

Received: 04-May-2018

Accepted: 09-Jun-2018

## Assessing the effect of land use changes on groundwater quality and quantity (Case study: west basin of Jazmoryan wetland)

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### Abstract

The growing population and consequently land use changes and increase of urban, industrial and agricultural activities in Iran has caused over-exploitation of groundwater resources so that these resources have been exposed to pollution and as well as declined quality and quantity. In this study, the effect of land use changes on groundwater resources as well as monitoring of spatial and temporal changes of groundwater quantitative and qualitative parameters were assessed in west basin of Jazmoryan Wetland. Landsat satellite images of TM 2002 and OLI 2015 sensors by applying of Maximum Likelihood Method were used to investigate land use changes trend. Also, information related to wells in years of 2002 to 2015 was used to assess groundwater quantitative and qualitative parameters. To do this, zoning maps of spatial and temporal changes of groundwater quantitative and qualitative parameters were prepared using the best interpolation method in ArcGIS software. The results related to evaluation of the best interpolation method showed that Kriging method had the least error. According to the results of this study, the area of agricultural and urban land uses has been increased, while the area of ephemeral stream, dam, rangelands, bare and mountain land uses has been decreased in 1394 compared to 1381. These changes indicate the increased degradation as well as unstable conditions of the region that adversely affect groundwater resources. As a result of these changes, groundwater quality in southern parts of the study area has been declined. Among the factor causing this declined groundwater quality are construction of Jiroft dam on Halil-rood permanent river, lack of water right and expanded urban and agricultural lands which have caused decrease in groundwater quality over time.

**Keywords:** Groundwater, Land use change, West Basin of Jazmoryan Wetland, Interpolation, Kriging

Received: 19-Aug-2013

Accepted: 13-Aug-2018

## Performance Evaluation of Several Data Mining Methods to Evaporation Prediction (Case Study: Yazd synoptic station)

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### Abstract

Evaporation is one of the important climatic parameters in arid areas and plays an important role in water resource management. Therefore, awareness of evaporation rate and its modeling as one of the important hydrological variables in agricultural research and water and soil conservation is of the utmost importance. In recent decades, artificial intelligence techniques have been shown high ability to estimate and prediction nonlinear phenomena. In this study, three important data mining methods including artificial neural network, Active Neuro-Fuzzy Inference Systems and regression decision tree was used to predict monthly evaporation at Yazd synoptic station. For this purpose, eight meteorological variables on the monthly scale (temperature minimum average, temperature maximum average, average temperature, sunshine, wind speed, wind direction, mean of relative humidity and evaporation) were used as input of the model. The results showed that three mentioned models are able to predict the evaporation amount of 12 next months by using climatic variables, however, among the three models used, artificial neural network showed the best performance with the correlation coefficient,  $r=0.97$ ,  $RMSE = 5.1$ ,  $MAE = 36.3$  and  $ME=-0.48$ . The results also indicated, in prediction of evaporation, there is no significant difference when using original data and normalized data, and data processing will not have much effect on improving the results of the models.

**Keywords:** prediction, evaporation, artificial neural network, Active Neuro-Fuzzy Inference System, Decision Tree, Yazd.

Received: 13-Jun-2018

Accepted: 28-Aug-2018

## Comparative Study of Frequency Analysis and Hydro-climatic Methods for Estimating Maximum Flood Discharge (Case Study: Bakhtiary Watershed)

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### Abstract

There are many methods for estimating the maximum flood discharge including frequency analysis methods and risk study of hydraulic structures based on flood frequency analysis is often sensitive to the observations and selected statistical distribution that cause errors in design. Since heavy rainfalls are the main cause of floods and the rainfall records are longer than flow records, hence long-term records of rainfall at rain gauge stations of Bakhtiary basin in a 66-year period and the 58-year records of daily maximum discharge were used in this study.

In this research, peak and maximum daily flows were estimated by using hydro-climatic methods of Agregee and Gradex. Then, the results obtained from the simulation based on hydro-climatic approach for the different return periods were compared with those of classical statistical techniques of Gumbel and Generalized Extreme Values (GEV).

The results showed that using additional information like rainfall data plus hydrometric data in hydro-climatic methods gives better estimates rather than frequency analysis methods. Because each three evaluation criteria of Root Mean Squared Error (RMSE), Nash–Sutcliffe efficiency (NSE) coefficient, Kling-Gupta efficiency (KGE) coefficient confirm performance of hydro-climatic methods in comparison with Gumbel and Generalized Extreme Values (GEV) distributions. Finally, a peak to volume ratio extracted from the 26 major flood events detected at Tang-e panj hydrometric station within the hourly discharge records was used to transform the cumulative distribution function of daily discharge into peak discharge.

**Keywords:** Maximum daily discharge, Flood frequency analysis, Hydro-Climatic methods, peak to volume ratio, Bakhtiary watershed

Received: 24-Aug-2017

Accepted: 03-Jul-2018

## Measurement and Modeling of the heterotrophic soil respiration response to temperature in grazing and grazing exclosure rangeland

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### Abstract

Soil heterotrophic respiration, which is the result of soil organic matter decomposition, is affected by environmental factors, especially temperature. A variety of models have been proposed to understanding the respiration response of the soil to temperature and respiration sensitivity to temperature ( $Q_{10}$ ). The aim of this study was to evaluate the respiration response of soil to temperature variations using incubation technique and to examine variety of models in two different management systems. For this purpose, intact soil samples were collected from a grazing and grazing exclosure in Fandoghlo Ardebil, incubated for 4 weeks at 10, 20 and 30 ° C temperature. Soil respiration was measured by alkaline adsorption method. Nonlinear regression method and The Levenberg-Marquardt algorithm were used to determine the parameters of models. Both ecosystem showed an exponential increase in Soil heterotrophic respiration with temperature. The rate of respiration in soil of grazing, at all three temperature levels, was higher than grazing exclosure. Most models describing the relationship between soil respiration and temperature showed a good fit to the experimental data, especially in the grazing exclosure.  $Q_{10}$  in the grazing (1.21) was higher than the grazing exclosure (0.97). In general, based on the coefficients of the models and the  $Q_{10}$  analysis, the Arrhenius model can be better than the others of model for expressing the relationship between soil respiration with temperature, as well as good numerical estimation for  $Q_{10}$  of soil.

**Key words:** Incubation, The Levenberg-Marquardt algorithm,  $Q_{10}$ , Arrhenius model

Received: 05-May-2018

Accepted: 27-Sep-2018

## Examining and introducing plant species in the process of soil refining of lands contaminated with heavy metals by irrigation with gray waters

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### Abstract

The purpose of this study is to investigate the potential of some plants for Phytoremediation of soil contaminated with lead, zinc, cadmium and copper. To do this, four plant species of *Achillea millefolium*, *Agropyron elongatum*, *Bouteloua dactyloides* and *Artemisia sieberi* were cultivated and plant samples were irrigated with refinery wastewater. The results showed that in terms of plants, *Bouteloua dactyloides*, *Artemisia sieberi* and *Achillea millefolium* are good transfer of metals to their aerial parts which is suitable for plant extraction (the most important technique of Phytoremediation). *Agropyron elongatum* mostly accumulates copper and lead metals in the root. This is a proper feature of phytostabilization. Also the capability of these four plants species for Phytoremediation is as follows: *Bouteloua dactyloides* > *Achillea millefolium* > *Artemisia sieberi* = *Agropyron elongatum*. *Bouteloua dactyloides* is proper for Phytoremediation of all heavy metals. For *Bouteloua dactyloides*, plant transfer factor (TF) in metals: zinc, copper, lead and cadmium is 1.17 and 1.9, 1.12 and 1.41, respectively, and bio concentration factor (BCF) for that in these metals are 1.77 and 1.22, 0.95 and 1.37, respectively. Since *Bouteloua dactyloides* has high tolerance to drought and high temperatures and is also suitable for lawn making, it is suggested that this type of species is used for Phytoremediation of soils contaminated with heavy metals in polluted areas as well as lawn making so that in addition to soil cleansing from heavy metals and being proper with native climates in many parts of Iran and having low irrigation requirements, it also helps the visual beauty of the environment.

**Keywords:** *Achillea millefolium*, *Agropyron elongatum*, *Artemisia sieberi*, *Bouteloua dactyloides*, Heavy metals, Phytoremediation

Received: 24-Jul-2014

Accepted: 20-Mar-2015

## Investigation of groundwater quality of Mashhad Plain Aquifer using GIS and multivariate statistical techniques

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### Abstract

Water quality is always one of the major challenges for managers and decision makers in water resource management. However, the problems of water quality are more important than water quantity. One of the main ways in thorough review and assessment of water quality is using multivariate statistical techniques which by identifying important and influential factors, could explain the majority of changes in a system. This study has been performed for zonation of underground water quality of Mashhad Plain Aquifer in terms of agricultural potential. For this, the quality of groundwater for agricultural use was studied and maps of water quality zonation for 2001-2011 years were prepared. Then, by using geological maps, the effect of geological formations on degradation of groundwater quality was assessed. For water quality analyses, 10 important water quality variables in 39 selected wells were measured and they were analyzed using multivariate statistical techniques. The statistical analyses which were used are: Factor Analysis for determining the most important variables, cluster analysis for determination of homogenous groups of variables and Pearson Correlation for investigating the relationships between variables. The results have shown the best relationship exist between geological formations and water quality factors. Also, the results of Factor Analysis showed that EC and TDS explaining %71.02 of the total variance with factor loading of 0.98 and pH explaining %14.91 of the total variance with factor loading of 0.93, are the most important variables affecting the quality of groundwater in the study area.

**Keywords:** Groundwater quality, geology, GIS, Multivariate statistical techniques, Mashhad Plain Aquifer

Received: 22-Dec-2016

Accepted: 26-Jul-2018

## Evaluation of preferred indicators of range plant species for improvement and restoration of semi-steppe rangelands (A case study of Ardabil- rangelands)

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### Abstract

Preference evaluation of four species of perennial forage grasses including *Alopecurus textile* L., *Festuca ovina* L. and *F. sulcata* L. and *Agropyron trichophorum*. In order to use for improvement and restoration of rangelands, seeds of species were collected from of Ardebil province. After seed germination test and preparing of seed bed. This eyperiment was done based on Randomized completely block design with 3 replicates in dryland conditions from 2010 -2014 in Ardabil station. After plants establishment and end of growing, crown cover Total height, seedling vigourity, forage and seed production. Analysis variance of data was done using SAS software and the mean comparison with Duncan method at 5% level. The results showed that, the species in term of studied traits, had significant difference exept survival, The highest height, crown cover and forage production. Be longes to *Agropyron trichophorum*, The highest seedling vigourity belodes to *Agropyron trichophorum* and *Festuca sulcata* finally, Therefore these can be used in improvement and developmend proces of pasture in arid and semi-arid region.

**Key words:** Perennial grasses, Evaluation, forage dry matter yield, Seed yield, Ardabil province.

Received: 04-Dec-2017

Accepted: 08-Aug-2018

## Evaluation of the efficiency of steam condensation system in soils with organic materials

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### Abstract

Due to the lack of water and the dryness of many areas, the development of new technologies for supplying water needs is important at the deployment stage of plants or afterwards. Steam condensation system in soil is a new and developing method that is capable of regenerating land using renewable energy. In this method, the energy from the sun, the supply of water and moisture, is obtained from the steam in the air and transferred directly to the root zone and increases the moisture content of the soil. In the present study, the method is used to increase the moisture content of different soils improved with organic matter. In this method, steam generating water is introduced into steam pipes, and after distillation it increases the moisture content of the soil. The results of this study showed that steam condensation has a significant role in increasing soil moisture and has a promising prospect. The moisture content stored in organic soils improved by more than 11% during the experiment. Statistical evaluation of measured data such as temperature, soil texture, organic matter and interaction of each of these parameters on soil moisture variations showed that this method was significant at 1% level compared to control. So, with a 99 percent chance of this, it can help to increase soil moisture. Also, temperature, organic matter and interaction of temperature and soil texture as well as temperature and organic matter on soil temperature changes were significant at 1% level. So, with a 99% chance of changing these factors, it's best to increase soil moisture. Soil texture was significant at 5% level, which indicates that by changing soil texture with a 95% probability, the best effect can be achieved in increasing moisture content. The result of the analysis of variance of texture interaction, temperature and organic matter showed that these three parameters had no significant effect on moisture increase. The results showed that soil with moderate texture, 35% organic matter and steam 45 ° C with coated conducting tube had better conditions than moisture and temperature in comparison with other treatments, reached over 11% moisture content during the experiment.

**Keywords:** Water, condensation, soil, moisture content, absorbent material



Received: 11-Nov-2017

Accepted: 12-Jan-2018

## The effect of the morphometric factors on the peak flow using the Structural Equation Techniques (PLS) in the Southern Watersheds, Iran

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### Abstract

Flood discharge in the outlet of the watersheds is a function of various factors such as morphometry, rainfall, soil type, and vegetation. The morphometric parameters of a watershed can be used to explain its hydrologic response. The purpose of this study is to investigate the effect of morphometric factors on the peak discharge in 108 hydrometric stations in the south of Iran. After carrying out the tests of homogeneous and randomness of data, a time period of 30 years (from 1983-1984 to 2013-2014) was chosen and used to select the best probability distribution function. Overall, the 84 morphometric and geometric parameters were calculated using the ArcGIS software. In this research, the structural equations modeling with the Partial Least Square approach was used in the smart – PLS software to check the most effective factors on the annual maximum discharge. 18 variables were identified as the effective factors (independent variable) on the maximum discharge of flood (dependent variable). In the first section, quality analysis of the combined measurement model (annual maximum discharge variable) was done using the tests of significance, outer weights and multiple isolinear for the observable variables. Based on the results, the significance of the factor loadings and validity of the combined measurement model were approved using the variance inflation factor. In the second part, the analysis of the reflective measurement models (the other variables) was explored in two stages of reliability and validity tests. All of the factor loadings of reflective measurement models were more than 0.7 and significant. Finally, in more than 84 structures, the effects of concentration time and the elevation ratio were positive, and the effects of Miller's circularity ratio, slope characteristics of the main river, elevation number and elevation characteristics of the main river were negative that these factors can predict overall the %46 of the annual maximum discharge changes in the southern watershed of Iran. Totally, the concentration time has a direct effect on the discharge of flood (with a value of 0.38) thus, the most effective factor influencing on the flood discharge is the concentration time which should be considered in flood management in the southern watersheds of Iran.

**Key Words:** Annual maximum discharge, Morphometric characteristics, Minor partial least squares regression, structural equation, factor analysis.

Received: 19-Oct-2017

Accepted: 10-Jan-2018

## Evaluation of the Efficiency of Satellite Imagery Classification Approaches in Monitoring of Land Cover Changes (Case Study: Shahrekord Basin, Chaharmahal va Bakhtiari)

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### Abstract

Land cover mapping is essential for natural resource management. Satellite imagery can be used for mapping land cover. Several methods are available for land cover mapping whilst choosing the best method is one of the most important issue in this context. To compare pros and cons of three methods of classification including maximum likelihood, object-based segmentation and artificial neural network, first, the efficiency of these three methods were evaluated. Then the trend of land cover changes in Shahrekord basin was investigated for 1999, 2009 and 2015 using Landsat images of TM, ETM+ and OLI sensors, respectively. After geometric and radiometric corrections, the land cover map of 2015 was prepared based on the three methods. The results of the validation mapping methods revealed that object-based method was more promising than the others with 93 and 90% for total accuracy and Kappa coefficients of agreement, respectively. So, the object-based segmentation method is recommended for monitoring of land cover changes. The results of the land cover change indicated that residential areas increased from 1.727% in 1999 to 2.98% in 2015 and agricultural lands increased from 5.73% to 12.60% but rangelands were decreased by 9.05 in total. Moreover, bare-lands were increased from 1999 to 2009 by 6.19% but decreased from 2009 to 2015 by 5.27%. The result of this study showed that the object-based method is superior to pixel based method of Maximum-likelihood and neural network. So, object-based segmentation is recommended for estimating land cover changes.

**Keywords:** Remote Sensing, Land Cover Mapping, Maximum Likelihood, Object-based segmentation, Artificial Neural Network, Shahrekord Basin

Received: 08-Jul-2018

Accepted: 15-Sep-2018

## Construction of cement-slag mulch using mixture experiments design for fixation of sand dunes

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### Abstract

Mulching on the ground surface is one of the common approaches for fixing the sandy dunes and controlling dust. Despite the frequent use of oil mulch, due to its heavy costs and environmental problems, researches are focused on producing new environmentally friendly mulches. In this research, different treatments of cement, lime, wind sands and steel-slag, as cement-slag mulch, have been used to fix the sand dunes samples prepared from Robot-Karim region. Steel-slag is added to the mulch composition because of the benefits of waste reduction from environment and replacement of a part of the cement in the mulch composition because of Steel-slag pozzolanic property. To reduce the number of tests and find the optimal composition of the mulch, statistical mixture design approach was used. Furthermore, the effect of different percentages of the ingredients on shear, compression and impact strength and moisture content of cement-slag treatments were investigated. Results show that the addition of steel-slag increases the compressive and shear strength as well as the ability to maintain soil moisture in the proposed mulch. Finally, developing the mathematical model of the experiments, six different objective functions were considered for optimizing the composition of the proposed cement-slag mulch. As a result combination of 68.731% sand, 27% cement, 2.979% steel-slag and 1.3% lime were the best mulch considering all the objective functions. To validate the results of the optimization, six optimal compositions were re-constructed and the tested again. Obtained results showed an acceptable consistency between the predicted and tested values.

**Keywords:** Dust, Cement mulch, Mixture Design, Steel-Slag

Received: 27-Feb-2017

Accepted: 28-Sep-2018

## The possibility of forage production and establishment of salt tolerant species in saline and low-yield lands (Case study: Garmsar- Semnan)

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### Abstract

The use of saline and lands low-yield lands for forage production is an important step towards optimal utilization of low quality soil and water resources and supplying livestock forage as well as conservation of soil and water resources. Therefore, this research was aimed to investigate the establishment potential, canopy cover percentage, height growth and yield. Garmsar Desert Research Station with a soil salinity of 30-35 ds/m and *Atriplex canescens*, *Atriplex leuoclada*, *Atriplex verrocifera*, *Aeluropus lagopoides* and *Aeluropus littoralis* were selected and the species were cultivated in three replications. In each replication, 15 individuals of the study species were cultivated on each row. According to the results, the establishment percentage of *At. ca*, *At. le*, *At. ve*, *Ae. la* and *Ae. li* was recorded to be 95.5%, 95.5%, 100%, 97.7%, and 100%, respectively, indicating high establishment potential. The results of analysis of variance for annual yield showed that all the study species were able to produce forage in saline lands with a soil salinity of 35 ds/m. Among the study species, *At. ca* and *At. le* had the highest canopy cover and height. The highest forage production (more than 2 kg ha<sup>-1</sup>) was recorded for *At. le*, compared with other study species. Our results clearly showed that yield and canopy cover superior to other traits in showing the differences among the study species.

**Keywords:** forage production, canopy cover, salt tolerant species, establishment, Semnan.

Received: 05-Sep-2014

Accepted: 25-Jul-2018

## Effect of converting rangeland to afforestation on carbon storage and some properties of soil (Case study: Hassan Abad afforestation, Sanandaj)

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### Abstract

Present study aimed to effect of converting rangeland to afforestation on carbon sequestration and nitrogen storage was done in forested areas of Hassan Abad in Sanandaj. Masses of studied was include *Cupressus arizonica*, *Pinus eldarica*, *Fraxinus rotundifolia*, *Robinia psedoacacia* and *Thuja orientalis* whit an average age of 20 years and adjacent rangeland that converting was not created was selected as control. Sampling of soil was done in afforestation mass and control and characteristics of organic carbon, nitrogen, phosphorus, potassium, bulk density, pH, electrical conductivity, percent clay, silt and sand was measured. To compare the effect of forestry corrective operations on carbon sequestration was used independent t-test analysis and to compare the effects of different types of afforestation on soil carbon and nitrogen sequestration rates was used one-way ANOVA and to compare the means was used Duncan's analysis. Results shows that *Robinia psedoacacia* have a significant effect on increase of carbon and nitrogen sequestered and amount of phosphorus and potassium in soil and in total in *Robinia psedoacacia* mass amount of cabon sequestered and nitrogen stored in soil was calculated 80.62 and 5.42 ton/ha and in control 47.05 and 3.08 ton/ha and *Robinia psedoacacia* mass cause to increase of soil carbon and nitrogen amount of 71 and 75 percent and lowest amount of carbon and nitrogen was obtained in soil of *Cupressus arizonica* mass. Stepwise regression results showed that nitrogen, phosphorus and potassium, respectively are most important components affecting in soil of investigated mass.

**Keywords:** converting, corrective operations, afforestation, carbon sequestration, nitrogen storage.

Received: 24-Nov-2016

Accepted: 20-Sep-2018

## Spatial and Temporal Evaluation of Soil Erosion using RUSLE model and Landsat satellite image time series (Case Study: Menderjan, Isfahan)

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### Abstract

Soil is one of the most important production factors that has a great impact on human socio-economic life and the process of soil erosion is one of the environmental issues that threatens the environment, natural resources and agriculture. Spatial and temporal information of the soil loss and soil erosion on the land has a significant role in influencing management practices, soil erosion control and watershed management. Therefore, this study was conducted with the aim of studying the spatial and temporal estimation of soil erosion during 1994, 1999, 2008 and 2015 in the sub-basin of Mardarjan with an area of 21100 hectares located in the west of Isfahan province using remote sensing (RS) and geographic information systems (GIS). In the present study, while conducting field studies, various data and information including the digital elevation model, satellite images, soil, and statistics on rain gauge stations were used as a research tool. Estimation of soil erosion in the study area was carried out using the Revised Universal Soil Loss Equation (RUSLE). The results of this study showed that the amount of soil erosion in 1994, 1999, 2008 and 2015 was 0.001 to 233, 0.001 to 297, 0.001 to 231 and 0.001 to 215 "ton"/"ha.year". The topography factor in the study area with the correlation coefficient of 80% had the greatest effect on the estimation of annual soil erosion by the RUSLE model. This research corroborate the effectiveness of modern GIS technologies and remote sensing in temporal simulation for quantitative, exact, and point-to-point estimates in the whole area to obtain soil erosion content.

**Keywords:** Modelling, Soil Erosion, Land Cover Change, Soil Conservation, Zayandeh-Rud Dam

Received: 08-Apr-2018

Accepted: 05-Nov-2018

## Hydrological drought monitoring using SDI and GRI indicators In the watershed of Azam Herat, Yazd province

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### Abstract

Drought is a natural and repetitive phenomenon. In this study, using SDI and GRI indicators, the hydrological drought condition was evaluated and compared with meteorological drought indicators.

In the MATLAB environment, the GRI index was determined. According to the results, the GRI index during the statistical period (1981-2015), the maximum drought severity was -73.25, and the maximum duration of drought was 79 months.

These values are higher than the SDI index in the same time scale and the common statistical period.

The Frequency of different groups of GRI indicator in the 35-year statistical period showed that normal drought had the highest percentage of abundance.

The SDI index has the highest maximum continuity in the low-level time scales compared to the drought indicators of the meteorology. Frequency of drought groups was calculated based on an SDI index for the statistical period for different time scales.

The results of this study showed that SPEI on 24 and 48 months scale with 3 month delay have the highest correlation with GRI which showed the impact of meteorological drought after two years has more effect on groundwater resources.

Knowing the time interval between the occurrence of meteorological drought as main cause of coming drought that could help planners and managers to take the necessary management measures to cope with the drought caused by a shortage of water resources including surface and groundwater.

**Key words:** SDI, GRI Indicators, Cross correlation, Azam river basin Harat. Regional rainfall and temperature.

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Received: 27-Jan.-2018

Accepted: 02-Jun.-2018

## Evaluation of morphoscopy and granulometry of wind sediments (Case study Aran-Kashan)

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### Abstract

By identifying the removal areas, the reasons can be identified instead of addressing the causes, and focused on executive activities in the harvesting areas and for this, the identification of sediments is particular importance in this paper, with the aim of better understanding and interpreting sedimentary samples, Investigating and analyzing the distribution of sediments in the facies of the study area has been investigated. For this purpose, after sampling of surface soil and preparation of samples, the drying procedure was performed according to A.S.T.M standard in 8 classes, which was smaller than 64 microns to 4000 microns. By entering the data into Gradistat software, statistical parameters such as mid-diameter, skewness and sample sorting were calculated based on the Fulc's comprehensive drawing method. The results of the study showed that the particle sorting is between 0.8 and 0.3, which confirms the near-average spacing distance from the harvesting area to the sediment accumulation point. The results of the particle tilting index are in the median vein facies, agricultural lands, agriculture, and sandy areas with symmetrical pebble cover. In other facies, the index is tilted towards fine particles. In the facies of the Rigi plain, the puffy lands and the permafrost shells of the wear coefficient classes are between 0-200 and then fully angled and the particles are transported from a distance. In the rest of the facies, the wear coefficients are between 200 to 400, in which case the particles are semi-angled and the particles are transported from a relatively distant distance.

**Keywords:** Grain, Morphoscopy, Sorting, Bending, Abrasion coefficient, Gradistat



Received: 12-Jun-2017

Accepted: 18-Aug-2018

## The economic valuation of forage production function and utilization of orchid in Targavar grasslands of Urmia

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### Abstract

Functions of a natural resource, including rangeland ecosystems, can be divided into four groups of regulatory, habitat, production and information functions. Therefore, in this study, the economic valuation of forage production function and utilization of rhizome orchid were in terms of performance and utilization of orchid feed, studied in Trgvr grasslands of Urmia. For this purpose among, the distribution areas of orchids in the grasslands area, six locations with a total area of 120 hectares with different water levels that are representative of a wide range of grassland area, were selected. Then, The production of different vegetation forms and the amount of orchids production was measured in repretive sample, and the economic value was estimated by marketing method according to the results each hectare of grassland area is able to produce 1731.78 kg forage and 4.02 kg orchids in a growing season, whit it's economic value of each hectare of forage production and utilization of orchids in terms of function, respectively equal to 16.88 and 44.72 IRR. The results of the study are useful in determine the acceptable level of damages grassland area and to calculated and green national accounts.

**Key words:** Economic valuation, Forage production, Orchid, Grassland, By-products of Rangeland

Received: 19-Sep-2017

Accepted: 11-Nov-2018

## Regional analysis of suspended sediment load using principal components regression method in Sefidrood Drainage Basin

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### Abstract

Sediment yield caused by soil erosion process as the most important land degradation index is considered a main challenge in sustainable development and threatens the ecosystems. It is therefore very important to estimate the reliable sediment discharge at watersheds outlets. The large river drainage basins and the lack of sediment gauges have led to apply regional analysis methods, to estimate suspended sediment load in the basins without gauges or the gauges with lack of data. The objective of this study was to estimate regional suspended sediment load using principal components regression in homogeneous regions of Sefidrood drainage basin with an area of 59273 km<sup>2</sup>. In this study, 23 sediment gauges with 30-year period were selected and the annual mean suspended sediment of sub-basins as dependent variable and 18 physiographic and hydrologic characteristics of sub-basins as independent variables were determined. Then, after determining homogenous regions, the controlling factors in sediment load were recognized in each homogenous region based on principal components analysis (PCA). Finally, the relationship between suspended sediment load with different return periods and controlling factors were determined. The results showed that the stations located in the study area were clustered in two homogeneous groups. In the homogeneous region one, based on the PCA, 18 variables reduced into 5 factors accounting more than 87% of total variance and in the second homogenous region reduced into 3 factors accounting more than 92%. Using the principal component regression in the first homogeneous region, the first factor with the coefficient of determination of sediment discharge with 25- year return period, 0.67, and in the second homogeneous region, the first and second factors with coefficient of determination 0.32 were entered in model.

**Keywords:** Homogeneous regions, estimation of sediment, physiographic characteristics, principal components regression, Sefidrood Drainage Basin.

Received: 10-Apr-2018

Accepted: 28-Sep-2018

## Groundwater Level Prediction of Boukan Plain using Fuzzy Logic, Random Forest and Neural Network Models

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### Abstract

Groundwater system studies to understanding its behavior, requires the exploratory drilling wells, pumping test and geophysical experiments, which can carried out with most cost. For this reason, simulation of groundwater flows by mathematical and computer models, which is an indirect method to groundwater studies, is being spent a few costs. In this research, the efficiency of artificial neural network, fuzzy logic and random forest models has been investigated in groundwater level estimation of Boukan plain. Parameters of precipitation, temperature, flow rate and water level within time period of the previous month were used as input and the water table in each period were selected as output through monthly scale (2006-2017). To evaluating the performance of models, Correlation coefficient, root mean square error and coefficient of mean absolute error were used. The results showed that the Fuzzy Logic and Random Forest models are able to estimate water levels with acceptable accuracy. In terms of accuracy, fuzzy logic model with the highest correlation coefficient (0.96), lowest root mean square error (0.068 m0) and mean absolute error (0.056 m) was recognized as a best the model in the groundwater level prediction.

**Keywords:** Fuzzy Logic, Groundwater Level, Neural Networks, Random Forest

Received: 15-Jan-2018

Accepted: 26-Jun-2018

## Producing rangeland vegetation types map using different algorithms of satellite image classification

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### Abstract

To better managing of rangeland the vegetation map is one of major factors, because plant communities is planning units of rangeland management and vegetation map shows the current status of plant communities. This research was conducted to produce vegetation type's map using Landsat 8 image classification in Behbahan, Khuzestan province. Rangelands of the study region is warm semi steppe and winter grazing. Geometric correction of satellite image was performed by ground control points with an error of less than one pixel. Atmospheric correction of existing data using the dark object subtraction was done. Field visits for vegetation type's border controlling and sampling training area was conducted. Eight supervised classification algorithms included Parallelepiped (PP), Minimum Distance to mean (MD), Mahalanobis distance (MAH), Maximum Likelihood (ML), Neural Net (NN) and Support Vector Machine (SVM) was performed. The results showed that ML algorithm has the highest overall accuracy (87.5 percent) and kappa (0.867) and PP algorithm has the lowest overall accuracy (67.1 percent) and kappa (0.571). It is suggested that, along with digital methods of classification of satellite images, visual interpretation should be used to clarify the boundary of the obtained vegetation types map.

**Keywords:** Vegetation Type, Semiarid, Classification, Landsat, OLI