454/96 + x 1505/0 = y 765/0 = R^2$$

In this equation, x: H (Digital Elevation Model) and y: rainfall is.

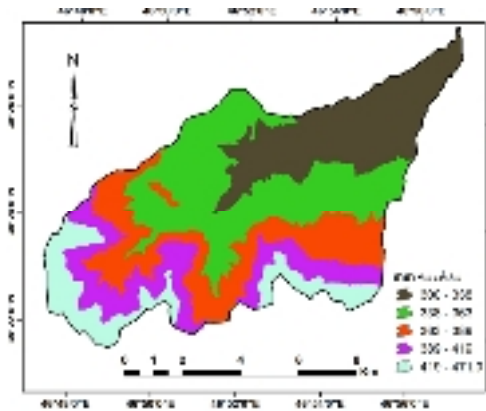


Fig. 7: Isorain map area Govijeh Bell

4.5. Temperature studies of the impacts of landslides

To investigate the effect of temperature on Bell Govijeh landslide area, map the relationship between high temperature and rainfall and the DEM was drawn with respect to the normal failures that exist in the area was classified into 5 classes and was evaluated 8 forms. It involves the characteristics and parameters of the temperature profile in the basin are studied.

$$\text{Relation...} - \dots: 608/16 + x 0028 / 0- = y, 702/0 = R^2$$

In this equation, x: H (Digital Elevation Model) and y: temperatures.

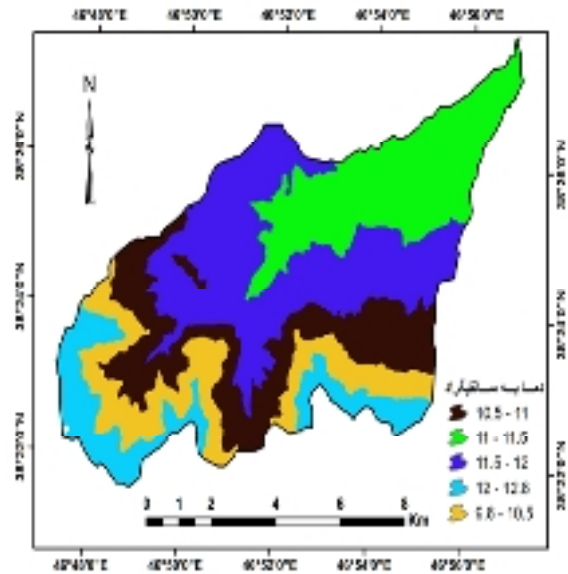


Fig. 8: Shows the temperature map area Govijeh Bell

4.6. Elevation of the study area and its impact on the Landslide

To investigate the effect of elevation on landslide Govijeh Bell basin, the area of the DEM elevation map is drawn and failures due to normal in the region was classified into 5 classes and evaluated. 9 forms contain features and characteristics of the study area are the height parameter.

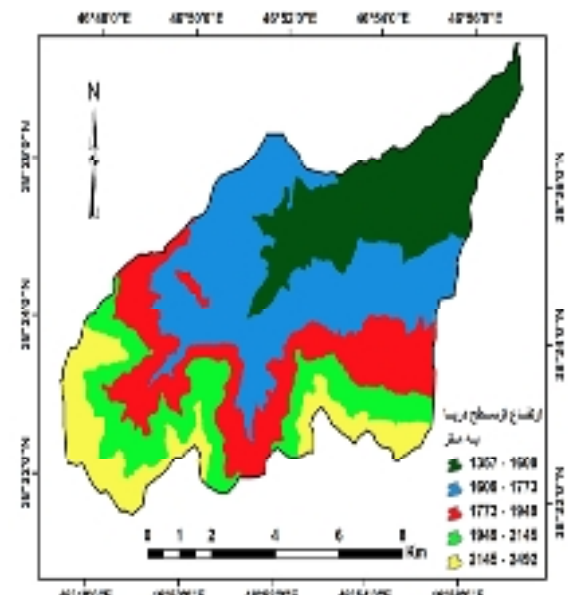


Fig. 9: Govijeh Bell basin elevation map

4.7. Slope of the impacts of landslides

Govijeh Bell basin slope map using Arc GIS software was developed in the area of digital elevation model based on natural failures were classified into five categories. Error 10 features and specifications contained in the basin slope parameters are studied.

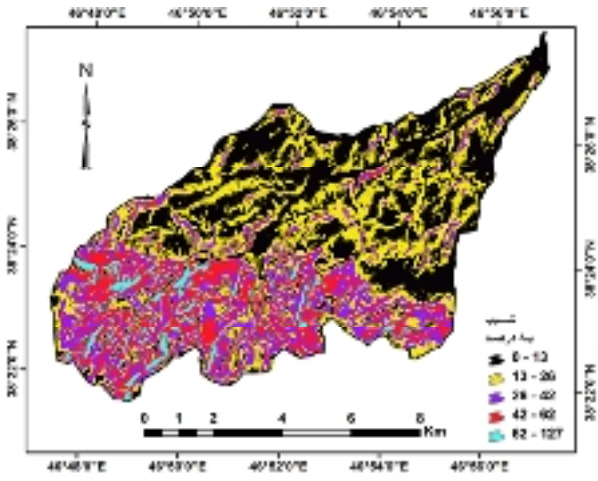


Fig. 10: Slope map

4.8. The slope of the impacts of landslides

Govijeh Bell slope map using the Digital Elevation Model in Arc GIS software and prepared on the basis of geographic aspects were classified into 9 classes. 11 forms contain features and specifications of the slope parameter in the study area are.

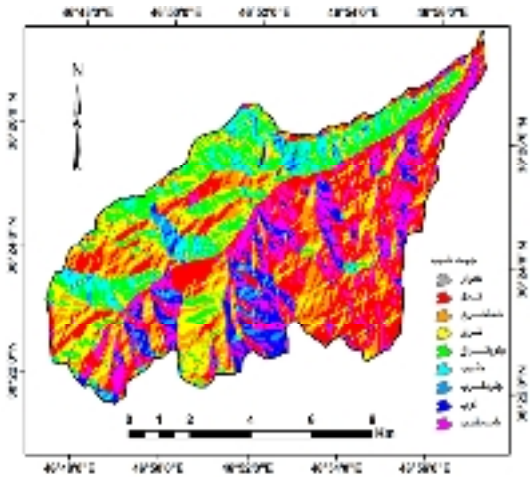


Fig. 11: Map of the basin slope Govijeh Bell

4.9. Density and distance from roads in the study area and its impact on the Landslide

Studies show that many of landslides during trenching in highways, railroads and canal has occurred. Roadmap Govijeh Bell basin using topographic maps nomads, Varzeqan , Khwaja and Ahar in Arc GIS software mapping and data layers were obtained. With regard to the effects of landslides on the roads, the distance from the road and compression parameters to evaluate the performance of landslides on the roads, but determined Govijeh was determined and the layer of digital. At the end of the layers due to natural failures in the region was classified into 5 classes and evaluated. Figs 12 and 13 contain the features and

specifications of parameters, density and distance from the area to be studied.

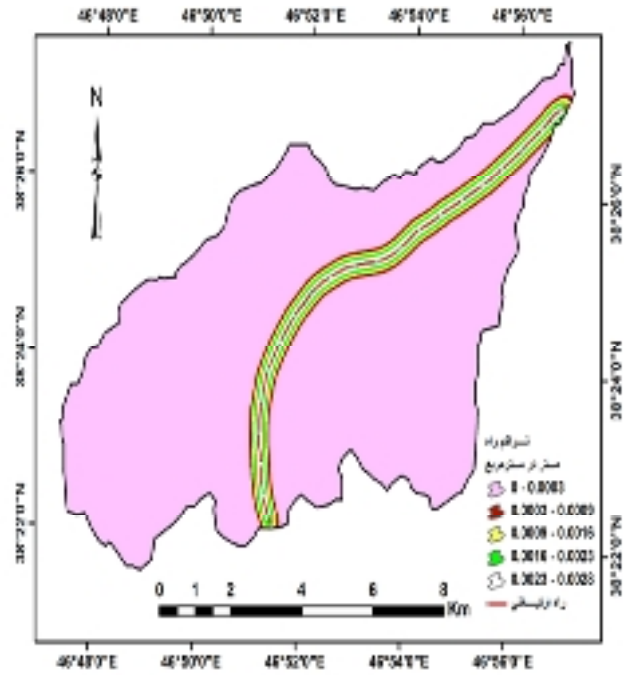


Fig. 12: Map of the area between Bell Govijeh

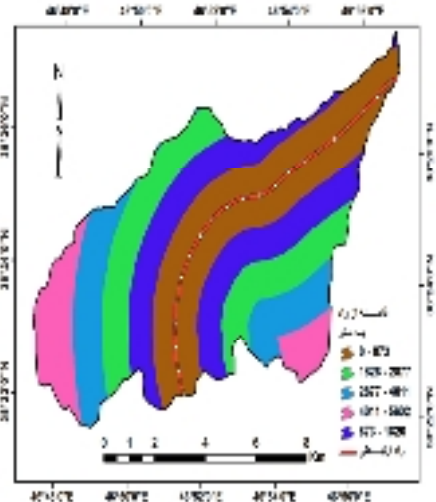


Fig. 13: Density map of the area Govijeh Bell

4.10. Impacts of land use studies in landslide

The results of various studies have shown that in most cases the user has negative aspects and cause instability of slopes and landslide occurrence is. Govijeh Bell basin land use maps using topographic maps nomads, Varzeqan, Khwaja and Ahar in Arc GIS software and mapping data layers were obtained. With regard to the effects of landslides, land of the study area to determine the numerical layer is drawn. The layer based on user type was classified into 6 classes and evaluated. 14 forms contain features and specifications of watershed land use parameters are Govijeh Bell.

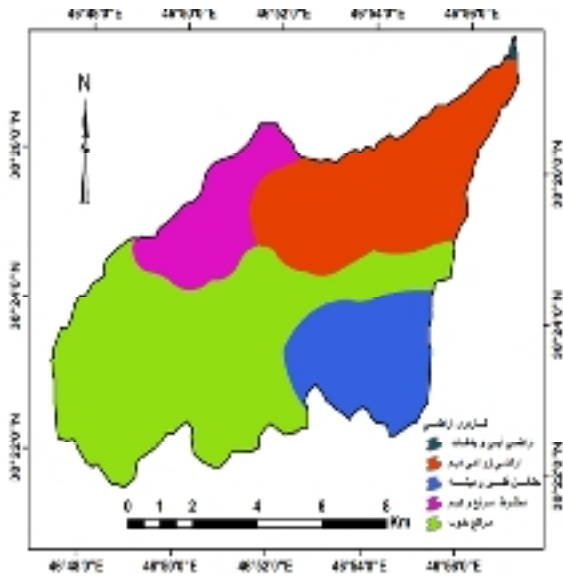


Fig. 14: Govijeh Bell watershed land use map

4.11. Landslide occurred in the area Govijeh Bell

Govijeh basin but has a high potential for landslides, and numerous landslides that occurred. In order to map the landslide occurred in the area of study of Google Earth satellite images used in this software using the precise location where the landslide occurred in the studied. A total of 69 dB in the catchment area where the landslide occurred Govijeh identify the areas of the catchment area of about 38/1 km from the study area (87/77

km) into account. The location of the landslide occurred in the area..... Govijeh Bell show. Compliance with the maximum landslide occurred in the basin parameters Vq Govijeh Bell in Table 1.

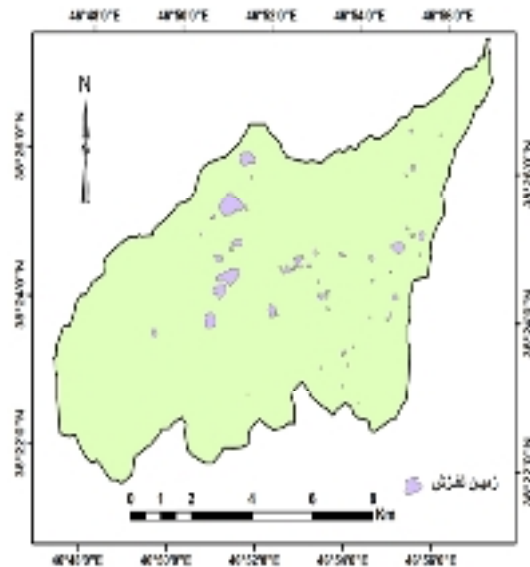


Fig. 15: Location landslide occurred in the area Govijeh Bell

Table 1: Compliance with the parameters maximum landslide occurred in the study area

Row	Effective parameter	Parameter Unit	Maximum class matches
1	Lithology	---	Metal bridge conglomerate, sandstone deposits and alluvial fans of thrust
2	Fault density	M m	0 - 001/0
3	Distance from the fault	Meter	0-4970
4	Channel density	M m	24/1 - 76/2
5	Distance from stream	Meter	0-432
6	Precipitation	Mm	338-363
7	Temperature	C	5/11 - 12
8	Height	Meter	1609 - 1773
9	Slope	Percent	13-26
10	Slope	---	North, Northwest and West
11	Road density	M m	0 - 0003/0
12	Distance from the	Meter	0-2877
13	Density settlements	M m	0 - 000002/0
14	Away from home	Meter	0-1713
15	Land use	---	Mixed farming and pasture land and the

4.12. Landslide hazard in the area Govijeh Bell

Landslide susceptibility, specific surface areas and separate from the actual or potential threat of no to very high degrees divide (Ramesht, 1375). Designers and engineers landslide zone map to select location of the development plan and the results of these studies can be of great help as basic information to help in management and planning used as Environmental (Pradhan,

2011). Finally, identify places with high potential slip hazards and avoiding them can be prevented. The landslide hazard zoning in the area Govijeh Bell, the influential factors in Arc GIS raster layers were prepared according to the importance and impact on the occurrence of landslides Method Weighted Sum was summed up. Output layer based on natural failures classified into five classes and class that the maximum numerical value allocated to the contingency landslide and vice versa. The results of

the study area due to landslide zoning and zoning specifications are forms 16.

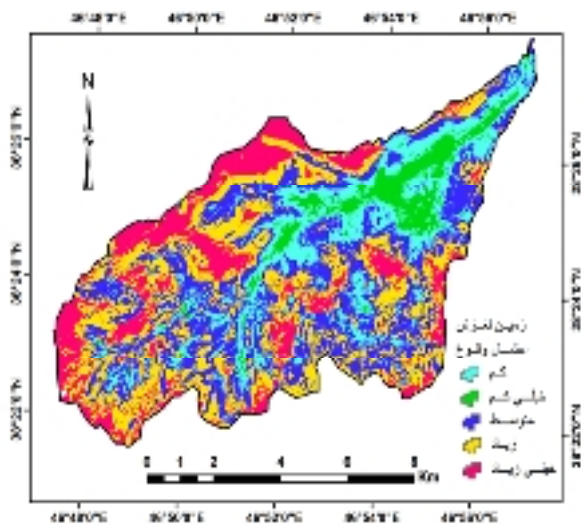


Fig. 16: landslide hazard in the area Govijeh Bell

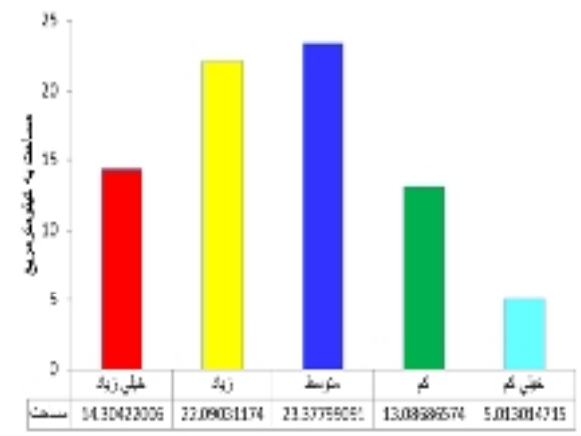


Fig. 17: Floor Area landslide occurrence in the study area

Table 2: Shows the results of a cross with a distribution map of landslide hazard map

Landslide Index (%)	Of the sliding surface	The sliding surface (km ²)	Area in%	Area (km ²)	Sliding range
27.12058	23.8018	0.328959	18.36879	14.30422	Very high risk
15.7798	21.38701	0.295585	28.36732	22.09031	High risk
24.26341	34.80212	0.480992	30.02089	23.37799	Moderate risk
20.00452	16.0624	0.221995	16.80552	13.08687	Low risk
12.83169	3.94666	0.054546	6.437473	5.013015	Very low risk
100	100	1.382077	100	77.8724	Sum

5. Results

To investigate the factors affecting the occurrence of landslides can be divided into natural and human factors. Natural factors may result from the internal dynamics and external dynamics. Govijeh area but due to the characteristics of geomorphologic, hydrologic, geologic 10 natural factors influencing the occurrence of landslide were identified, namely: lithology factor (material), fault density, distance to fault, channel density, distance River, rainfall, temperature, elevation, slope and aspect. In contrast to natural causes, according to the human characteristics and human activities existing in the human 5 important parameter influencing the

4.13. Accuracy of landslide hazard map of the area Govijeh Bell

Direction Investigation the Accuracy and the Accuracy Map Zoning Risk Landslide In the study area from Index Landslide use out. Evaluation Maps Zoning Generally based on Map Distribution Landslide face (Hatami et al., 1391). For The Purpose MapDistribution Landslide Area Studies with Map Zoning Offering By Intersection Data And With the Use Of the Method Evaluation Landslide Index, Accuracy And the Accuracy It Calculation Respectively.

Landslide index is the percentage of slip surface in each zone, the area of the zone divided by the ratio of the total surface area of the slide. The following equation represents the landslide index is calculated (Wen et Vstn, 1997). In this regard, Li: index of risk of landslides in the area; Si: sliding surface area in each zone; Ai: area of each zone and n: number of the zone.

The results of crosses and evaluate landslide hazard map the distribution map for the model is presented in Table 2. The table shows that very low risk area to the total area of the region accounted for 4.6 percent, but 9.3 percent of the surface area containing slides. On the other hand, having a very high risk area 14.3% of the total area of the region, 23.8 percent was in the landslide area. Comparison of the results obtained from the proposed model of landslide events is observed in Table 2.

occurrence of landslide were identified Govijeh Bell. Parameters such as density, roads, distance from roads, residential density, distance from residential and land use can also be considered as a subsection of the human factors respectively.

Govijeh basin but has a high potential for landslides, and numerous landslides that occurred. In the area where the landslide occurred in the 69 studies identified the areas untreated area of about 38/1 km of the total area of the basin studies (87/77 km) into account. To answer this question and to determine the degree of accuracy and the The accuracy of the map zoning risk of landslides in the study area of the landslide to be.

This result is based on the hypothesis that it contains one of the capabilities of GIS in management and planning proved because technique GIS, in management on the ability of spatial large amounts of data, the means of empowering for these types of studies is.

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