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Research Paper

Landslide hazard zonation for determination appropriate regions with AHP model in dry areas of Iran Khuzestan

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Abstract: Identify areas prone to landslide hazard zonation and its is the first step to assessment of enviromental hazard .many factors are involved in the occurrence of landslide,that their evalution,makes necessary the use of powerful analytical tools.the purpose of this reserch assessment and evalution each of the factors in landslide and select the appropriate model landslide hazard zonation in semi-arid watershed in Iran(khuzestan province).Need to assess the area landslide potential and Determine the best and most favorable zones To do this. First , landslides distribution map of study area was prepared in Arc GIS using field observations and then the map of effective factors in landslide occurrence were prepared. Thus The layers provide information about the geomorphological factors include slope, Altitude, aspect, litho logy, NDVI, soil rain and temperature. The import layers software Geographic Information Systems and Preparation and completion of the initial matrix and the normal to determine the relative weight of the layers Using the software Expert Choice (11) And the final Arc GIS(9.3) and prepared Maps of the various weight categories were prepared using the AHP model weight of the layers and data integration software. Then, the map can be predicted from the model of landslide hazard zonation with the land use Map the current situation overlapping territories and calculation correlation matrix and Compare models. The results showed that regions model predicted have relatively complete overlap.

Keywords: assessment, landslide hazard zonation, hierarchical analysis (AHP), the correlation matrix

Introduction

Falsity of the type of using ground means that ground & water are not used as amount of its potential or power, in these cases the agriculture is done in a ground that has no power for producing agricultural products. In one words, the cause of excess decrease of resources is human 'irrational use of ground. The ground is a limited & Vulnerable resource, but many of its benefits, if it is not used, are permanent and reproducible (Miller, 1966). The human, after many years experiences found that he should more with nature exploit ground as amount of power or its productive power for preventing poverty destroying the resources of biologic environment(Nix,1985).Fortunately the civil human has devised it. from the end of past am century ,the human found that if he want exploit ground with economic saving ,it is better to execute exploitation trend in a programmed from called management plan (Malhotra,1980).Identifying resources regard as the first step of ground' evaluation programming without identifying resources means knowing parameters related to the ground ,evaluating planning ground will not be possible. (Naveh and Liberman, 198 4).Evaluation ecologic power is processes that try to provide appropriate harmonic extensions with nature through regulating human relation with nature. In fact, the evaluation is an effective step for the purpose of obtaining a plan for stable improvement, because with identifying evaluating ecologic characteristics in every region, improve mental plans can compile concurrent with nature (Radklyft, ١٩٩٤). Permanent exploitation from reproducible natural resources is guarantor of identifying ecologic power of ground in any environment thus identifying land slids and landslide hazard zonation is the first step to assessment of enviromental hazard then use of AHPcan appropriate and rapidly In determination map landslide hazard zonation. In this regard, articles by some researchers of different sciences have started to evaluating and prepared map landslide hazard zonation with use of AHP Models (Sardashti,2007; melki,2012; Al-Sheikh,2006;josie,2011;Poorjafar,2010; Behnyafr,2010; Saberi,2011; Shadfr,2007).

Geographical information' system (GIS) allow evaluating in minimal levels with mush complexity and volume with the ability that has in attachment between environment al qualities and computer sciences , with the power of integrating different information and creating maps that are explain of common section of different conditions ,provide high ability in planning & evaluating(Huigen,2003; Parkash,2003).

Achievements result from empirical applications show that the method based on mutual comparison is one of the most effective mooted technologies in spatial decision-makings, including the approaches based on GIS(Eastman et al.,1993;Malczewski et al.,1997a).

Co covering techniques provide the possibility of combining layers based on standard map of evaluating direction of determining the layer of complex map (output maps).the technique can be executed in both environments of raster and Vector GIS (Eastman, 1993; environmental system research institute, 1995; Heywood et al., 1995) and Elaalem et al., 2010 used from TOPSIS, fuzzy, AHP model in evaluating.

In the research, the good is the application of hierarchical analyze process in determining landslide hazard zonation of research region and evaluating the correspondence of map landslide zonation with the present conditions and determining compatibilities and incompatibilities for the purpose of future planning.

Martial mad Methods

The province of Khuzestan is 63,213 km2 (24,407 sq mi) in the south-west of Iran, bordering Iraq and the Persian Gulf. Base on geographical statue is located between29° 58´ to 33° 1´ North latitude and 47° 44´ to 50° 37´ east longitude. Basically, the province of Khuzestan can be divided into two regions, the plains and mountainous regions. The agricultural lands are fertile and mainly in the west of the province, which are irrigated by the Karun, Karkheh and Jarahi rivers. These three large and permanent rivers flow over the entire.

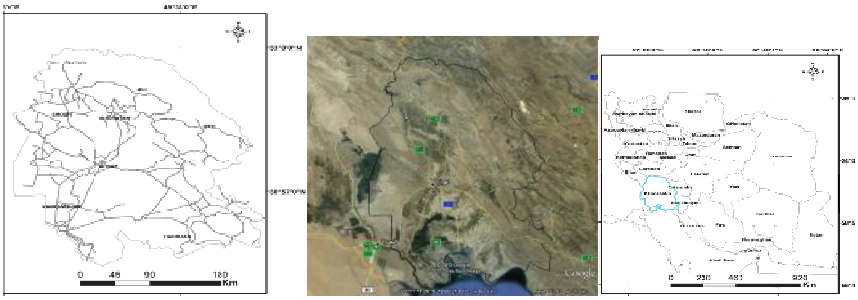

Figure 1. geographical statue of Khuzestan Province

The used software in the research are Arc GIS and LLWIS .In digitalization analyze and process management and displaying data and software expert choice for perform are compared n*n matrix is Created and different binary standards are compared and the related values are Allocated then the find weight is determined.

At first ,identifying the present resources and situation performed with library and area research then using region' topographic maps with benefiting from Arc GIS software digital .model of height were prepared and maps of height classes ,region' direction and slope produced ,then precipitating maps ,region temperature Were entered along with other informative layers with interpolating method like geology and soil maps prepared vegetation for summing and integrating.Different methods are present for relative weighting and starting character' importance toward each other. The methods are different in use easiness, accuracy, the rate of apprehensions by decision makers with hawing theoretical bases. The decision-maker can select an appropriated method with availability of related software's & the quality of its data with GIS.The method of mutual comparison because of having strong theoretical base, high accuracy and use easiness, enjoying value , credit , trueness and accuracy, is the result of one of the most applicative and reliable methods (Malczewski, 1999).

In this method, first the comparative matrix is created and the characters are compared mentally and their relative weights are determined theoretically. The mentioned ratios are stated with quantitative amounts between1 to 9 (Saaty, 1980).

Table 1. hounly scaling

1	Equal importance of two elements regarding to higher level enjoy equal importance.
3	Relative more importance regarding to the experiences during elements comparison, relative more value is given to one element.
5	More importance regarding to the experiences during element comparison, mush value is given to an element.
7	Much importance, priority of an element is confirmed.
9	Much more important, among elements, degree high is given to a special element.
2,8, 4,6	Median values

Using the relative and Scale screening, we can do weighting quantitative and qualitative element. For determining degree of accuracy and weighting trueness is used from compatibility index. The index is calculated based on vector approach special to theory graph (Saaty, 1980). If the index of compatibility would be 0/1 or less, weighting has been correct and otherwise the given relative weights to standards should be changed and weighting to be done again (karam, 2004).

The method of hierarchy cal analyze is a simple computational method based on the main operation matrices. With creating hierarch and stepwise process ,building comparative matrices in different levels of hierarch ,it's special vector is calculated with combining vectors ,weight coefficients of different options are calculated in the vector of find weight' coefficients ,relative importance of every option is determined regarding to the goal of head hierarch (Ghanavati,2006).

Results

For doing comparison, first the matrix is formed and duplet standards are compared and the related values are determined based on saati scaling. Regarding to that compatibility index is calculated 0/04 is less than 0/1, is indicative of accuracy of weighting to the standards, for determining relative weight of layers was used from duplet comparison method. For calculating, the values vectors special to columns are summed and each cell is diving into the sum of the related columns, so the table becomes normal , then the average of the lines of normalized table is calculated as the relative weight

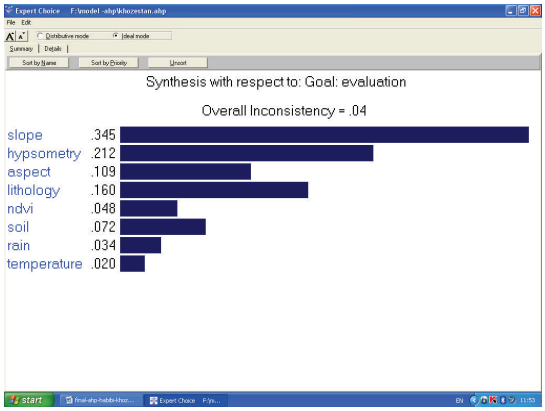

Figure 2. *The relative weights computed by the software Expert choice*

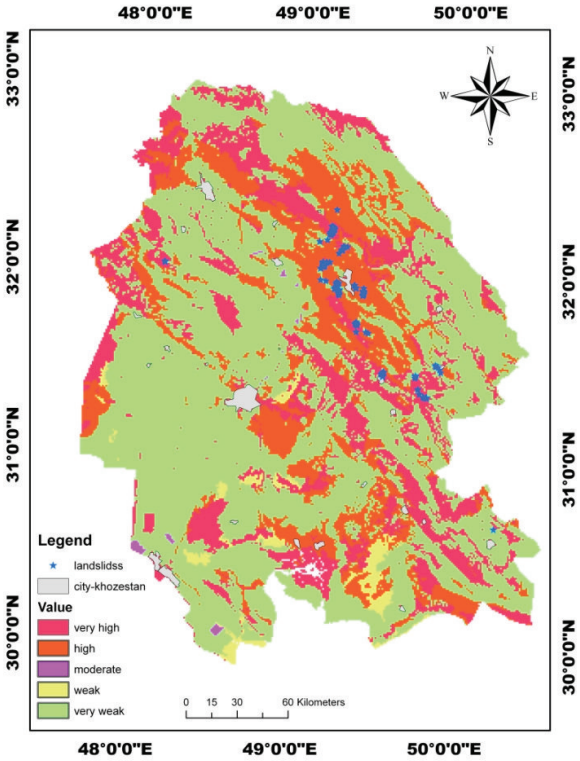

Figure 3. landslide hazard zonation with AHP

After duplet comparisons of standards ,sub standards and calculating the relative weight for every one by expert choice software ,the relative weight is attributed to the respect maps ,then for spatial analyze , multi standard evaluation and providing find map of region 'power class in GIS software was used from Raster fold .for the purpose , the desired layers entered into Arc GIS environment and all weighted layers accumulated in raster fold. In the method ,after determination of relative weight of every effective factor in hierarchical analyze process with converting effective in formational layers from shape file format to Raster Grid ,the possibility of combining the weight of every layer with the ability of every studied limited regions in that layer is provided. For the purpose ,with summoning informational layers of the region include slope ,height ,slope direction ,vegetation ,soil ,geology ,precipitation,temperature in the environment of GIS software with exerting the determined weight for every class of different layers ,the find weight of that layer calculated, in final analyze for multi standard evaluation (for ground suitability) from the technique weighted liner compound (WLC) is being used. then the find interaction for determining landslide hazard zonation was obtained like the following.

$$M=0.345X1+0.212X2+0.109X3+0.160\ X4+0.048X5+0.072\ X6+0.034X7+0.020\ X8$$

Factors Respectively x1 to x8 include slope, hypsometry (Altitude), aspect, litho logy, NDVI, soil rain and temperature then with use Correlation matrix technique to Comparison of current land uses and were analyzed.

The result showed that about half of the area (about 54.14%) was classifying very high and high risk to landslide,and 5.4% area of the occurrence of land slide is weak.Also result showed that overlap field observations land slid 92.3% (109 point land slides) adaptation to classifying very high and high risk is Good accurate.

Table 2. Amount over lap layers *landslide hazard zonation* with field observations land slid

classify	Number of land slide	Percent of total
Very high	38	32.2
high	71	60.16
moderate	0	0
low	9	7.62
Very low	0	0
Mean	20	

For the purpose of evaluating the equality among landslide hazard zonation with the type of its present used,two maps were correlated on each other in GIS enviroment.the result of correlation of the two above maps are presented in the following table.

Based on the present data, there are different compound of mutuality of classes of landslide hazard zonation map the present use of lands which are determined lay the resulted show of matrices of the rate of suggestive optimal applicative correlation with present use of lands.

Table 2. Comparison of Amount layers Present Land Use and landslide hazard zonation (AHP)

Layers	Present Land Use														
landslide hazard zonation	Grass land	Percent of total	forest land	Percent of total	Bare land $kavir	Percent of total	urban	Percent of total	agri	Percent of total	Total	ercent of total
very weak	45798 5	7.98	3248 8 5	5.66	3993	0.07	68 97	0.12	39325	0.69	8 3308 5	14.51
weak	763268	13.30	190696	3.32	205579	3.58	22143	0.39	337106	5.8 7	1518 792	26.46
medium	8 69& 69	15.15	71269	1.24	627022	10.92	5578 1	0.97	128 7077	22.42	2911018	50.71
high	16008	2.79	28 556	0.50	22506	0.39	14278	0.25	2178 00	3.79	443223	7.72
very high			3146	0.05	8 47	0.01	121	0.00	30613	0.53	34727	0.60

Figure 4. Area landslide hazard zonation with AHP

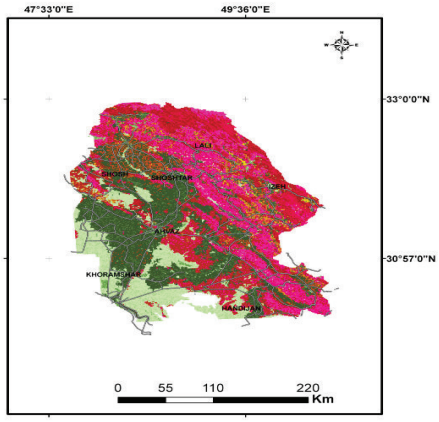

Figure 6. Overlapping Present Land Use and landslide hazard zonation (AHP)

Conclusion

Regarding to Variety &the number of the effective indexes in development , using GIS, provide appropriate conditions for analyzing the data ,while doing this with hand methods would be very difficult and time consuming. The result from evaluation region landslide hazard zonation in hierarchical analyze process method regarding to the final out put imply that about 34727 hectare of total region possess a very high landslid and about 443223hectare (%7.72)possess appropriate high risk.

An extension about 2911018hectare (%50.71) possess also average. In other words, more than 40 percent possess weak and very weak From the perspective of landslide. In addition, the results from correlated matrix in this research indicated that the regions processing very weak capacity have correlated with grasses averagely 45798 5 hectare (%7.98), while they have correlated with agri 39325 hectare, weak landslide regions are equal 337106 hectar and the average grasses are 763268 hectare in area surface. while the rate of correlations of regions processing average risk with grass, forest ,bare land are 869869, 71269, 627022 hectares.respectively. High risk and very high landslide hazard zonation are correlated 443223 and 34727, while high risk with 160083, 28556, 22506, hectares are correlated with grass, forest and bare land (excessive exploitation) .unfortunately with excepting plan less management, we are witness of that about 14399 hectares of lands processing high risk and very high landslide hazard zonation are allotted to civil regions.

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