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## The effects of vegetation cover on runoff and sediment yield in plot scale of Kheyroud Forest watershed

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### Abstract

Land cover is also important factor for protecting the soil against erosion. A fully forested watershed experiences relatively little surface erosion, but timber harvest alters the canopy cover, exposing the soil to water and wind. Forests provide the maximum amount of soil protection. Reduction of vegetative cover by forest harvesting generally increases the average surface runoff volume and sediment while, the hydrologic response of forest harvesting has been rarely considered. Towards this attempt, the present study has been conducted to investigate the effect of vegetation cover on hydrological components in plot scale (2m\*1m) with four replicates in tow slope scale (0-20%, 20-40%) in Kheyroud forest, Iran from December 2014 to December 2015. The rain depth was measured by using a rain gauge installed in the study area. The runoff volume and sediment yield were also measured through field data collection and lab analyses by weighting and decantation methods. The results showed significant effects of vegetation cover ( $P \leq 0.01$ ) on runoff volume and sediment yield. Natural forest without harvesting, forest with selective harvesting treatments exhibited the lowest amounts of runoff and sediments, with averages of 372.31, 878.96 cc, and 0.08, 0.17 gr m<sup>-2</sup> respectively, compared to other treatments. The linear regression among mentioned parameters (precipitation, runoff, and sediment) determined significant correlation among precipitation, runoff and sediment.

**Keywords:** Forest canopy cover, Forest harvesting, Runoff, Sediment, Kheyroud forest

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## Suitability Model of Medical and Industrial Plants of Ghareh Aghach Rangelands of Semirom

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### Abstract

Range inventory is the recognition and evaluation of potential and actual production in the order of optimal utilization of valuable natural resource. Determination of range suitability for medical and industrial plants, considering sustainable utilization and creating models for medical and industrial plants use in Ghareh Aghach of Semirom watershed by FAO and GIS, was the main objective of this research. Two criteria of vegetation cover and accessibility to water resources were integrated to determine suitability model of medical and industrial plants on rangeland. In vegetation cover criteria, the samples were randomly collected along 3 two hundred meter transects in each vegetation type. The vegetation cover percentage, composition, abundance, and the presence or absence, diversity, production, application and consumption of medicinal plants and industrial were measured using 1 sq. meter quadrates. Accessibility to road and slope determine and by integrating these two criteria, suitability maps based on FAO method were prepared. The results showed that from 7158.69 hectares of the studied rangelands, 3.69% ha (0.05%), 1761.1 ha (24.6%), 3217.7 ha (44.95%) and 2176.17 ha (30.4%) of the area was classified to S1, S2, S3 and N suitability classes for medical and industrial plant utilization. A lack of desirable vegetation covers due to continuous overgrazing and miss use of rangelands. Using shrubs as wood, utilization of *Astragalus* species for firewood, low medical plants cover in vegetation composition and overgrazing were main limiting factors in the area.

**Keywords:** Range suitability, FAO, Range utilization, Geographic Information System (GIS), Semirom

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## Regional distribution and clustering of dust storm index (DSI) using linear moments approach

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### Abstract

Dust event is one of the common and destructive phenomenon in arid and desert regions. This phenomenon has negative impacts on human life and environment. Dust storms, in addition to soil loss, can cause and aggravate health problems, food production reduction, economical damages to the industrial, agricultural and communication sections. Therefore, accurate investigation of this phenomenon is necessary. The aim of this research was regional analysis of dust storm index (DSI) in 44 meteorological stations of Iran. At first stage, the dust storm index for each station was calculated using hourly dust data. Next, monthly averages of dust storm index (DSI) were used for regional analysis using linear moments approach. Based on regional analysis, the study area is divided into six homogeneous dust storm index regions. The Pearson Type III (PE3) and Generalized Logistic (GLO) distribution models were the best fitting regional distribution models for 1, 4, 5, 6 homogeneous regions, and 2, 3 homogeneous regions, respectively. Estimation of the dust storm index and its regional analysis can be used in many environmental studies, decision making and management processes in relation to combating desertification and dust storms.

**Keywords:** Distribution function, Dust, Arid lands, Homogeneous regions

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## Investigation of the effect of *Haloxylon* plantation on groundwater resources (Case study: Jafarieh plain of Qom)

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### Abstract

Despite climatic fluctuations, arid and semi-arid areas are as habitat for many plants, animals and human communities. Investigation of the effect of plant community on limited water resources of aridlands is an important issue in water resources management. Different species of *Haloxylon* are compatible with desert condition and can use groundwater resources due to deep roots and proper structural condition. The purpose of this study was to investigate the effect of *Haloxylon* plantation on groundwater resources in Jafarieh plain. For doing the study, the number of *Haloxylon* plants was determined in the study area using satellite images and JMicroVision software. Then using minimum water requirement of each plant, estimated with lysimeter, the number of surplus plants was determined based on their water requirement and rainfall of the region. Then groundwater level status was determined using GMS 8.3 and MODFLOW models. The results showed that the number of *Haloxylon* plants in the study area was equal to 3746291 and the amount of groundwater evacuation by these plants was equal to 56.194 Mm<sup>3</sup>. The reduction of groundwater table was about 0.46 meter in the first study period (1992-2001) while 0.93 meter in the second study period (2002-2012) so that the depletion of groundwater level in the second study period was about 2 times higher than the first period. This results showed that severe depletion of groundwater table has happened in recent decade because of planting *Haloxylon*. However, the positive effects of these plantation on reducing damages of dust storms should not be ignored.

**Keywords:** *Haloxylon* planting, Jafarieh plain, MODFLOW, Groundwater, JMicroVision

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## Investigating the effect of restoration practices on soil physical and chemical properties (Case study: Chahshirin rangelands of Behbahan)

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### Abstract

The present study investigates the effect of restoration practices of planting Mesquite tree (*Prosopis juliflora*) and the construction of contour furrow and also Eucalyptus tree (*Eucalyptus camaldulensis* Dehnh) planting on physical and chemical properties of soil in Chahshirin rangelands of Behbahan. In this study, along each treatment, a non-operational correction treatment was also selected as a control. Soil sampling was done systematically and randomly during 3 transects of 100 meters in two depths of 0-30 and 60-30 cm at each site of the corrective work and also its adjacent control. The soil samples were transferred to the laboratory and nitrogen, phosphorus, potassium, organic matter, organic carbon, lime, clay, silt, sand, electrical conductivity and acidity factors were measured. The results of the independent t-test showed that the studied factors had a significant difference at the level of 1% and 5% compared to the control area. Also, the results of analysis of variance ANOVA between correction treatments in the first and second depths for phosphorus, potassium, organic matter, carbon, lime and EC showed that there is a significant difference at 1% level. In general, three corrective operations have had a positive effect on soil properties; consequently and Mesquite tree planting and contour farrow had a better condition than the Eucalyptus tree planting site. Therefore, with further studies and monitoring in this regard, the role of management and proper implementation of rangeland improvement practices can be found in various rangelands of the country to make a better decision to continue with or replace them with proper activities.

**Keywords:** Chahshirin, Contour furrow, Mesquite tree, Eucalyptus tree, Soil properties, Range improvement

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## Effect of land use on changes of land surface temperature index in urban areas (Case Study: Bandar-e Emam Khomeyni, Khuzestan)

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### Abstract

Climate change and global warming and their impact on different ecosystems requires extensive studies. For this purpose, the efficiency of thermal bands and land use changes in determining the surface temperature index using the single window algorithm in the Bandar-e Emam Khomeyni of Khuzestan province by Landsat 8 satellite imagery was conducted. The single window algorithm is one of the most practical and accurate algorithms for remote sensing, in which by eliminating atmospheric effects, one can monitor and measure surface temperature of the earth in a regional scale. Based on this, the vegetation index (NDVI) for band ratio between the red and near infrared bands was used to prepare the LST map as four seasonal images over 2016-2017. The results of comparison of the two thermal bands showed that the thermal band 11 has higher accuracy than the thermal band 10 (RMSE = 3.6 for the band 11 and RMSE = 4.4 for the band 10) because its wavelength is higher. Also, the comparison of satellite imagery data with ground truth showed a high accuracy ( $R^2=0.9$ ). Comparing the temperature of land uses determined that the industrial and urban areas more effective on increasing LST than the vegetation and water areas. Base on bands ratio between near and red infrared bands, it is revealed that the vegetation index decreased with increasing temperature. So, the lowest amount of vegetation was estimated in August (-0.42) while the highest was in October (0.35).

**Keywords:** Surface temperature, Landsat 8 satellite images, Thermal bands, Single window, Bandar-e Emam Khomeyni

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## Dust & sand source identification using remotely sensed data: A Comprehensive Approach

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### Abstract

This study aims to develop a comprehensive approach to identifying dust & sand sources and to investigate their changes over a given period using remotely sensed data. For this purpose, OLI data of Landsat 8 during the years 2013 through 2015 were used to prepare the maps of vegetation cover, soil moisture and land cover sensibility to wind erosion. These maps were combined with geology and roughness by multi-criteria evaluation method to obtain a map of sand & dust source potential areas. In the second step, data of synoptic stations, meteorological and air pollution measurements were prepared and using statistical analysis, and with the help of MODIS data, the history of local events was obtained. These dates were validated by a numerical model of airflow simulation (HYSPLIT) to ensure that the flow of air is in contact with the surface of the earth has the potential of wind erosion. Also, the intersection of the air flow with the surface of the earth and the application of masks of non-wind erodible areas as potential sand and dust sources were identified. These regions were integrated with the map of sand & dust source potential areas using the MCE method (WLC) and based on a stratified random sampling plan, susceptible sites of sand & dust sources were identified. In order to validate the identified areas and investigate the trend of their changes, the time series of satellite data and weather station data were used and the trend of vegetation, soil moisture and surface temperature at the location of identified areas over 15 years were monitored. The validation results show high accuracy of identified areas and significant reduction trend of vegetation, soil moisture and surface temperature in the locations of identified sites during the study period. The results of this research and field observations indicate the usefulness and efficiency of this method and can be used for future studies in this area as a comprehensive framework for the identification of dust & sand sources.

**Keywords:** HYSPLIT, Time series of satellite data, Trend analysis, Comprehensive approach, OLI, MODIS, TMI

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## Landform classification of karstic area by Geomorphometric Index and Artificial Neural Network (Case study: Parts of Korram Abad, Biran Shahr and Alashtar watersheds)

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### Abstract

The geomorphometric indexes have been widely used for separation of surface landform features in the geomorphology over the past decades. In this study, the Multilayer Perceptron Neural Network (MPNN) was used to provide karstic landform classification. First, the geomorphometric indicators were extracted from Digital Elevation Model (DEM), and then these indexes were used as neurons of input layer in artificial neural network. Furthermore, the box plots were applied to analyze the relationship between karstic landforms (such as dolines, hills, karstic plains, karstic valley and headland) and geomorphometric indexes. The results showed that 34, 6.9, 1.07, 48.5, 9.51 percent of the studied area are spatially covered by valleys, plains, dolines, headlands and hills, respectively. It has also been found that the optimal structure of artificial neural networks for classification of landforms is model 12-9-1 by having the learning rate 0.1 and 87.18 percent of determination coefficient. Also, it should be noted that the accuracy of the innovative method for classification of karstic landform is 90.58 percent. The analysis revealed that variations in geomorphometric indexes are very visible in the landform of hills, headlands and karstic valleys, whereas there are slightly overlapping in the plains and dolines.

**Keywords:** Lorestan province, Karstic area, Artificial Neural Network, Landform classification, Box plot.

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## Comparison of topographic thresholds of gully erosion in the agriculture, fair and weak rangelands in Ghasreshirin, Iran

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### Abstract

Gully erosion affects land degradation, particularly in the semi-arid regions. Topographic thresholds are strongly affected by land use change and degraded vegetation. The objective of this study was to evaluate topographic thresholds of gully erosion in different land uses including agriculture (AG), fair rangeland (FR) and weak rangeland (WR) which carried out in Ghasreshirin, Kermanshah, Iran. The topographical parameters were measured in the field and relationship between gully catchment area and slope was analyzed for each land use. The results revealed that some main topographic characteristics in the cross-section including width, depth and gully branches length in the FR was significantly lower than in the AG and WR ( $p < 0.05$ ). Furthermore, analysis of gully threshold based on catchment area-slope showed that the critical area for gully formation in AG, FR and WR was 1300, 1689 and 1233 m<sup>2</sup>, respectively which was significantly lower in FR reducing by vegetation cover. The respective slope threshold was 1, 3 and 3 percent in AG, FR and WR. However, the affected area by gully erosion in AG, FR and WR was 12.4, 14.1 and 21%, respectively. The gully in the agricultural land was more deeper compared with other land uses. The volume of gully channels in FR was 3.4 and 2.2 times less than AG and WR, respectively. It is concluded that rangeland degradation and thereby removing vegetation attribute to severe gully erosion and consequently environmental problems such as soil carbon dioxide emission.

**Keywords:** Ghasreshirin region, Fair rangeland, Land use, Slope- area threshold

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## Investigating the effect of flowering stage on the quality and quantity of *Salvia limbata* essential oil in different altitudes in Taleghan rangelands

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### Abstract

*Salvia limbata* is an herbaceous plant which belongs to Lamiaceae family and is native to Iran. In this study, essential oils and variety of chemical compounds of *Salvia limbata* in flowering stage in different altitudes in July were studied. In order to study the active ingredients of plant in studied sites in flowering stage nine plant samples were examined for phytochemical analysis. Identification of the basic constituents (quantity and quality) with GC / MS and GC-FID (gas chromatography coupled to mass spectrometer) has been done. The yield of essential oils in flowering stage in lower Taleghan 0.34% in middle Taleghan 0.34% and in upper Taleghan is 0.46%. According to the results, difference in altitudes in three habitats shows a significant difference among the percentages of the obtained compounds. The most important constituents of essential oil include  $\alpha$ -Pinene,  $\beta$ -Pinene, allo-aromadendrene and Spathulonol. Also, *Salvia* is reported as one of the sources for the extraction of  $\alpha$ -pinene.

**Keywords:** *Salvia limbata*, Flowering stage, Altitudes classes, Taleghan, Essential oils

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## Determination of economic loss caused by soil erosion in different land uses (Case study: Beheshtabad watershed, Chaharmahal and Bakhtiari province)

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### Abstract

Soil erosion along with population growth, water supply, food and energy, climate change, biodiversity loss, etc. is one of the major environmental problems. The effects and consequences of soil erosion can be examined from a variety of perspectives. From the spatial point of view, the cost of soil erosion is divided into two categories of on-site and off-site costs. Soil erosion affects the production cycle and economics directly and indirectly. The purpose of this study was to estimate and compare direct and indirect economic losses of soil erosion in different land uses in the Beheshtabad Basin. To achieve this, sediment production by each land use of the Beheshtabad watershed was initially determined by SWAT model, then direct loss of erosion was calculated based on the method of replacing the main soil organic fertilizer (NPK) by chemical fertilizers and indirect loss of erosion based on the loss caused by sedimentation behind the check dams inside the basin and reservoir dams outside the basin. According to the results, the highest amount of economic loss of soil erosion was related to rainfed farms equivalent to 56 million Rials per hectare. Due to the fact that these lands are located on high slopes and also improper agricultural operations. The least amount was related to gardens, equal to 4.5 million Rials per hectare that indicated the importance of the crown cover of trees and observing the proper slope in the construction of gardens in the soil conservation. In this watershed, overgrazing and unwise utilization of rangelands have led to a high erosion rate and sediment production in upstream rangelands and caused 3.33 million Rials per hectare economic losses of erosion in this land use.

**Keywords:** Sediment, Economic loss, Fertilizer elements, Check dam, Reservoir dam

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## Evaluation of the relationship between quantitative characteristics of vegetation and rangeland condition based on four and six-factors methods in the northern rangelands of Ardebil province

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### Abstract

It is difficult to select and analyze the appropriate ecological variables for measuring the ecosystem's condition due to the multiplicity of components and the complexity of the relationships between the components. The purpose of this research was to facilitate the quantitative evaluation of different ecological factors in determining the rangeland condition by four- and six-factors method using mainly structural and functional variables of vegetation. In this study, the condition of 28 sites located in the northern part of Ardebil province was determined by four and six-factors methods, separately for grass-shrubland and shrub-grassland habitats, and some parameters of vegetation were quantitatively measured. The results of condition determination were compared based on two mentioned methods. Finally, the relationship between variables of vegetation and the scores of rangeland condition were detected and the Linear Multiple Regression relations were extracted using the step by step method. The results indicated that the average score of the rangeland condition in the four-factors in both grasslands and shrublands (69 and 60 scores, respectively) was higher than the six-factors method (64 and 54 respectively), and paired T-Test comparison showed a significant difference ( $P \leq 0.05$ ) between the two methods. Also, the results showed that variables such as canopy cover of decreasing species canopy cover, total canopy cover, forbs' canopy cover, annual forbs' canopy cover, and production had the most significant positive relationship ( $P \leq 0.05$ ), and the variables of invaders and pebble-gravel cover had the highest negative correlation ( $P \leq 0.05$ ) with the rangeland condition. The results of regression models showed a strong relationship ( $R^2=68.46-88.41$ ) between the evaluated variables with condition score. Also, the validation analysis of the models indicated the ability of quantitative variables in both four and six-factors to quantitative analysis of the rangeland condition.

**Keywords:** Ecosystem function, Ecosystem structure, Four-factor method, Rangeland condition, Six-factors method

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## Analysis of landuse type effects on soil carbon sequestration (Case study: Vaz watershed, Noor city)

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### Abstract

In near future, earth's temperature fluctuation will be considerable. This phenomenon is the result of concentration of greenhouse gases in the earth's atmosphere. Therefore, it seems necessary to prevent of its happening. The biological methods including plant biomass and phytomass and soil are proposed as the best and practical ways in this issue. The watersheds are the greatest physical and geomorphologic units which are contain two important factors including soils and plants. So that the current trend of climate change is a double challenge and threat to the sustainability of watersheds. Soil and plant carbon sequestration are economic feasibility act and adaptable to their environment which they can be provided with land management ways by kind of scientific method. Therefore, by scientific method of landuse planning. This research has been carried by aims of study of landuse type effects on soil carbon sequestration and determines the best landuse in Vaz watershed of Noor city. Soil sampling was carried at the selected different landuse area at two depths of 0-15 and 15-30 cm and after analyzing soil organic matters were calculated. The results showed that forests are rich at both depths. But on the farms and orchards, rangelands and rural areas have had least amounts of organic material. Therefore, Vaz watershed has 741666 tons of reserve of carbon.

**Keywords:** Soil carbon sequestration, Vaz watershed, Carbon storage, Landuse, Greenhouse gasses

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## Application of SIM and AHP techniques for assessing of shallow landslide susceptibility in Khiov-chai watershed

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### Abstract

Landslide susceptibility assessment is a primary tool for understanding the basic characteristics of slopes prone to landslides. In this study, a landslide susceptibility assessment was accomplished, by adopting the Statistical Index Method (SIM) and the Analytic Hierarchy Process (AHP). Ten landslide causing factors were considered including: elevation, slope, aspect, lithology, landuse, drainage density, plan curvature, precipitation, geomorphologic faces, and rock unit's sensitivity to erosion. The SIM was used to determine the weighted value ( $S_i$ ) for classes of every landslide causing factor, the AHP was utilized to determine the weighted value ( $W_i$ ) for every factor. The summation of the product of  $S_i$  by  $W_i$  represent the landslide Susceptibility Index (LSI) value for every pixel. Based on the derived LSI, landslide susceptibility map (LSM) was produced then the study area was grouped into five susceptibility classes. The densities of landslide for five susceptibility classes implying there is a satisfactory agreement between the susceptibility map and the actual landslide data. In the following, the results of the LSM were quantitatively validated using observed landslide dataset and the receiver operating characteristic (ROC) method. The validation results showed that the AUC for prediction rate of model was 95.2%. The landslide susceptibility showed the areas with lithology of old terraces, young terraces, lahar, and porphyritic trachyandesite-trachyte with different degrees of sensitivity to erosion which distribute between 10 – 40% slope and more than 60% are very prone to slope failure. Therefore, SIM and AHP were found to be effective models for landslide susceptibility mapping.

**Keywords:** Weighted value ( $S_i$ ), Weighted value ( $W_i$ ), Landslide Susceptibility Index, Slope failure, ROC method

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## Network analysis to identify key actors of local beneficiaries' network in the establishment of participatory management of natural resources (Case study: Sarayan watershed, South Khorasan province)

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### Abstract

Nowadays, the concept of participatory management is a functional and modern approach in the management of natural areas. This approach is a comprehensive approach to personal and group stakeholder participation to achieve sustainable management and empowerment of local communities. Therefore, identifying and realizing the most influential actors in local decisions is an important step. The aim of this study was to determine the social powers and key stakeholders in the period before and after running a local community project in network of local stakeholders. This study has been carried out through questionnaires and direct interviews with members of split Rural Development Committee, in the Sarayan watershed, South Khorasan province supported by RFLDL international projects. For this purpose, ties of trust and partnership with local stakeholder network using quantitative indicators were analyzed at the micro level. This research analyzes the position of the local development groups and determines the key actors in terms of authority, influence and intermediation before and after the empowerment project. The results show that the centralization before and after the run is reduced. It is claimed that this project reduces centralization in network structure and strengthens trust and participation between stakeholder that has an important role in establishment of natural resources participatory management and rural development.

**Keywords:** Key actors, Network analysis, Social power, Participatory management of natural resources, Sarayan

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## Modelling and mapping effects of managerial and biophysical factors on occurrence of forest and rangelands fire in Chahrmahal-va-Bakhtiari province using geographically weighted regression

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### Abstract

One of the important factors threatening forests and rangelands is intentional fires that leads to destruction of a large part of the forests and rangelands. Study of this phenomenon and providing management strategies plays a major role to deal with and control such crisis. This study aimed to identify the affecting factors on fire occurrence and risk. The identification of major criteria conducted using a questionnaire as well as collecting required information from Natural Resources and Watershed Management Organization in addition to calculation and extracting some other factors via DEM and remotely sensed data. To do so, three category of variables including: 1- Human factors, 2- Biophysical factors and 3- Instrumental and logistic factors that contained altogether 26 variables are studied. Geographically Weighted Regression (GWR) method was used for mapping and zonation of the burned areas in the province that were occurred from 2007 to 2013. The results showed that amongst the 26 studied variables, monthly income ( $R=-0.61$  and  $VIF=8.08$ ) and number of rangeland and forest guardian members ( $R=-0.56$  and  $VIF=10.81$ ), number of guard stations ( $R=-0.54$  and  $VIF=2.2$ ), guardsmen's average age ( $R=0.53$  and  $VIF=9.71$ ), average of slope ( $R=0.5$  and  $VIF=8.99$ ) and number of voluntary rangeland and forest guards ( $R=-0.42$  and  $VIF=15.11$ ) are respectively the most affective variables on the occurred fires in the rangelands and forests. Finally, based on extracted predicted map, Vardenjan, Mizdej-Olia, Poshtkouh Ardal, and Aarmand are the most vulnerable regions for fire incident. Whilst, Monj and Mougooei encountered the least vulnerability of number of fire occurrence that is significantly in line with the occurred fires.

**Keywords:** Natural resource; Fire; Fire management; Fire-zonation, Chahrmahal-va-Bakhtiari

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## Evaluation the efficiency of statistical and data mining techniques in gully erosion susceptibility mapping of Loess areas in Golestan province

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### Abstract

In this study using Frequency Ratio (FR), Statistical Index (SI), Weights of Evidence (WOF), Logistic Regression (LR), Random Forest (RF) models the probability of gully formation was calculated in Aytamar watershed and susceptibility maps was prepared. First the thematic maps of 13 gully conditioning factors including lithological formations, distance to faults, faults density, altitude, slope-length, slope angle, slope aspect, plan curvature, profile curvature, distance to roads, land use, distance to rivers, stream power index and topographic wetness index was prepared. Then landslide inventory map was combined with each gully conditioning factor and all models weights and parameters were calculated. The area under curve for test data was calculated as 0.74, 0.78, 0.75, 0.86 and 0.96 for Frequency Ratio (FR), Statistical Index (SI), Weights of Evidence (WOF), Logistic Regression (LR), Random Forest (RF) models, respectively. The results showed that the Random Forest, Frequency Ratio and Logistic Regression have the least the area of high susceptibility zone, respectively. Based on three validation criteria, the multivariate methods including Random Forest and Logistic Regression had the best performance among all models.

**Keywords:** Gully erosion, Bivariate, Multivariate methods, ROC Curve, Aytamar watershed

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## Monitoring and predicting of landuse changes in Farsan watershed using LCM

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### Abstract

The land use of the watersheds is one of the most affected and highly vulnerable due to developmental process which alter other variables such as the hydrological function. The purpose of this research is to monitor land use changes in the past and to investigate predictability of its future using Land Change Modeler (LCM) in the watershed of Farsan county of Chaharmahal-va-Bakhtiari province. For this purpose, the Landsat-5 TM images of 1986 and 2009 as well as the Landsat-8 OLI images of 2017 were analyzed. The land covers including residential areas, agricultural lands, dryland farming, rangelands, rocks, water bodies, bare-land and snow were classified for three periods. The prediction of land cover of 2017 was done using the LCM model based on artificial neural network and Markov chain analysis after assessing model's accuracy based on Kappa index. The land cover of 2027 was also predicted using a change probability table extracted from occurred changes over 1986-2017. The results show that the rangeland decreased by 4379-ha in the years 1986 to 2017, but the agricultural land increased by 1922-ha. This study proved that the LCM could accurately forecast future changes (85% overall accuracy). An increase of 149-ha of residential area and 100-ha decrease of rangelands in the study area was predicted for 2027. Therefore, while emphasizing on the conservation of rangelands, it is necessary to study and use this technique to predict changes, its causes, as well as the consequences of land use changes at the broader scales.

**Keywords:** Land use, Rangelands, Remote sensing, Modeling, Land cover change, Land Change Modeller (LCM)

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## Effect of climate variability on spatiotemporal pattern of rainfall erosivity (Case study: Fashand watershed)

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### Abstract

Rainfall erosivity (RE) energy is an important factor in soil detachment and transition of them implying an important role on the regional potential region erosion. Different indices have been introduced for calculating RE which are based on the rainfall characteristics such as intensity, duration, drop size, kinetic energy or a combination of them. Having knowledge about the RE at the different conditions and is an essential issue for implementation of soil conservation projects in a watershed. In this study SPI was used in order to determining the climate condition and its consequent effects on RE in Fashand watershed, Alburz province. At first the drought, wet and normal periods were determined in four rain gauge station and then, both EI30 and modified Fournier index (MFI) were calculated at each gauge station. The regression analysis was used to investigate the relationship between EI30, MFI and 24-hour rainfall as well as annual rainfall of data-logging rainfall stations. Then, through applying the regression equation the EI30 was extrapolated for eleven typical rain gauges over the different climate periods. The best correlation was obtained between EI30 and annual rainfall ( $R^2 = 0.71$ ). The spatial zonation RE maps were extracted through geostatistical analysis for drought, wet and normal condition as well as for whole period 2000-2012. According to the findings the effects of climate variability on the value of RE are significant. Maximum and minimum RE are related to the wet and dry periods, respectively. However, the RE of summer season of dry condition is more than the wet condition and such condition together with low vegetation cover related to the drought condition lead to complicated situation. Despite the popular thought that the low RE can be addressed into the drought condition the rainfall pattern affect the erosivity potential and not the amount of precipitation.

**Keywords:** Rain erosivity, Interpolation, Continental change, SPI, Modified Fournier

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## Determining the Origin of Salinity using Hydrodynamic characterize and Factor Fnalysis method

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### Abstract

Malekan region is one of the most active agricultural areas in northwestern of Iran. Unfortunately, the existence of about 6,000 wells in the plain and the extraction of groundwater resources has led to a sharp decrease in water table and consequently, an increase in the salinity of the aquifer. For this purpose, 27 samples of Malekan water resources were collected and hydrochemical properties were analyzed. The results of the analysis were compared with the lake water sample with respect to the hydrochemical characteristics of the main elements. Salinity increasing and salt water intrusion into the aquifer was investigated using geophysical methods, geochemical diagrams, as well as various ion ratios. The results showed that salinity increasing in the aquifers around Urmia Lake is related to the low slope at the end of the plains and its ultra-fine grain sediments, which, as a result, when groundwater flow collide with such sediments, their movement slow down and water raised to the surface via capillary action. Finaly shallow groundwater caouse to intense evaporation and increasing groundwater salinity. Moreover, In addition, the distribution of surface currents in the ends of the plain leads to evaporation and the formation of salt crops, and high exploitation lead to the gradual flow of water to upstream of the aquifer. The presence of the salty sludge from ancient lakes beneath the alluvial and salts formations with high exploitation and decreasing of groundwater levels leads to upconing in the lower layers of clay formations and reaching the saltwater to the wells.

**Keywords:** Malekan Plain, Urmia Lake, Saltwater Intrusion, Hydrochemical, Evaporation

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