

Investigating the role of Geological Formation on mass movement occurrence Case study: Bar watershed)

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Abstract

Iran, because of its special geographical conditions of various geological and geomorphologic properties and also diversity of climate, is challenging with many different catastrophes including mass movement which cause plenty of damages. Geological factor, especially type of geological formation is considered as an innate element to occur mass movements. To determine different geological formation tendency on mass movement occurrence, it is necessary to consider mass movement density occurring on different geological formations. In this study, performed bar domain, with area of 5399 hectares, that is 33 km far from north of Neyshaboor, numerical layers of geological formation and mass movements have been provided in GIS in order to estimate the effect of each formation on mass movement occurrence. Then diagrams have been drawn by statistical software and finally area percentage of each type of mass movement on formations of the zone has been provided. The results showed that Delichay formation and Lar formation have the most effect on mass movement occurrence and 54.3% and 40.2% of area mass movements occur on them, respectively.

Key words: *Geology, Mass movement, GIS, Delichay formation, Lar formation*

1- Introduction

Land morphology usually indicates the type of land materials, resistance of this material to erosion, soil permeability, erosion type and flooding hazard. The geology factor always, has a major role in creating of landslides. Iran in terms of specific geographic location has different geological zones and constructor variety of Geology (Prkambryn to the present covenant). This material layers are always under stress of deformation because the Alps Himalayas belt is near and has grown tectonic structure types such as faults and joints and fractures. This transformation reduces the resistance of the stone mass and caused increase mass movements. On the other hand, exposure this material in various weather of Iran, affect the types of weathering on the geological materials and in this case, density and type of Landslides will be different due to various in climates, sedimentation zones and structural geology. This matter caused to researchers with various studies of mass movements occurred; pay attention to role of factors involved in this phenomenon, especially the role of Geological formations on Landslides. The research results from this article express effects the constructor geology and the role of structural differences had in the occurrence and distribution of many types of mass movement.

Chang and colleagues [5] review and zonation effectives factors of mass movements occurrence in the Hoshe basin (Taiwan Center) that area were 92 kilometers. The results indicated that geological formation is important factor of mass movement factors. Tangestani

[11], research the roles of geology factor, slope angle, slope direction, land cover and soil depth on Landslide occurrence in the Kakan basin (located northwest of Shiraz) and reached to this conclusion that formation type have effective role on Landslide. Yalcin [12], attempted to review factors mass movement in the 40 basin of Ardesen (located in the north-eastern Turkey) was an area of 50 kilometers, and concluded that factors such as region formation, degree of slope and land cover are more effective in the occurrence of Landslide. Shirani and colleagues researches [10] also showed that in Semiroom of Isfahan, geology role had most important factor among the factors in mass movement occurrence.

2- Materials and Methods

2-1 Features the study area

Bar Watershed with 5,399 hectares area that is 33 km far from of north Neyshaboor city between 65.04 and 66.11 Geography altitude and 40.39 in latitude. It region in spring and summer have a mild weather but in winter is very cold and have many snow. Average of area rainfall is 338 mm. This region contains Mesozoic stone and quaternary sediments. Minimum and maximum of elevation are, respectively, 2900 meter and 1580 meter and average slope is 39 degrees. This region has many faults that one of important of faults is Bar fault. (Appendix1)

2-1-1 watershed Geology

First time Eshtoklin with considering the complexity of the structure and different sedimentary conditions divided Iran to several separate structural sedimentary basin. Then the other studies provided more comprehensive and complete divisions that can noted to Nabovati (1355) [9] Eftekhari nejad (1359) [7] Brbryan (1373) [4] Alavi (1996) [2] Agha nabati (1383) [1].

Region based on Nabovati Studies (1355) [9], and Darvish Zadeh (1383) [6] is located in the Alborz zone on under zone of Geology of Kope dagh and eastern Alborz (Binalud).

Formation in this area is to follow:

Delichay Formation (Jd)

The unit consists of light gray marl with limestone is between the layers with about 100 meters thickness. It is the result of become more relaxed environment of sedimentation at this time. In this formation are visible Brakiopod and Ammonite Fossils that are specified for the unit the Middle Jurassic age to early upper Jurassic. The Ammonites Find in this collection can be name Parkinsonis sp and Oppella subroliata. In much of the regions, this formation is directly metamorphosed on the Carboniferous - Triassic units. In this case, cut faults can be seen in the low surface of layer that it is result of pushed to them on another. Surface example of this formation is in the right side of Delichay River (Firouzkooch way to Tehran). [6] It is thickness about 110 meters. Delichay (Jd) Formation consists of marl and thin layer of sand limestone that its color is green and Sometimes the marl shale seems between layer. Underside it can be seen Lime Alit with Limonitic Rubbles and sometimes muddy splits. Delichay formation was sensitive to erosion. [8]

Lar Formation (Jl)

Gray marn Delichay Formation toward high-level in a gradually contact convert to limestone with pea color. This unit includes two sections. Underside is consists of the mass limestone to thick layer and the upper layer is consists of medium limestone layers which layers are clearly defined. Thickness of this collection is about 260 meters. High resistance of the lime and Non-resistance of older units of stone in front of erosion caused to this limestone create high topography. Lithacoceras sp and Ataxioceras sp that found in this formation are Ammonites. Sample point of Lar formation is Lar Valley in Central Alborz. Thickness formation is between 250 and 350 meters. This formation composed of thin layer from Mykrity limestone to mass dense with light gray color that have puddle or white cherty layers to light violet is filled with fossils. Lar formation appears in Shahrud, Semnan and Damghan on Eastern Alborz. [8] This Formation is equivalent to the upper part of Surmeh formation of the Zagros and is similar to Mozdoran formation in kope Dagh. This formation is sensitive to destruction and sometimes dissolution that is related to past wet period. [6]

Shale and Jurassic sandstone (Jsh.s)

This unit consists of periodic sandstone and black shale that often shales have some coal. Plant fossils that have been identified in the shales include Ginkgoites and Kelokia with Middle Jurassic age and Glodophlebis friziensis and Cladophlebis sohabis. Based on these fossils, formation age is at the end of Jurassic to lower Middle Jurassic. Low surface of this unit has fault and the upper surface with gradually contact convert to Delichay. [6]

Quaternary sediments

Quaternary deposits are youngest sediments in this region and include different units. Old alluvial cones (Qt1) mainly caused the highlands and alluvial fan (Qtf) in foot of height and the beginning of the plain. Travertine deposits (Qtr) are resulting of warm springs activities and inform about Earth heating Phenomenon in the region. Young alluvial terraces (Qt2) mainly in the lowest point are covered to plain floor and deposit around the drainage rather than old alluvial terraces. Young flood sediments (Qal) in the path have been caused rivers and channels. Sand Hills (Qs) appear in plain floor and points that have more severe winds. Clay zones (Qc) and salt zones (Qsm) deposits in plain floor and flood plains path. [6]

2-2 Research Methodology

To determine different geological formation tendency on mass movement occurrence, it is necessary to consider mass movement density occurring on different geological formations. For this purpose, we used informations that were collected from explanation air photos and satellite images. In first section, we used remote sensing techniques to recognize tumble and surge mode, then boundaries these as mass movements. After this step, referring to the Landslide database and use field study, to measure work accuracy. Researches have shown us received an acceptable result from this method. Then Import these in formations to GIS and made numeral layer of occurred mass movements and saved them in the significant database. We used the geology map to made numeral surface layers of geological formation. Numerical layers of geological formation and mass movements have been provided in GIS in order to estimate the effect of each formation on mass movement occurrence. In next step, using GIS

to made overlay numeral layers of geological formations and numeral layers of mass movements. After this stage, check attribute tables of each layer and extracted data from area and surface of mass movements and enter to EXCEL software. Then using capability of this statistical software to compare tables and made diagrams. Finally area percentage of each type of mass movement on formations of the zone has been provided (Appendix 2)

3- Conclusion

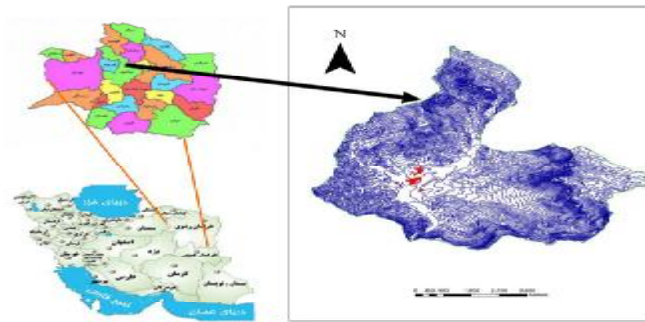
Review of this subject is indicating, if the landslide surface developed on geological formation this formation named as sensitive. With overly Layers and research attribute tables such understanding is that the total area of 5399 hectare, 1050.7 hectare of total basin surface that is equivalent to 19.4 percent have been influence under of mass movements. Analysis showed that are contributions Lar (Jl) formation and Delichay (Jd) formation, respectively, 40.2% and 57.3% of the total types of mass movements occurred in the basin surface and other formations in the basin are including a share equivalent to 5.5%. Air photos researching and review of field studies Will be determined that from derrises on basin surface, respectively, 53 percent occurred on Lar (Jl) Formation, and 47% occurred on Delichay (Jd) Formation and other formations don't had any contributions on occurred derrises. About other types of mass movements, Delichay (Jd) formation with 39% make the largest contribution and (Qal) with 5.5% make the lowest contribution. It should be mentioned that Lar (Jl) formation is allocation 24% of the other mass movements. (Appendix 3)

According to these observations can be concluded to two reasons: Nature of this formation, vast of these formations in the study area. Considering these cases can be justified that the Lar (Jl) Formation due to the nature of lime is being too hard and resistant and this type of lime creating high topographic, thus accrued more derrises against environmental factors. [8] Delichay (Jd) Formation consists of marl and thin layer of sand limestone that it color is green and Sometimes the marl shale seems between layer. Due to the nature of the marn in limestone caused its tendency to absorb more water. Because of this formation is directly metamorphosed on the Carboniferous - Triassic units, in this case, cut faults can be seen in the low surface of layer that it is result of pushed to them on another and it can be a reasonable cause of more landslides. [8] It should be note that in this region, vast of these two formations than to other formations cannot be affectless to having more percentage of mass movements. (Appendix 4)

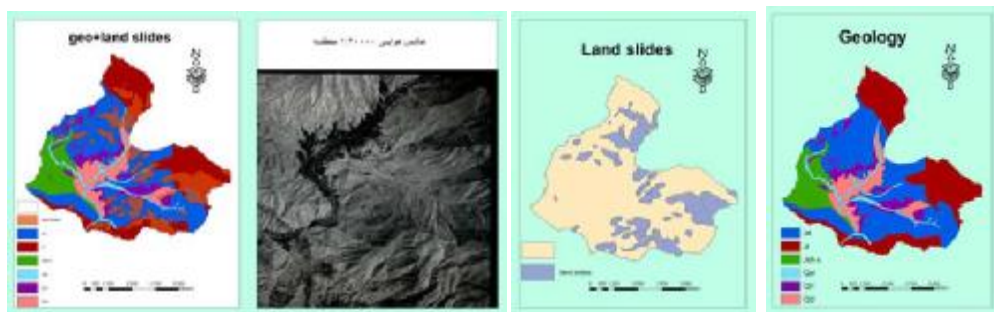
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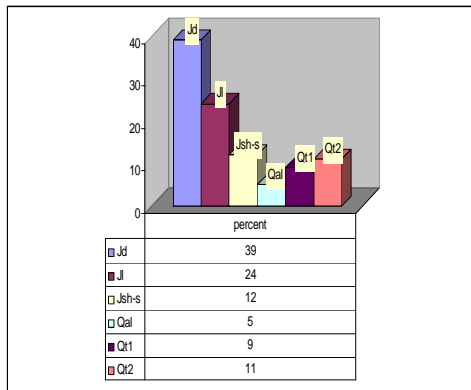
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Bar watershed (Appendix 1)

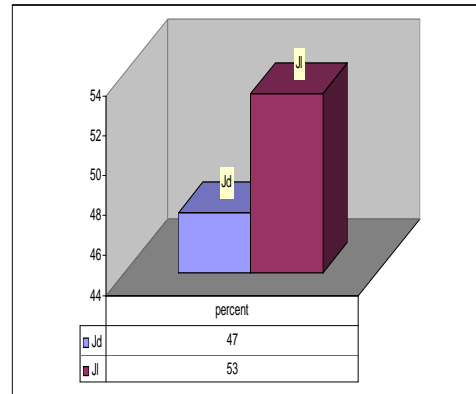


Overly landslides and Geology maps (Appendix 3) landslides map Geology map



Percent of landslide occurrence

(Appendix 4)



Percent of derrises occurrence

Area and percent of mass movement occurrence on formations (Appendix 5)

Formation	Jd	Jl	Jsh-s	Qal	Qt1	Qt2	Total
Landslides	570.91	423.10	4.18	10.65	21.43	20.42	1050.71
percent	54.3	40.2	0.3	1.1	2.1	2	100