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Assessment and Mapping Desertification Risk in *Roudab* Region

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Abstract

Iran is mostly consisted of arid and semi-arid areas. *Rudab* region, *Sabzevar*, is indicative of an area exposed to and affected by the risk of desertification. This study accordingly is aimed at assessing the risk of desertification using ESAs model, through mapping the risk of desertification. Initially, work units' map was prepared based on which relevant indicators were valued. Then, relevant indices were prepared based on ESAs model using GIS. Finally, ESAI index was calculated for each work unit. After mapping the risk of desertification, desertification damages were evaluated. It was found out that the risk of desertification in *Rudab* can be classified at three classes i.e. class I, II, and III; and subclass III1 covered the biggest surface of the study area i.e. 44.48%. Based on desertification damage map, *Rudab* region is divided into five classes so that class III covering 35.20 percent of the area is the biggest area. Active sandy dune faces are prone to the highest risk of desertification since they entail significant risk factors and need to be paid due attention for desert greening programs.

Keywords: Desertification Risk, ESAs Model, Desertification Damage, Roudab region.

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Forage Quality of Important Range Species in the Mountainous Highland of *Alamut* (Qazvin) and *Badamestan* (Zanjan)

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Abstract

Being aware of the quality of rangeland forage and recognizing their anti-quality characteristics is one of the basic necessities of animal feeding management in rangelands. Therefore, in the current study, forage quality of 23 rangeland species (*Acantholimon flexuosum*, *Agropyron trichophorum*, *Astragalus capax*, *Astragalus demavandicus*, *Astragalus micricephalus*, *Astragalus vereciferom*, *Bromus tomentellus*, *Centaurea aucheri*, *Centaurea virgata*, *Chaerophyllum macropodum*, *Cirsium haussknechtii*, *Cousinia calocephala*, *Cousinia esfandiari*, *Euphorbia denticulate*, *Festuca ovina*, *Hypericum scabrum*, *Nepeta heliotropifolia*, *Prangus ferulacea*, *Tanacetum polycephalum*, *Thymus kotschyanus*, *Verbascum speciosum*, *Veronica orientalis* and *Vinca herbacea*) is determined in the vegetation composition of mountainous highland of *Alamut* in Qazvin province and *Badamstan* in Zanjan province which represent the growth domains of Iran and *Turani*. For this purpose, the samples were taken from the species at three stages of growth (vegetative growth, flowering and seeding stage) in 2008. Afterwards, the forage quality parameters were determined. In order to compare species and their growth stages regarding the forage quality indices the one-way ANOVA was used and for finding the sources of variations within groups the Duncan test was employed. The results show that the mean values of crude protein, digestible dry matter and metabolism energy of studied species per unit weight of vegetation at the early stages of rangeland growth (vegetative and flowering) is more and at the final stage (seeding stage) less than the critical level for the maintenance of animal unit. In this regard, the quality of rangeland forage is desirable at early stages of growth; however, some of the studied plants with desirable forage quality attract the attention of animal less than others. *Acantholimon flexuosum*, *Cirsium haussknechtii*, *Cousinia calocephala* and *Cousinia esfandiari* species for having structural anti-quality components and *Centaurea aucheri*, *Centaurea virgata*, *Euphorbia denticulate*, *Hypericum scabrum*, *Nepeta heliotropifolia*, *Tanacetum polycephalum*, *Thymus kotschyanus* and *Verbascum speciosum* species for containing alkaloids, tannins, nitrates, toxic glucosides and sometimes essence attract animal's attention less than other species. To deal with this issue, management strategies can be employed to help the animal fighting with anti-quality elements to graze on the species while reducing the toxicity and damage caused by the nuisance plants. Results are presented as the basic data for animal and pasture management in the study area and as a means of providing some of the information related to the classification of the quality of pasture plants forage of the country.

Keywords: Forage quality, animal unit requirement, anti-quality properties of forage, Alamut rangelands, Badamestan rangelands.

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Application of the Maximum Entropy Method in Modeling Prediction of Plant Habitats Distribution (Case Study: Rangelands of Qom Province)

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Abstract

Current study addresses identification of the most important variables of plant habitat distribution as well as providing plant habitat distribution maps using Maximum Entropy method. For this purpose, after determination of homogeneous units using digital elevation model and geology maps of scale 1:25000, vegetation sampling was carried out using random systematic method. Depending on plant species, the plot size was determined from 2 to 25 m². Sample size was also determined to be 60 plots with respect to vegetation cover variations and intended characteristics using statistical method. In order to sample the soil at each habitat, eight holes were drilled and samples were taken from 0 to 30 and 30 to 80 cm depths and intended characteristics were measured in the laboratory. In order to perform maximum entropy modeling, layers of environment variables were prepared using Geostatistics and GIS and plant distribution modeling was conducted using MaxEnt software. After implementation of the model, to evaluate model classification accuracy and conformity of prediction with actual maps, area under the curve (AUC) and kappa coefficient were measured. Based on results, model classification accuracy was found acceptable and altitude, aspect, slope, lime, gravel and silt content in the upper and lower layers of soil had the greatest impact on the plant habitat distribution. Agreement value between predictive and actual habitat maps of the *Artemisia aucheri-Astragalus glaucacanthus* and *Amygdalus scoparia*, *Scariola orientalis* -*Stipa barbata*, *Pteropyrum olivieri*- *Stipa barbata* were assessed at excellent (kappa=0.91) and very good level, respectively. These results indicate that the Maximum Entropy is a generative method and models can be easily interpreted by human experts and this feature has great practical importance.

Keywords: Predictive modeling, Maximum entropy, Geostatistics, AUC, Kappa coefficient.

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Network Analysis of the Structural Pattern of Organizational Stakeholders in Water Resources Management with Purpose of Establishing an Integrated Management System for Water Resources in Garmsar Plain

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Abstract

Identification and analysis of the organizational stakeholders are one of the requirements of an integrated cooperation-based management of water resources. Based on the network analysis method, we could evaluate the network structural aspects of organizational stakeholders and investigate their roles in establishing a coherent and unified system for water resources management. This study aims to analyze the cooperation and information exchange network among stakeholders related to water resources management in Garmsar plain to establish an integrated management system for water resources. The related stakeholders in this study are categorized in three developmental, conservational, and intermediary groups. Solidarity, stability, and endurance of network were evaluated based on information exchange and cooperation between stakeholders and calculating the macro indicators of network such as density, tie reciprocity, geodesic distance, and transitivity. According to the results of this study, organizational solidarity within the considered groups was unequal and it was weak to very weak for intermediary organizations. Also, stability and endurance of the management network of water resources were weak. In addition, the results showed some conflicts, particularly between developmental and conservational organizations in cooperating on participatory management of water resources. According to the results of this study, we suggest doing infrastructure actions such as capacity building and empowering the stakeholders to establish an integrated management system for water resources in the considered region.

Keywords: Cooperation, Garmsar plain, Network analysis, Organizational stakeholders, Water resources management.

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Assessing the Effects of Socio-Economic Issues on Social Cohesion of Nomads (Case study: *Shahsavan* Nomads, *Sabalan* Mountain Range)

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Abstract

Nomadic migration has been a way of living in Iran from ancient times. Although this way of life has changed in different periods, the intensity of these changes has an origin in social, political and security issues in addition to livestock and rangelands. The population of the study area is 70 and a number of 58 people were selected using Cochran formula. In the present study, questionnaires were used and data collection was performed using interview. To measure social integration, five factors were used which were included in the questionnaire including customary rights, within group-trust, tribal and local trust, confidence and awareness of the projects provided by the government, and legal protection. Cronbach's Alpha coefficient for the social integration was calculated to be 0.88 and the correlation between social integration and the factors including beneficiaries' literacy, the history of exploitation, annual income from animal husbandry and the number of livestock was analyzed through Pearson test using SPSS software. It was revealed that there was a direct and significant relationship between social integration and annual revenue of animal husbandry and the history of exploitation while social integration had a significant inverse relationship with the number of livestock, indicating a close relationship between the nomadic community and their social integration. Nomadic community needs should be provided in the form of nomad's social integration. Finally, the tribal system of the country should be viewed as a cultural heritage and it should not be measured by modern development indicators.

Key words: Social and economic issues, Social integration, *Shahsavan* tribe, the *Sabalan* mountain.

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Evaluation of Logistic Regression Efficiency in Mapping Flood Susceptibility

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Abstract

In order to prevent any damages which can be caused by flood at Haraz watershed in the Mazandaran province, it is essential to prepare a flood susceptibility map using logistic regression. About 211 flood locations and 211 non-flood locations were first recognized. Ten flood conditioning factors such as Slope, plan curvature, altitude, distance from river, topographic wetness index (TWI), stream power index (SPI), rainfall, landuse and normalized differences vegetative index (NDVI) were then identified. The maps of all affecting factors were prepared using ArcGIS10.1, ENVI 5.1 and SAGA GIS2 software and they were exported to raster formats. Flood locations were randomly divided into two groups: 70% (151 flood locations) and 30% (60 flood locations) for modeling and validation, respectively. Enter method was selected for weighing the 10 factors in SPSS.18. The factors with their corresponding weights were used in the ArcGIS software for generation of flood susceptibility map. The map was divided into 5 classes. ROC curve and area under curve (AUC) are used for the validation of derived map. The results indicated that for prediction rate, the AUC is 78.3%; thus, the logistic regression has a reasonable accuracy for flood susceptibility mapping. The findings of this research are useful and necessary for scholars, the Mazandaran Regional Water Authority (MRWA), Ministry of Energy, and other agriculture and natural resources-related organizations in order for mitigating losses and damages during flooding events.

Keywords: Flood susceptibility to flooding, GIS, Haraz watershed, Logistic regression, ROC.

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Vulnerability Assessment; a Strategy for Sustainable Rangeland Management (Case Study: Lowland Rangelands of *Aran-v-Bidgol County, Isfahan*)

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Abstract

The purpose of this study was to assess socio-economic vulnerability in lowland rangelands of *Aran-v-Bidgol* County. Accordingly, the most important socio-economic indices were identified using literature review. The sample size was calculated based on Cochran's formula. Data was collected using a researcher-made questionnaire. A panel of experts and Cronbach's alpha coefficient approved respectively the content validity and reliability of the questionnaire. Me-Bar and Valdez's vulnerability formula was applied to assess the socio-economic vulnerability. Results showed that "presence of experts in rangelands", "local problems and the collapse of past utilization systems" and "number of rangeland users" were the most important indices of social vulnerability. Findings further indicated that "life expenses of rangeland users", "number of livestock of rangeland users", "economic status of rangeland users", "livestock type" and "increasing prices" are the most important indices of economic vulnerability. The results also identified that more accuracy can be obtained to assess rangelands vulnerability by integrating social and economic factors at local scale. Therefore, policy-makers and rangeland managers and practitioners should pay more attention to socioeconomic factors at local scales to sustainable rangeland management.

Key words: Socio-economic vulnerability, Local problems, Livestock, Rangeland users, Sustainable rangeland management.

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Effects of Simulation Burning on Soil Moisture, Physical and Chemical Properties under Controlled Conditions

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Abstract

Since fire effects on soil properties, awareness about effects of fire on soil is important for fire management. This study was carried out to investigate effects of fire on hydrological, physical and chemical properties of soil in *Charat* rangeland of *Savadkuh*. Sampling was performed in two plant types *Astragalus gossypinus* and *Artemisia aucheri*, 120 soil samples were gathered. Experimental design was factorial design based on complete randomized design with three repeat. Five prepared treatments for Experiment were control soil, burned soil with burner and burned in oven at 100, 300 and 500 °C. Soil characteristics including the texture, saturation moisture, pH, organic matter, field capacity, wilting point, available water and retention capacity were measured in the laboratory. Results showed that percent of sand and pH increased but percent of saturation moisture, silt and clay decreased as temperature increased. On the whole, fire and heat have decreased soil potential of keeping moisture and infiltration considerably. As physical and chemical properties of soil change, especially hydrological ones, living environment of soil microorganisms and plant roots change as well. Besides, amount of runoff and erosion increases.

Keywords: Soil water retention, Thermal treatments, *Astragalus gossypinus*, *Artemisia aucheri*, *Charat* Rangeland.

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Estimating Biomass using Landsat Satellite Images (Case study: Marak, Birjand)

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Abstract

Vegetation is an important component of each global ecosystem. Determining of the biomass of plant is important to assess its impact upon climate, soil erosion, and as well for management of natural resources. The aim of this study was to estimate biomass using vegetation indices based on remote sensing. The Landsat 8 data of May 2013 and field studies coinciding with field imaging in Marak (South Khorasan province) were used. Tamarix plant biomass measured in 30 random plots of 11 vegetation indices including DVI, IPVI, NDVI, PVI, RVI, SAVI, TSAVI, WdVI, and Tasselcap were used to estimate biomass of Tamarix. Then, using cluster analysis, vegetation indices were divided into three groups among which SAVI, RVI, and IPVI were chosen. The results showed that indexes which consider soil factors are more accurate than other measures. In this study, biomass map was prepared using the SAVI index.

Key words: Arid lands; Biomass; Remote sensing; Landsat 8; Vegetation index; Cluster analysis.

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Evaluating the Trend of Spatial and Temporal Changes in Groundwater Quality in Jiroft Plain

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Abstract

In recent decades, increasing population growth and development of agriculture have increased groundwater consumption and decreased the quality of groundwater resources of most parts of the country. Given the importance of this issue, present study investigates the spatial and temporal changes in parameters of calcium, magnesium, pH, chloride, sodium sulfate and water in Jiroft plain. The data was obtained from 40 wells in the region of Kerman province over which in 2002-2012 water harvesting and qualitative analysis had been done. In this regard, after normalizing the data, the accuracy of different geo-statistical methods including the Kriging and inverse distance weighted were evaluated and then the map of the spatial zoning was prepared in the software quality parameters ArcGIS9.3 using the best method of interpolation. The results showed that the amount of pH, Sodium, Chlorine, and Sulfate increased but the amount of calcium and magnesium declined. But in general, in 2012 the quality of groundwater resources of Jiroft plain decreased compared to 2002 and the trend of changes showed water quality reduces toward the South and West.

Key words: Modeling, Jiroft plain, Groundwater, Spatial changes, Interpolation.

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Comparative Study of the Hydraulic Thresholds of Gully Erosion Flow in Different Land Uses (Case Study: Ghasreshirin, Kermanshah, Iran)

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Abstract

Negative impacts of gully erosion in marl areas are severe due to improper landuse practices such as irrigation, tillage, overgrazing and degradation of vegetation cover. The objective of this research was to evaluate hydraulic flow thresholds of gully erosion in the agriculture (AG), fair rangeland (FR) and poor rangeland (PR) areas in the Qasre-shirin, Kermanshah, Iran. Nine flumes were performed in the field to determine the critical values of hydraulic parameters including flow discharge, velocity, Froude and Reynolds numbers, Darsi resistance coefficient, shear tension, head-cut dimensions as well as vegetation cover. Results showed that respective critical value of discharge as the gulling thresholds for AG,FR and PR was 1.53, 12.0 and 4.49 li/s indicating significantly higher ($p<0.05\%$) in the FR due to higher vegetation cover. In addition, there were no significant differences for flow disturbance based on Froude number, while the respective value of Reynolds number in the AG, FR and WR were obtained 3113, 26092 and 9525 significantly higher in the FR. Furthermore, the critical level of shear tension for gully formation in the AG, FR and WR were found 12.12, 14.01 and 9.28 Nm⁻², respectively showing significant differences among them. Finally, it is concluded that hydraulic flow parameters as the gully triggering are strongly affected by vegetation cover through landuse practices so that higher plant cover in the FR was the key factor resulting in significant enhancement of gully.

Key Words: Gully thresholds, Gasreshirin Region, hydraulic flow, landuse, shear tension.

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Role of Livestock Management on Vegetation Properties in Summer Rangelands of *Chahr Bagh*, Golestan

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Abstract

Grazing management is one of the basic elements in managing rangeland ecosystems. Proper use of grazing lands in order to achieve optimal efficiency and maintain the sustainability of rangeland ecosystems is the purpose of grazing management. In order to evaluate the response of vegetation to grazing in summer rangelands of *Chahr Bagh* region of Golestan province, vegetation density, vegetation cover and functional properties were measured at five different grazing sites. Thus, using the statistics method of samples and regarding the size of the dominant plants canopy, 20 plots 1*1 meter by using a systematic- random method was considered in order to do sampling in each site and the density, and vegetation cover were recorded within each plot. Finally, parameters were analyzed using Duncan test and analysis of variance and the vegetation compositions of sites were compared using cluster analysis and Jaccard's coefficient of similarity. Results showed that the grazing intensity have significant effect on the vegetation. As grazing intensity increased, the density of desirable species decreased and density of undesirable species increased. So, the enclosure site had the highest desirable species density. Moreover, some functional types such as perennials, Hemicryptophytes, Chamephytes, grasses and decreaser plants significantly reduce with increasing grazing intensity. The greatest increase belongs to grasses with density of 9.8 and class I of palatability with density of 22.8 in enclosure site. Between functional groups, grass life form had the greatest increases in enclosure site with the cover of 19.65 percent. According to results of clustering and similarity index, pen surrounding and watering sites had similar vegetation composition. Enclosure and key area also had similar composition. In general, it can be concluded that increase in grazing intensity has caused negative changes in vegetation in study sites and the changes in watering area, village vicinity and pen area clearly observed. So, using of the management methods in order to improve vegetation indices and pushing it toward balance is recommended.

Keywords: Grazing Management, Density, Canopy Cover, Summer Rangelands, *Chahr Bagh*.

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Statistical Comparison of IMERG and TMPA 3B42V7 Level-3 Precipitation Products of TRMM and GPM (Case Study: Kashafrud Basin, Khorasan Razavi Province)

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Abstract

Satellite precipitation products have been used in scientific studies in global and regional scales from several decades ago. The purpose of this research is quantitative comparison between TRMM and GPM precipitation products in Kashafrud basin. The important point about these products is their accuracy and pixel size. GPM satellite launched on 28th February 2014 and there is no research in Iran and few in the world. This research aims to assess GPM and its predecessor i.e. TRMM products in comparison with 34 ground rain gauge stations in the basin. Comparisons are done in basin and gauge spatial scales and each in daily and monthly time scales. For validation, the statistical metrics including RMSE, MAE, CC, BIAS, FAR, POD and CSI are used. The results indicated that generally the 3B42V7 product from TRMM has higher accuracy than IMERG product from GPM in our study region. IMERG product only in monthly and basin scale has better accuracy in comparison to 3B42V7 product. Regarding time scale comparison, monthly analysis showed higher accuracy. RMSE value for TMPA product in daily time scale for rain gauge and basin scale is 1.88 and 1.55 and in monthly scales is 2.87 and 2.77, respectively. Also, RMSE for IMERG product in rain gauge and basin in daily time scale is 2.43 and 2.3 and for monthly time scale 3.64 and 2.56, respectively.

Key words: Precipitation, Kashafrud Basin, IMERG Data, 3B42V7 Data, GPM satellite, TRMM Satellite.

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Assessment of Flood Water Spreading Projects on Soil Characteristics in Yazd Province

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Abstract

Given the widespread distribution of flood water spreading areas and variety of main effective parameters in their design and implementation, assessment of the performance of system components located in different areas of the country is necessary so that optimal patterns can be achieved. This research was done to assess the impact of the flood water spreading projects on soil characteristics in Yazd (Bafg, Herat and Mehriz flood spreading projects). To this end, in the first to the third spreading basin of projects and three a control sites were selected. Then, 99 soil samples in profiles were collected at five depths and physical and chemical properties were studied in the laboratory. Statistical analysis was performed by independent t-test. The results showed physical and chemical properties of soil is not significantly different from controls in Bafgh flood water spreading projects. In Herat, some parameters such as Electrical Conductivity, pH, Calcium and Potassium in the limited depths was significantly different but in Mehriz, most chemical parameters showed significant difference and decreasing trend. The results showed water infiltration and leaching of soil in the Mehriz area was more than others, while less in Herat and the least in Bafg.

Key words: Assessment, Flood water spreading, Soil physical and chemical properties, Herat, Bafgh, Mehriz.

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Temporal and Spatial Patterns in Rangeland according to Indigenous Knowledge of Boirahmad Tribe

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Abstract

Iran is a country with an ancient culture. During a long time, its inhabitants have created various classifications, nominalizations and technologies on the basis of preference and innovation in different fields in order to adapt with the events happening around. These rich sources of knowledge are being eroded with an unimaginable speed that is in fact a part of the process of local indigenous culture destruction. Accordingly, their data collection and protection are of importance. This study aimed to record the knowledge of nomads of Boirahmad tribe about time and place recognition, playing an important role in forming their various activities in rangeland. The research was done in Dilegan Rangeland that is the summer quarter residence of nomads and located in cold weather regions of Kohgiloie and Boirahmad province. Participatory observation was used for data collection. Regarding the knowledge of experienced shepherds about temporal and spatial components, interviews were divided in two parts, interview with shepherds and others. By applying free interviewing and participatory observation, the required data for local calendar and rangeland identification were recorded. Finally the interview notes were analyzed via content analysis method. Results show that nomads had local daily and yearly calendar in their knowledge, regulating their activities in accordance with. Daily calendar consists of 12 parts that different parts of a day are named accordingly. Also in their yearly calendar different times of the year are classified in 13 various time units which nomads' annual activities (such as migration, harvesting edible and medicinal plants,...) are set based on this calendar. As it was previously mentioned, it is recommended that the classification and naming patterns of time and place in rural and tribal traditional system be more investigated by rangeland management authorities and researchers of habitat prediction. Thus, it will give the possibility of more realistic analysis of the following research and also offered more practical solutions to advance the goals.

Keywords: Indigenous knowledge, Pastoralism, Nomad's temporal and spatial patterns, Cold weather rangelands, Boirahmad tribe.

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Investigating Geology Impact upon Flood Occurrence (Case Study: Joneghan Watershed Basin, Shahr-e-Kord)

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Abstract

Physical characteristics of drainage basins such as geological materials, landuse type and vegetation cover, soil type, surface permeability, depth of underground water table, topographical conditions and drainage are important factors in flood occurrence which affect prevailing equations on water movement in drainage and determine storage capacity of drainage basins. Geology is one of the most important factors affecting flood occurrence of drainage basin. In this study it is attempted to investigate the effect of geology factor on flood occurrence in Joneghan drainage basin, Shahr-e – Koord, using a new method. In this respect, after preparing base maps consisting of slope amount , geology , landuse , erodibility of geological material , soil depth and drainage pattern , studies were performed in two stages as follows: In the first stage, flood occurrence of hill slopes of each sub-catchment was investigated. For doing so, work unit map was prepared using slope and infiltration maps. Then in each sub-catchment, land use, erodibility of geological materials and soil depth were overlaid with work unit map one by one and dually. In the second stage, flood occurrence of drainage was investigated as follows: First, longitudinal profile of main drainage of each subcatchment was prepared using GIS. For investigation of flood occurrence of drainages, slope and permeability of geological units were used. The results of the first stage showed that permeability, slope, erodibility of geological materials and soil depth have the greatest effect on flood occurrence, respectively. Also based on this four – factor method, subcatchments were divided into five flood occurrence classes as follow: low, low to medium, medium, relatively high, and high. The results of the second stage showed that drainage flood occurrence belongs to two classes of low to medium and medium. By combining slope and drainage flood occurrence, it can be concluded that the third subcatchment with medium flood occurrence is more susceptible to flood relative to other subcatchments. With regard to the results of the present study, it can be concluded that geology has high impact on flood occurrence and permeability of geological materials decrease flood occurrence in the basin.

Keywords: Geology, Flood occurrence, GIS, erodibility of geological materials, Joneghan drainage basin.

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Economic Valuation of Soil Fertility Protection in Reclaimed Rangeland Ecosystems of Arid lands (Case Study: International Project of Carbon Sequestration in South Khorasan Province)

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Abstract

Soil conservation and its control against erosion are known as the most important environmental functions of rangelands. Therefore, recently environmental economists and agriculture researchers and also economic development planners pay attention to evaluation of costs of soil erosion. The purpose of this study was applying nutrient replacement method to determine economic value of preserving soil fertility in rehabilitated rangelands through Carbon Sequestration International Project (CSP) in Hosseinabad-e- Qinab, South Khorasan during 2009 – 2014. For this purpose, firstly the figures for soil erosion and protected soil nutrient elements (NPK) were extracted by monitoring and via evaluation reports of the CSP for 2009 – 2013. Also, for determination of same information for 2014, the IRIFR method was used for wind erosion. In order to measure soil nutrient elements (NPK), samples from soil profiles were taken. Then sieved soils were carried to soil lab for NPK measurement. The amount of protected soil for each year was determined by subtracting the amount of eroded soil between two areas of rehabilitated and control and determined the conserved NPK amounts. Then by evaluating the costs for substituting the protected soil elements (NPK) with chemical fertilizer application, the economic value of protected nutrient was estimated. The result showed that economic value of soil fertility protection function in study area estimated to be 1.94 billion Rials in 2014. Thus, economic value of one hectare of rangeland in this area based on this function after project implementation will be 367244.5. If the cost of labor force for fertilization and rebuilding the damage caused by soil erosion are as well considered, rangeland value in terms of preserving soil fertility and reducing erosion will be proved more effectively.

Keywords: Soil fertility, Nutrient replacement method, International project of carbon sequestration, South Khorasan province.

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Numerical Analysis of Applying Quantitative and Qualitative Scenarios on Khezel Aquifer in Hamedan Province with MODFLOW & MT3DMS Models

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Abstract

Increased exploitation of groundwater besides recent periods of drought caused a negative balance in Khezel aquifer located in Hamedan province, Iran. From 2000 to 2010, groundwater surface drop was estimated 5.8 meters. With regard to high potential of GMS in using GIS and careful stratification of the aquifer, GMS was used in present study to investigate and predict the groundwater table fluctuations in Khezel aquifer. Thus, Quantitative modeling was performed using MODFLOW model. The model was calibrated (using trial and error method) in two conditions: steady state (in september 2009) and transient state (from October 2009 to July 2010). Also, the quantitative model validated for August 2010. The impact of groundwater artificial recharge (within 31 injection wells for 5 months from October to March) was evaluated by calibrated model. Results showed maximum rise of water level was 19 cm in April. Next, in the same flow simulation stress periods, qualitative modeling was carried out by MT3DMS model. Optimum values of longitudinal dispersion and distribution coefficient were achieved by trial and error method and the qualitative model was calibrated. Statistical results of qualitative modeling are as follow: $R^2=0.98$, slope of regression line ($y=1.0079x$), mean error (ME=4.56 ppm) and RMSE=3.36%. Finally, dispersion of point source pollution (leaching pit) was investigated as a scenario. The result indicated that the radius of influence of leaching pits varies from 150 to 200 m in different areas.

Key words: Groundwater, Quantitative and Qualitative Simulation, MODFLOW, MT3DMS.

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Investigation of the Effects of Different Land Uses on Some Chemical Properties of Soil in Jamalabad Region of Baft County

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Abstract

This research was done to investigate the effects of change in land use on chemical soil properties in Jamalabad region of Baft county of Kerman province. The experiment was conducted in six sites with the same ecological condition as non grazed site (NG) for 10 years, a moderately grazed site (MG) and a heavily grazed site (HG), a dry farming site of barley and wheat (D), a long time fallow site for 5 years (F) and a plowed *Glycyrrhiza glabra* site (GI T). Soil samples were collected from two soil horizons (0-15 and 15-30 centimeters) based on a randomized complete blocked design with six replications from each horizon in 2013. Samples were sent to laboratory for soil chemical properties as organic carbon, total nitrogen, available phosphorus, available potassium, PH and electrical conductivity. The results indicated that Land use change significantly decreased organic carbon, potassium content, available phosphorous and nitrogen content as 58.2, 21, 23.5 and 71 percent in dry farming site and 58, 17.3, 19 and 60 percent in plowed *Glycyrrhiza glabra* site compared to non grazed site. A decreasing trend of organic carbon was seen in moderately and heavily grazed sites in comparison to non grazed site as 42 and 56 percent, respectively. Available potassium of moderately and non grazed sites were maximum. Total nitrogen of soil in moderately and heavily grazed sites was decreased in comparison to non grazed site as 0.035 and 0.04 percent. PH of soil was significantly changed only between non grazed and plowed *Glycyrrhiza glabra* site (GI T). Electrical conductivity of soil was increased in dry farming site (165 percent) and heavily grazed site (140 percent) in comparison to non grazed site. According to negative effects of land use change on soil quality and remaining this harmful effect after release of dry farming lands, our recommendation to natural resources offices are programs preventing rangeland occupying, minimizing giving off rangelands, rehabilitation of released dry farming by pioneer plants and improvement of soil qualities in root collection designs of *Glycyrrhiza glabra*.

Key words: Kerman province, Chemical properties, Soil, Land use.

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Monitoring and Zoning Metrological Drought Characteristics Using Markov Chain and Geo-statistical Methods (Case Study: Qazvin Province)

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Abstract

When the rainfall in each period of time is less than its long-term one, meteorological drought happens. Usually related indicators are used after the event but effective drought management demands indices to be specified before the hazard. In this research, Standard Precipitation Index (SPI) is used for monitoring draught in precipitation stations within the province for a- 37- year period (1971-2008) using 1, 3, 6, 9, 12, 24 and 48 monthly temporal scale. Using Markov Chain and four interpolation methods, draught characteristics in Qazvin province were examined and monitored. The results revealed that as temporal scale increases, positive and negative frequency decrease and intensity goes up. Transition matrixes illustrated that dominant status in each scale is approximately normal. According to the amounts of return period in some gauges, the lowest period is for approximately normal, mildly humid and mildly dry, respectively. Variogram amounts demonstrated that outstanding models for 1, 6, 9, 12 and 24 are Gaussian and Exponential for 3 and 48 monthly scales. Finally, the best interpolation for each scale is determined based on evaluation indices in order to create extent maps of drought for 2007-2008. It was found out that as temporal scale increases, drought extent and status from East to West of the study area decreases.

Keywords: MONITORING, ZONING, METROLOGICAL drought, MARKOV chain, Geo-statistical method, Qazvin.

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