Evaluation of Land Surface Temperature and Snow Cover Ratio by Using Remote Sensing Data (Case Study: Kasilian Watershed)

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Abstract

Land Surface Temperature (LST) affects snowpack spatiotemporal changes as one of the crucial components of water balance. Despite the ease of access to Remote Sensing (RS) data, such as Moderate Resolution Imaging Spectroradiometer (MODIS), products that are used for monitoring and evaluating LST effect on snow cover area SCA are sometimes not available for some reason. In order to overcome such a limitation, the monthly average values of SCA and LST in each 8 days for 13 years (2003-2016) were evaluated by regression relations. The results showed, minimum and maximum values of annual mean of snow covered area percent that occurred in 20009 and 2011 as being equal to 5.86%, 20.32, respectively. In addition, the annual mean of minimum and maximum values of LST related to 2004 and 2010 were 17.65 and 21.1 ^{0}C, respectively. The pattern of two variables changes illustrated that the SCA changes to LST are reverse and gradually increasing during the study period. Also, the results revealed that in power regression, the Nash-Sutcliff Efficiency (NSE) coefficient for SCA percent simulation, R^2, RMSE and Bias, are 0.6, 0.64, 9.88 and -2.14, respectively. These coefficients are 0.16%, 47%, 14.37% and 86.32% in linear regression method, respectively. Thus, this study may be helpful to estimate SCA and reconstruct missing data in satellite images.

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Evaluation of Evapotranspiration Using Satellite Images and SEBAL Algorithm (Case Study: Eastern Azerbaijan Province)

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Abstract

Evaluation of evapotranspiration is one way to prevent water loss and to manage water resources. Therefore, in this study, an attempt has been made to calculate the actual evapotranspiration rate in the east of East Azerbaijan province using the SEBAL algorithm. For this purpose, first, based on two Landsat 8 satellite images dated 2017/08/22 and 2017/08/09, the values of Net radiation, soil heat flux, and sensible heat flux are estimated. Then, based on the difference, the amount of instantaneous heat flux was calculated and a 24-hour evapotranspiration was obtained for each image. Finally, the amount was compared with the values obtained from the Penman-Monteith method. Also, for processing and analyzing images ENVI4.8 software was used. The results indicated that the amount of evapotranspiration in the Penman-Monteith and SEBAL method on 2017/08/22 was about 6.15 and 7 mm per day, and on 2018/08/09, respectively, about 7.38 for Penman-Monty and 7.94 mm per day for SEBAL. Overall, the amounts of SEBAL actual evapotranspiration and Penman-Monteith potential evapotranspiration have a mean absolute difference (MAD) 0.705 mm per day which indicates that the estimated values are consistent with the SEBAL algorithm and the Penman-Monteith method.

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Evaluation of River Self - Purification Behavior Using One - Dimensional Numerical Modeling

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Abstract

Due to the growth of surface water pollution, this study intends to evaluate the behavior of self-purification and pollution removal in rivers by using numerical modeling. In this research, using data and information provided by water sampling in the Kardeh River, in Mashhad as a source for supplying drinking water in Mashhad city, we have investigated the river quality monitoring processes using the MIKE11 numerical software. In this model, boundary conditions include discharge, pollution (Ecoli) and water level, which has been done through field measurements. Measurements were performed in two time periods, one in April 2014 (indicating the high water season of the year) and the other in August 2014 (indicating the low water season of the year) by taking 12 samples of Kardeh river. The resulted outcomes of this research show that Manning roughness coefficient with the help of hydraulic model calibration in the study period is 0.058 and the river decay coefficient for Ecoli parameter in the warm season with a diffusion factor of 20 and diffusion coefficient of 0.5 is 0.08 and in the cold season with a diffusion factor of 5 and diffusion coefficient of 2 equals to 0.207. According to the results, the effect of Manning coefficient in estimating pollution is 90% and the share of other parameters is 10% in total. In order to calibrate the model, sensitivity analysis was used, which concludes from the above sensitivity analysis that the Manning coefficient has a great effect on modeling the spread and transmission of contamination.

Keywords: deterioration factor, Kardeh River, MIKE11 Model, pollution prediction, Self-purification factor.

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Investigating the Role of Water Yield Ecosystem Service in WA + Resource Base Sheet (Case of Urmia Lake Basin)

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Abstract

Water yield is one of the most important hydrological ecosystem services. It directly affects the sustainable development of socio-economic systems. This study aims to quantify the ecosystem water yield and compare it with the water resource base sheet in water accounting Plus (WA +) in the Lake Urmia basin. First, the resources base sheet from WA + framework was estimated for the study area using hydrological data and remote sensing data in 2015. In the next step, in order to quantify the water yield in the same year, the water yield model was used in InVest software. Water yield input data include land use/cover, precipitation, average annual reference evapotranspiration, root restricting layer depth, plant available water content, sub-basin and basin layers and biophysical data. The amount of water yield (m^3) in the basin and sub-basin was obtained through running the water yield model in InVest 3.5.0. The results showed that the amount of water inflows in the Urmia Lake basin in WA + in 2015 is equal to 16 Km^3, of which 7 Km^3 was the share of ecosystem service of water yield in this basin. Therefore, the land use/cover plays an important role in supplying water resources by producing more than 43% of the volume of water inflows in the basin. In conclusion, quantifying the ecosystems water yield can lead to better planning in water resources management as well as preserving ecosystem values. The results of the water yield model and the WA + resources base sheet can be used in integrated water resources management and planning for equitable water allocation.

Keywords: Water Yield, InVest, WA+, Watershed Services.

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Storage Volume and Exploitation Changes of Aquifers in the Eastern Plains of the Kurdistan Province

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Abstract

In the past, exploitation from aquifers was limited due to lack of modern technology. During past three decades, the methods of aquifer discharge have changed gradually so that using modern exploitation systems such as deep and semi-deep wells is very common. Using these kinds of wells, water discharge from aquifers has dramatically increased and the charging level has not been taken into account and, as a result, the groundwater level has been decreasing. In this study, the exploitation status, the storage volume changes as well as the changes of the storage volume of forbidden aquifers such as Qorveh, Dehgolan and Chahardoli were analyzed during the 2017-2018 water year. Accordingly, saturation thickness, with the same depth level and direction maps of groundwater flow in the aquifers were prepared using ArcGIS and then the effects level of each well was calculated through polygon Thiessen. Pysometric heights of the aquifers for different years were calculated by weighted average and unit hydrograph diagrams were drawn for each. Analyzing unit hydrograph diagrams of eastern plains of the province during a 31-year period (1987-2018) indicated that the ground water level has a decreasing trend. The calculation of ground water balance of the aquifers indicated that the cumulative deficits for Qorveh, Dehgolan and Chahardoli aquifers were 2, 17.4 and 2.98 MCM respectively, so the balance is negative. Generally, exploitation is forbidden in eastern plains in Kurdistan and much efforts should be done specifically by farmers. Nonetheless, the storage has encountered cumulative deficit by 22.2 mcm.

Keywords: storage volume deficit, groundwater table, unit hydrograph, aquifer.

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Investigating the ability of Dyna-CLUE Model in Analyzing and Predicting Future Land Use Patterns in Simineh River Basin

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Abstract

Land use changes are the result of complex interactions between many processes. Many models have been developed in recent decades to understand these dynamics. The present study, using Landsat satellite images and applying the maximum probability classification algorithm, examined the land use pattern of Simine River basin in 2000, 2005, 2010 and 2017 and identifies the historical transformations of them. Finally, the various scenarios of land use change in 2040 are examined using the latest version of the Dyna-CLUE land use model. The results of modeling indicate Dyna-CLUE model performance in analyzing and predicting future land use patterns at the basin level and its calibration and validation coefficients in 2005 and 2010 are 0.84 and 0.69, respectively. Analysis of land use changes between 2000 and 2017 has shown that the most important change was the conversion of rangeland lands to irrigated lands so that about 343 square kilometers of rangeland lands (equivalent to 13%) decreased and irrigated agricultural lands increased by about 127%. Also, the spatial arrangement of land use classes in 2040 in the form of three optimistic, pessimistic and the continuation of the previous trend scenarios and its outputs have shown that the future pattern of most land use classes in the region has not changed much compared to historical spatial patterns and shows a marginal spatial expansion. The results of this study can be used as an effective tool for environmental planners to manage the future infrastructure of the Simine River basin.

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Efficiency Evaluation of the VIKOR, L-THIA, and Artificial Neural Network (ANT) Models in Flood Zone Analysis (Case Study: Khorasan Razavi Province)

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Abstract

Considering the natural conditions of Iran, not paying attention to floods can cause irreparable damages, among which flood estimation and zoning of floodplain areas are very significant in controlling hazards, so zoning of climate change is necessary. The present study aims to investigate the risk of floods in selected basins of Khorasan Razavi using the VIKOR, L-THIA, and ANT models. Then, fourteen variables affecting the occurrence of floods including climate, land use, altitude, drainage density, geomorphological units, lithology, run-off height, permeability, slope and direction, distance to rivers/waterways, precipitation, temperature, and soil were used. The results showed that among the mentioned variables, climate parameters, land use, slope, drainage density, distance to rivers/waterways, precipitation, soil, and geomorphological units have greater effects on the occurrence of floods according to statistical calculations. Quantitative and qualitative evaluation of the results using various statistics showed that the L-THIA model, with a $\gamma=0.8$, had the highest correlation with the primary layers and was more accurate and efficient than the two VIKOR and ANT models in flood prediction.

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Application of Satellite Data for Determining Environmental Water Requirement of Wetlands in Data-sparse Regions (The Case of Kanibrazan Wetland, Iran)

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Abstract

Determining and supplying environmental water requirements (EWRs) of ecosystems including wetlands is one of the most effective ways to mitigate wetlands degradation and to ensure the provision of ecosystem services. This study aims at determining EWR of the Kanibrazan International wetland, south of Lake Urmia, using a combined hydro-ecological approach. The wetland's water and vegetation areas were extracted using long-term satellite data. Moreover, frequency analysis of the inundated areas, investigation of the vegetation life cycle, and estimation of evapotranspiration (ET) from the wetland were conducted. Subsequently, through multi-season field surveys from summer 2015 to fall 2016, the wetland's hydrography and spatial distribution of vegetation and birds' habitat in the wetland were obtained. Then, indicator vegetation and winter bird species were identified and used to determine appropriate inundation areas and volumes. Finally, satellite-derived inundated areas and ETs were used in an inverse water balance model to calculate the associated inflow regime to the wetland. Results show that in a normal year an annual volume of 16.5 MCM, with a tow-peak hydrograph in mid-fall and late spring is required to be supplied as EWR of the Kanibrazan wetland. The findings of this study can be applied in the planning of the surface and groundwater water resources feeding wetland and to better manage wetland's water quality.

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Locating Suitable Sites for Relief Camps during Severe Floods Using GIS (Case Study: Chaharmahal and Bakhtiari Province)

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Abstract

Natural crises are unavoidable, but the damage to the financial and human sectors can be greatly reduced by relying on engineering techniques and scientific innovations. Many parts of Iran are among the accident-prone areas in the world that need special attention before crises. Chaharmahal Bakhtiari province is one of these areas due to its geographical location and special climatic conditions, which makes the location of emergency accommodation for floods in this province important. In the present study, a method based on compiling a researcher-made questionnaire and reviewing library documents and statistical models has been used. Therefore, using Analytic Hierarchy Process (AHP) method, safe places during floods are identified and the existing criteria and sub-criteria are prepared. Then using the fuzzy-hierarchical statistical information (FAHP), the values of each criterion and sub-criteria and the final weight were calculated, and the relevant drawings were prepared and compiled in the GIS environment to display them as best as possible. The results showed that Shahrekord has the lowest level of risk among the cities of the province and the north and northeast of Borujen, Ardal and the central and southern parts of Koohrang and the northern parts of Lordegan have more safety than the northern parts of the city, respectively.

Keywords: GIS, AHP, Crisis Management, Emergency Housing, Flood.

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Modeling of Precipitation – runoff for Predicting Upcoming Flow Streams in Halilroud Basin

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Abstract
Climate change has an impact on discharge in rivers by changing the temperature and precipitation. Iran is much more vulnerable to climate change compared to other countries because of its limited water sources and heterogeneous distribution. The simulation of run-off plays a significant role in some environmental and engineering issues. The purpose of this study was to evaluate the impacts of climate change on run-off in the Halilroud basin in Kerman province using the IHACRES model in two time periods (2020-2050, 2070-2100). In this respect, daily data such as rainfall, temperature from 1995 to 2017 were collected. Then, the outputs of the CanESM2 model, which is a general circulation model (GCM) under two middle emission scenarios (RCP4.5) and pessimistic scenario (RCP8.5) using the SDSM model were downscaled. The average temperature in the stations in the present and next periods decreased by 5.6 and 4.6 percent, respectively. The stations' precipitation increased by 42.5 percent and in the next period by 40 percent compared to the observation period (1989 - 2017). The predicted values of temperature and precipitation were entered into the IHACRES model by the SDSM climate model, and then, the discharge changes were expected in two periods of time. The average monthly discharge shows an increase in the warmest months of the year in both stations (Kenaruyeh, Cheshmeh Arous). The results indicated that reducing the temperature and the rise of precipitation in warm months of the year led to increased run-off and the intensity of flood events in the studied area.

Keywords: SDSM, IHACRES, Climate Change, CanESM2, RCP Scenarios.

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Evaluation of Water Requirement of *Fraxinus rotundifolia* Mill and *Morus alba* under Different Water Stresses in Arid Region (Case Studty: Robat Karim City)

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Abstract

In arid and semi-arid regions that are affected by drought, maintaining and developing vegetation and green space are faced with serious challenge of the dearth of water. The purpose of this study is to compare the water requirement of *Fraxinus rotundifolia* Mill and *Morus alba* as common species in Robat Karim, located in the southwest of the Tehran province. This research was carried out in greenhouse and in the field and saplings of two tree species planted in a completely randomized design in the field and inside the pots. This research has two stages and each stage consists of several phases. The results showed that in *Fraxinus rotundifolia* Mill and *Morus alba* species, the fastest time to reach the MAD point respectively was 4 days (from 6 to 9 July), and 4 days (from 6 to 9 July, 10 to 13 July and 29 July to 1 August) in the greenhouse, and the fastest time to reach the MAD point respectively was 7 days (from 9 to 15 July and 9 to 15 August) and 9 days (from 12 to 20 June, 1 to 9 July and 2 to 10 September). The highest moisture consumption of *Fraxinus rotundifolia* Mill saplings used in the greenhouse and during different months on 11 to 12 July is equal to 19.3% by volumetric water content; 15.6% weight water content or 38.6 mm while the highest moisture consumption is used for *Morus alba* saplings in the greenhouse and during different months on July 6 to 7, equal to 12.8% by volumetric water content. The weight of water content was 9.83% or 32 mm. The highest moisture consumption used by *Fraxinus rotundifolia* Mill saplings in the field and during different months on July 1 to 2 was equal to 6.2% by volumetric water content or 4.3% by weight water content while the highest moisture consumption used by male *Morus alba* saplings in the field and during different months on 18 to 19 August was equal to 3.75% by volumetric water content or 2.7% by weight water content. Generally, the results of this study showed that *Fraxinus rotundifolia* Mill and *Morus alba* are classified according to the intensity of water requirement and irrigation frequency from high to low in the field and greenhouse.

Keywords: Ash and Mulberry, Evapotranspiration, Irrigation Cycle, Management Allowable Deplation, Water Stress.

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Simulation of Parameters Affecting the River Flow Trend using the IHACRES Rainfall-runoff Model in Future Periods (Case Study: Zolachai River)

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Abstract

Considering the importance of the effects of climate change on water resources, it is useful and necessary to study the behavior of the river, especially its discharge in future periods, to manage water resources and provide solutions to adapt to the phenomenon of climate change. The purpose of this study is to investigate the effect of climate change on the discharge of the Zolachai River in West Azerbaijan Province. For this purpose, using the LARS-WG model, the precipitation and temperature values of the Upper Chehriq meteorological station under different scenarios from 2021 to 2080 were predicted. Then, based on the microscale data of future precipitation and temperature, the volume of run-off output of the basin in future periods was simulated using the IHACRES rainfall-runoff model. The results of run-off forecast during future climatic periods showed that the average long-term annual run-off changes during the period 2080-2021 at the rate of 1.12 cubic meters per second (33.34%) under the RCP2.6 scenarios, 1.17 cubic meters per second (0.67 33%) under the RCP4.5 scenario and 1.37 cubic meters per second (39.42%) under the RCP8.5 scenario compared to the base period.

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Evaluation of Snow Cover Changes Trend Using GEE and TFPW-MK Test (Case Study: Marber Basin- Isfahan)

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Abstract

Studying and evaluating changes in snow cover, as one of the most significant sources of water supply is very important. Due to the conditions of inaccessible mountainous areas, it is not possible to make permanent ground measurements to estimate snowfall resources and form a database. Therefore, the use of satellite imagery in identifying snow-covered areas and evaluating its changes is very important and necessary. In this study, satellite imagery of MODIS sensor in Marber Basin located in the south of Isfahan province for the 20-year period from 2000 to 2019 was used. It is noteworthy that in this study, the Google Earth Engine system, or GEE, was used, which is a new and very useful system. In the present study, more than 7000 images of daily snow cover were used, which are available in GEE in the shortest time. TFPW-MK test was used to evaluate the trend of snow cover changes. In this study, in addition to programming and calling images and extracting snow cover values in the engine system and process analysis by performing TFPW-MK test, ArcGIS10.5 software was also used in preparing the outputs. The results showed that the trend of changes in snow cover levels during the mentioned 20-year period has been decreasing, so that from about 120 square kilometers to less than 60 square kilometers in 2018, according to the percentage of trust (p-column in The TFPW method has a significant negative trend at the level of 5% in January and August and a significant negative trend at the level of 10% in June. The annual trend was also examined by TFPW test and shows a significant negative trend at the level of 5%.

Keywords: Snow, Marber Basin, MODIS, GEE, TFPW-MK.

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Prediction of Monthly Potential Evapotranspiration under RCP Scenarios in Future Periods (Case Study: Golpayegan Basin)

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Abstract

Evapotranspiration is the transfer of energy between the Earth's surface and the atmosphere and it is the most productive mechanism of communication between the hydrosphere, lithosphere and biosphere. This study focuses on predicting potential evapotranspiration in Golpayegan basin as a response to climate change. For this purpose, six algorithms including Hargreaves-Samani, Thornthwaite, Romanenko, Oudin, Kharrufa and Blaney-Criddle and also, Penman- Monteith- FAO as a standard algorithm, were used for estimating the potential evapotranspiration. The results showed that the Hargreaves-Samani algorithm performed closer to the Penman-Monteith-FAO standard algorithm compared to other algorithms. Therefore, this algorithm was used to evaluate the potential impact of climate change in future periods on the rate of potential evapotranspiration. After that, the amount of potential evapotranspiration using general circulation models (GCM) was estimated under RCP scenarios 2.6,4.5,8.5 for near, middle and far periods of 2021-2040, 2041-2060 and 2061-2080 by the LARS-WG6 model using the HadGEM2-ES climatic model. Finally, the predicted evapotranspiration values in future periods were compared with the evapotranspiration results in the baseline period of 1992-2017 to investigate the impact of climate change on potential evapotranspiration. The results showed an increase in potential evapotranspiration under all RCP scenarios in future periods. Increase under scenarios of RCP2.6, RCP4.5 and RCP8.5 in the near future were obtained 6.31, 7.5 and 7.10 percent, In the middle future period, 9.69, 9.84 and 11.82 percent and in the distant future period, 8.17, 13.79 and 18.15 percent, respectively.

Keywords: Climate change, Potential evapotranspiration, Hargreaves- Samani, Golpayegan basin.

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The Impressibility of Flood Regime from Rainfall and Land Use Changes in Cheshmeh Kileh Watershed

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Abstract

Assessing the impact of changes in rainfall and land use on flood is a key issue in watershed management. However, their simultaneous effect has received less attention. The aim of this study was to investigate the impressibility of flood from rainfall regime and land uses in Cheshmeh Kileh Tonekabon watershed. For the present study, data from five rain gauge stations in the region and Haratbar hydrometric station were used. First, the land use map of 1984, 2001 and 2017 was prepared using a Random Forest algorithm in the Google Earth Engine. Then, rainfall and discharge components were used to investigate the impressibility of flood on the rainfall regime. In order to quantitatively estimate the minimum and maximum flood indices and Flow Duration Curve, IHA 7.1 software and EFC approach were used. Investigating the effect of rainfall regime variables on flood showed that there is no significant trend in precipitation data in the statistical period. On the other hand, the area of forest lands in 2017 compared to 1984 decreased by about 21.25%, but rangeland, agricultural and residential areas increased by 24.16, 315.00 and 225.47 percent, respectively. The percentage of difference between 1, 3, 7, 30 and 90 days' maximum indicators, rising rate and large flood in 2017 compared to 1984, was respectively showed 193.17, 156.02, 124.87, 77.22, 57.93, 197.22 and 207.66 percent increase, which indicates the impressibility of flood flow indicators from land use changes. From the results of the present study, it can be concluded that land use change has detrimental effects on the soil and water conservation as well as on the ecological and hydrological balance of the watershed.

Keywords: Eco-Hydrology, Soil and Water Conservation, Rainfall Regime, Flood Indices, Flood Management.

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Spatial Mapping of Northeast Bijar Plain Aquifer Quality Index and Comparison of Water Quality Using Different Methods

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Abstract

Considering the quality of drinking water has an important role in human health, so the quality of aquifers as the main source of drinking water supply should be analyzed. The purpose of this study is to investigate the quality of groundwater used for drinking in the northeast of Bijar plain with GQI index using ArcGIS software. Study area of Bijar plain aquifer is one of the aquifers in the Kurdistan province that provides a drinking water source in a part of Bijar city and more than 12 villages. Drinking water quality index used four methods GQI, GQI-GA, GQI-FL-GA and GQI-FG was prepared for this aquifer and then in order to validate and compare the results of the four methods of correlation coefficient (r) and root mean square Error (RMSE) were used. Based on the obtained results, GQI-FL-GA method with correlation coefficient of 0.89 and RMSE 0.01 showed the best results and GQI-FG method with correlation coefficient of 0.86 and RMSE 0.11 presented the weakest results. According to the water quality index method, 91.2 percent of the plain has suiteble good quality and the remaining 8.8 percent of the region, which is mostly the northeastern parts (plain output) has acceptable quality.

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Renewable Energy-driven Seawater Desalination: A Comprehensive Review

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Abstract

Population growth, urbanization, and industrialization have led to a significant increase in global freshwater demand. Desalination of available and abundant water resources is a feasible option to meet the potable and industrial water demand. Seawater desalination is an energy-intensive process, and 99% of installed desalination plants use fossil fuels as the main energy source. Fluctuating prices and depletion of this type of energy resources, as well as their destructive environmental effects due to emissions and greenhouse gases along with other strategic, political, economic, and social factors, have led to widespread attention to the integration of renewable energy as a driving force for desalination plants. This study provides a comprehensive review of the recent progress made in renewable energy-driven seawater desalination and focuses on the use of solar, nuclear, wind, geothermal, ocean, biomass energy, and hybrid renewable resources in desalination. Utilization of a hybrid system of two or more renewable energy sources along with storage devices are proposed as a reliable and promising solution to provide a sustainable energy supply for desalination. In our country, researchers and experts in this field are trying and researching.

Keywords: Seawater desalination, Freshwater, Renewable energy resources, Hybrid systems.

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Investigation of Important and Effective Factors in soil Erosion and Sedimentation of Shirin Darreh river Using Remote Sensing and GIS Approaches

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Abstract
The purpose of this study is to use and explain the application and importance of multi-time images (time repetition) of Landsat Satellites to highlight changes in the area (bed and shores) of Shirin Darreh River, as well as evaluating river geomorphology variations with respect to the extent of bed development. General and active river types and river deformation during the periods 1995 to 2019 was studied over five evaluation periods including 1995 to 2005 (first period), 2005 to 2010 (second period), 2010 to 2015 (third period). The period of 2015 to 2017 was considered as the fourth period and the period from 2017 to 2019 was recorded for the fifth period. Two empirical EPM and MPSIAC erosion and sedimentation models were employed for river variation prediction. EPM model was based on the principle of scoring two main variables including the intensity and extent of erosion and sedimentation was examined with respect to the erosion-susceptibility of the catchment. The MPSIAC model was used to determine the impact and role of 9 important and effective factors in soil erosion and sedimentation of the catchment, estimated sedimentation and erosion status were obtained. According to the results, it was found that Shirin Darreh catchment area has a total sedimentation of 831,340 cubic meters per year and sedimentation was equivalent to 217909.94 tons per year estimated by the EPM model, while a total value of 750.750 cubic meters per year sedimentation equivalent to 5/5. 658509 tons per year at a surface area with a sediment delivery rate of 38.02 was obtained by the MPSIAC model. Also, by validating the experimental models, it was found that the results of the MPSIAC model were more accurate than the EPM in the study area.

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Explaining Water Behavior in the Formation of Birjand Horticulture Based on Quantitative Modeling

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Abstract

Water is one of the main elements in the formation of gardens and the way of its presence and movement has a special system. In different types of Iranian gardens, water takes different forms. In this regard, the present study was conducted to explain the behavior of water in the formation of the Birjand horticultural system based on quantitative modeling. Method: The present study is applied in terms of its purpose and deductive in terms of the method used and its strategy. Therefore, the statistical population of the study consisted of 247 people, including members of committees and experts in the field of architecture, of which 150 members of committees and experts in the field of architecture were selected using Morgan and Georgian table as the sample size. Data collection tools were also researcher-made questionnaires. Data analysis was performed using Spss software version 25 and the KMO test. Results: The results of data analysis showed that not only water is important in the view of architects in the Birjand horticultural system, but also water (in terms of process, functional and environmental dimensions) can make the audience rise and mobilize psychological pleasure in the gardening system ($P < 0.05$). Conclusions and Suggestions: According to the obtained results, it is suggested that organizations such as a municipality, cultural heritage, and the like revive the identity of traditional and original Iranian architecture for the next generation in the design of urban parks, tourist complexes, and tourism, design of spatial elements and squares and use the spatial patterns obtained in this research along with other researches.

Keywords: Water Behavior, Birjand Gardening System, Quantitative Modeling of Gardening System.

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Determination of Flood Prone Areas with FR, SI and Shannon Models in Order to Reduce Flood Risks (Case Study: Kashkan Watershed)

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Abstract

The mapping of flood-prone areas for the purpose of storing run-off to supply the water needed for various purposes, as well as controlling flood damage, shows the importance and necessity of this issue in order to protect natural and human resources. The Lorestan province and especially the Kashkan basin, including: Selseleh, Delfan, Doreh, Khorramabad, Poldakhtar and Kuhdasht, are very flooded and have suffered flood damages many times and in April 2019 had the biggest flood of the last 200 years. In this research, an attempt has been made to map flood zonation in order to reduce flood hazards in Kashkan watershed using frequency ratio models, statistical index and Shannon entropy and also using ArcGIS based methods to improve the decision. Provide flood control and management in this area. For this purpose, the geographical location of 123 floodplains in the region were divided into two groups: calibration and validation. In the implementation of all three models, effective parameters in floods including: slope, slope direction, land curvature, geology, land use, soil science, topographic moisture index, precipitation, waterway density, distance from waterway and digital elevation model of the region were used. The ROC curve in SPSS software was also used to validate the model results. The highest accuracy for this region was assigned to Shannon entropy model (0.82, very good) and then the frequency ratio model and statistical index (0.78, good) were introduced as suitable for this region. The results show that Shannon entropy model shows a larger area of the basin under conditions of high flood risk potential (about 40% of the area in the flood risk category is high and very high) that most of the western areas as well as the central areas of the basin which are located in Kuhdasht, Khorramabad and Poldakhtar. Due to the fact that these areas were introduced to the Kashkan basin in recent studies with other methods, they were introduced as more prone.

Keywords: Flood map, FR model, Kashkan Basin, Shannon model, SI model.

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