**The zoning of the risk of landslide using information valuation methods and surface density in the**

**ghouchan- Shirvan watershed**

**Extended Abstract:**

The mass movements of materials are the movement of weathered materials and rocks on slopes under the influence of gravity, which can be traced back to at least 186 AD in China (Borabb, 1991: 52). Landslide is one of the types of mass movements that occur from downward or monolithic movements and often high volumes of sedimentary material along the slopes (Izadi & Hope, 2013). These movements may occur slowly or slowly (a few millimeters per year) or abruptly and rapidly (160 km / h), which in many cases can cause unfortunate accidents (Selby, 1970: 57). Landslide zoning involves dividing the land surface into separate zones and ranking these zones according to the actual degree or potential of landslide risk on slope gradients (Shari'ah Ja'fari, 1375: 148). Identification and classification of landslide prone areas and its hazard zoning is an important step in assessing environmental hazards and plays an undeniable role in watershed management (Sakara, 1995: 300). Increasing trend of land use with different goals, especially in recent years, has increased the occurrence of landslide phenomenon and its damages at the basin level. Therefore, the purpose of this study is to study the variables affecting landslide occurrence and separation of hazardous zones. Generally, different landslide hazard zoning methods are empirically and statistically split the land surface into separate zones and rank these areas based on the potential for landslide hazard (Shari'at Ja'fari, 1996: 149). Identifying and selecting the most appropriate method for landslide hazard zonation within a range makes it possible to take more precise results to prevent or improve conditions (Shirani & Seif, 2012). In this research statistical methods of information value and surface density have been evaluated and evaluated.

In this research, effective factors were determined for zoning landslide risk according to such factors as purpose, scale of work, conditions of the area and amount of influence of each factor. Then, the factors that played a major role in landslide occurrence, as well as maps and related information, were used. Considering the specific lithological, structural and climatic conditions of the studied basin, the most important criteria affecting landslide, altitude, climate, geology, land use, slope, slope direction, soil, erosion, distance from waterways, faults and roads were identified. Each of them has a significant role in the amount and type of rainfall, infiltration, temperature, soil formation, movement and mass movement of materials and disturbing equilibrium and increasing slope instability (Moghimi et al., 2008). In order to determine the correlation between the slip points and each of the factors influencing the slip, a probability ratio model was used. In order to determine the frequency ratio using GIS, the percentage of landslide and non-landslide area in the study area was determined and then the frequency ratio for each of the factor classes was calculated by dividing the percentage of landslide area by the percentage of non-landslide area. . After determining the extent and percentage of landslides in different classes, the effective factors and weighting of the classes were quantified according to the factors of information value models and surface density. Landslide hazard zoning is done in different ways, many of which are based on the specific conditions of the study area. Due to the effective parameters map prepared, the need for different data zoning models and the ability to monitor and control the implementation and flexibility of data in statistical methods, the statistical methods of information weighting and surface density were used in this study.

Among different formations present in the study area, limestone formation in southwestern part of the basin has the highest value in landslide occurrence that its value in weighting method is 15/70 and in level density method is 78. Is / 16. Due to the co-location of this formation on the Shurijeh Formation, the influence and accumulation of water in the contact between the two formations increases, which increases the sensitivity of the calcareous Formation to the occurrence of mass movements. The results of slope factor analysis showed that the most susceptibility to landslide was in slope classes of 16 to 24 degrees and its value in weighting and density method were 0.7 and 0.01, respectively. Therefore, it can be said that the slope and morphology of the slopes have a great influence on the occurrence of landslide phenomenon, so that in natural slopes the increase of slip instability occurs to a certain degree of slope and then the instability decreases. The reason for this can be attributed to the hardness of the lithology constituting these slopes and the alteration of the mass movement processes. Basin elevation map was categorized by using histogram curve changes and by matching the landslide distribution map with elevation map, it was observed that about 31% of landslides occurred at altitudes of 1572 to 1842 m, which were equal weighting method. It is 2.10 and 3.18 in surface compaction method. The most stable area is located at altitude of 994 to 1320 m. In terms of slope direction, the areas in the north direction (N) are more at risk of landslide and its hazard rate in weighting method is 0.70 and 1.78. This is due to the fact that the northern slopes will have the highest humidity due to the lower angle and duration of solar radiation in the northern hemisphere. In the climate type study, the lowest sensitivity is related to semi-arid climate which is -0.002 in weighting method and 0.008 in surface density. The highest sensitivity to slip is in semi-humid climate in southwestern part of the basin. It is 0.10 and 0.11 in both weighting and flat density methods, respectively. In the study of range soils, the highest susceptibility to landslide was related to Incepticol soil (young soils with insufficient drainage and mostly formed in mountainous areas and in moderately steep lands, with weighting and density levels of 0.41 and 1.49 and lowest sensitivity. The results of the land use raster map disaggregation with the landslide distribution map and field surveys showed that about 45% of the landslide areas are located in gardens and water lands, which is worth 002 in the information weighting method. 0.01 in surface compaction method is 0.013 Ten showed the highest risk in areas with moderate erosion, which is 1.61 in weighting method and 2.69 in surface compaction method. Map of fault distance using 1: 50,000 digital topography maps. Country vector and Distance and Reclassify functions in ARC GIS environment were prepared and divided into 5 categories.In the study of fault distance layer, maximum effect on occurrence of mass movements in information weighting method and surface density were 2.85 and 0.93, respectively. 3 is located 300 meters from the fault and causes the most damage. Investigation of the distance from the canal to the basin showed that most of the landslide movements occurred near the waterways and canals, and the highest susceptibility to landslide was 0 to 200 meters from the river, with value in both weighting and density methods. The level is 0.89 and 1.97, respectively. The results of the study of distance from the road and field surveys showed that the highest susceptibility to landslide is 100 to 500 meters away from the road with a value of 0.37 in weighting method and 1.45 in surface density method.

Studying the landslides in Quchan-Shirvan basin shows that landslide potential is high in this area. Based on the studies carried out at the basin level, the Lar lithology unit due to its high influence on water infiltration and loosening of the layers, altitudes of 1572 to 1842 m, slope class of 16 to 24 ° and north slope (N) due to Less solar radiation duration, semi-humid climates due to high rainfall and humidity, young soils of insecticidal and medium soil erosion, orchards and irrigated lands due to their large extent and type of irrigation, as well as areas that are shortest with main fault lines. , Roads and waterways had the highest rate due to changes in slope geometry and disruption of balance and increased stress. They are allergic to slip. In addition, factors such as the creation of traditional gardens on steep slopes and downstream water transfer through the installation of a water pump, construction of houses and drilling of sewage wells on slopes and inappropriate exploitation due to the lack of familiarity with the type of villagers. Soil in the area also has a significant impact on slope instability. The final zoning map obtained from two information weighting and flat density models based on 11 factors affecting landslide showed that the most landslide risk was in the southwestern part of the basin and the most important factor in it was the presence of landslide-prone formations and the type of land use that was most frequent. Caused danger in the region. Creating surface and deep drainage systems and building artificial walls on both sides of the river as well as educating villagers on soil use, cultivation and irrigation are some of the factors that can contribute to the stability of slopes that have potential for landslides.

**Key words**: Quchan-Shirvan watershed, information weighing method, surface density model, landslide.