Designing and Developing a Web-Based Decision Support System in Order to Improve Water Quantity and Quality in the Bonekooh Watershed

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Abstract

In this research, a web-based decision support system was designed and developed to improve water quantity and quality status in the Bonekooh watershed, Hable-rud River Basin, through introducing the characteristics of the watershed in a systemic manner and introducing possible solutions and choosing the best management practices. In this research, subsequent to identifying a set of management options, predicting the probable impacts of their implementation was achieved using hydrological, erosion, economic, social, and ecological models. MySQL environment was used to manage the data and generate the data base. Generating model base and multi criteria decision making analysis were done using PHP programing language. SAW and TOPSIS methods were used to prioritize the management options. In addition, HTML programing language was used to develop the graphical user interface. The developed system provides a brief introduction of the watershed characteristics in the form of the DPSIR systemic approach and then presents the problems structure and shows the cause and effect relations between the variables of the system in the form of a conceptual model. Then, a set of vegetation-based solutions and their spatial distribution are provided to the users. In the process of modeling the possible impacts of the proposed solutions and their different impacts are predicted and presented separately, considering all evaluation indices proportion. Finally, following assigning different weights to the evaluation indices by the users, results of prioritizing the management options are presented to the users using multi-criteria decision-making methods. In further studies, technical evaluations of features such as user-friendly graphical user interface, relationship of the components used in the proposed system, or concerns and priorities of users and the like can help to provide the final version of this system.

Keywords: Best Management Practices (BMPs), Multicriteria Decision Making (MCDM), Participatory management, the Hable-Rud River Basin.

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A Framework to Achieve a Shared Vision in the Collaborative-Strategic Management of Water (Case study: Kashafrood basin)

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Abstract

The shared vision is the main element of planning in the field of water management and the core of all the tasks of the actors. The vision of water management in Iran is to achieve sustainable development. But the lack of a clear framework for achieving sustainable development in the country's water management is significant. This can be achieved through collaborative-strategic planning. The present study, as a targeted action integrating internal and foreign trade, has provided a systematic framework for achieving a shared vision in collaborative-strategic management of water and has been implemented in Kashafrood basin. This framework is presented in three steps. In the first step, the actors of the basin are identified by Snowball method. then by using the Mind Map method their concerns were extracted and thereafter the basin vision was developed. In the second step, strategies for achieving the vision were identified by using the Freeman method and then the policy of achieving these strategies was developed. In the third step, a questionnaire was used to assess the capability of implementation and the impact of macro policies, and ultimately, executive policies were developed to achieve relevant macro policies. The results of this study led to the development of a common perspective on the 1420 horizon in the Kashafrood basin, in which this basin will have a sustainable balance in water resources and consumption. Under this vision, 19 strategies, 63 macro policies and 232 executive policies have been developed, 41% of which have a social nature. The evaluation of the implementation and effectiveness of policies reflects the high consensus among actors on the implementation and effectiveness of policies to achieve the shared vision of the Kashafrood basin.

Keywords: Strategy, Policy, Sustainable, Collaborate, Strategic Management, Kashafrood.

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Comparison of Seasonal Time Series, Bi-linear and Nonlinear Threshold (SETAR) Models in Forecasting the Monthly Inflow to Maroun Dam Reservoir

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Abstract

In the present research, the SARIMA seasonal time series, Holt-Winters, bi-linear (BL) and Self-Exciting Threshold Auto-Regressive (SETAR) models were used to predict the monthly inflow to the Maroun dam reservoir. To this end, the 34-year data of the Idanak hydrometric station located in Khuzestan province of Iran between the years 1982 and 2015 have been used. The logarithmic transformation was used to normalize the monthly discharge data of the Idanak hydrometric station. Also, differencing technique was used to eliminate the seasonal component of the monthly data. The independence test of the model residuals (Ljung-Box or porte-manteau), the autocorrelation and partial autocorrelation functions were used to check the validity (quality of fitting) of these models. Finally, SARIMA models (1.0.1) * (2.0.2) 12, BL (2.1.1.1) and SETAR (2; 7.3) were chosen as the best models with the minimum values of Akaike and Schwartz criteria. The results of the evaluation of fitted models showed that the BL model with the values of the coefficient of determination and root mean square error which are 0.81 and 14.80 m^3/s, respectively, has an acceptable accuracy to predict the monthly flow to the Maroun River. It was also found that by increasing the non-seasonal rank degree in SARIMA models, the model validity and performance are weakened to predict monthly flow. Also, the results showed that the Holt-Winters model with the values of the coefficient of determination and root mean square error which are 0.56 and 10 m^3/s, respectively, has the weakest performance to predict the monthly flow to the Maroun dam reservoir.

Keywords: monthly flow forecast, time series, Akaike criterion, Schwartz criterion, Maroon basin.

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Estimation of Transverse Dispersion Coefficient of Pollutant Transport in Rivers Using Evolutionary Computations

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Abstract

Surface water is taken into account as one of the most important water resources available to mankind, which is used for various purposes, such as drinking and agriculture. Recently, with the growing urban population, there are many problems associated with the pollution and quality of water resources. Therefore, recognizing and studying the process of mixing and conveying materials in rivers is one of the prominent activities in water resource management programs. In the process of mixing, after the longitudinal dispersion coefficient, the transverse dispersion coefficient is considered as the most effective parameter. According to the importance of dispersion and distribution of pollution in rivers, in order to estimate the transverse dispersion coefficient of pollutants in surface flows, MT and SVM using two Kernels including radial basis function (RBF) and polynomial (Poly) are applied. To achieve this aim, 187 dataset including flow depth (H), flow velocity (U), shear rate (U_*) and channel width (W) are used. The results of the evaluation criteria showed that the SVM-Poly model had higher accuracy (R = 0.992 = 0.92 OI =) compared to the SVM-RBF (R = 0.968 and O = 950) and MT (R = 0.966 and OI =0.946) in the training phase for D_T estimation. The D_T values obtained by proposed models were also evaluated for testing dataset. Based on the result, it was found that SVM-RBF had the best ability to estimate D_T with the lowest error (RMSE = 0.029). In addition, comparing the performance of intelligent methods with empirical relationships suggests that empirical relationships failed to show acceptable accuracy.

Keywords: Rivers, Pollution transport, Transverse dispersion coefficient, Support vector machine, Tree model.

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The Blue Water Footprint of Electricity Production from Hydropower Plants in Iran

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Abstract

Hydroelectric power plants are a global potential for electricity production. Common types of hydroelectric power plants use dams on rivers to store water in reservoirs. They consume water by evaporation from the reservoir surface. This is a major issue in hydrology and water resources, which results in the availability of water resources. In this regard, the concept of water footprint was used to calculate the water consumed in the process of generating electricity from these plants. In this study, to calculate the water footprint in electricity produced in hydropower plants of the country, data on the annual evaporation volume (m3) and annual electricity generation (m3/TJe) from 17 hydropower plants in Iran for the period of 2010 to 2017 is analyzed. The results showed that on average, the largest water footprint in electricity produced by Droudzan power plant was 287649 (m3 / TJe) and the lowest was related to Masjed Soleyman power plant, being equal to 405 m3 / TJe. The annual average water footprint in electricity production from Iranian hydropower plants was estimated at 3694.82 (m3 / TJe).

Keywords: water footprint, blue water, electricity, hydropower plants, Iran.

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Flood Survey of Golestan Province in 2018-2019 and Providing Solutions for Its Control and Management in the Future

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Abstract

Considering the occurrence of damaging flood in the Golestan province in 2018-2019, it is necessary to investigate and analyze the different dimensions of this flood. Therefore, a brief overview of recent floods in Iran was carried out and after the description of the specification of the Gorganroud basin, floods of the Golestan province were reviewed in the last two decades. After describing the reports of floods of 97-98 in the Golestan province, the reasons for the flood were reported according to reports considered by the experts. At the end, comprehensive solutions were made to the conditions of the country, especially Golestan province. Some strategies of the advanced countries in the field of flood management have also been described, which can help to improve our country in this field and in case of appropriate investment and attention. Establishment of an overarching comprehensive flood management system, more attention to watershed management, as well as consideration of the principles of the river bio-engineering, the strict implementation of the limit and the privacy of the bed, and, if necessary, reviewing the relevant laws in order to increase the relevant limits, designing the principles of intersecting structures, rehabilitating and restoring natural habitats and eliminating their aggression and uprising, restoring the pastures in the northern part of the Gorganroud River, considering its historical geography, are among the most essential measures and issues for the prevention and Improved management, precluding the natural transformation of catchment areas and non-systematic actions of instruments to better counteract this phenomenon.

Keywords: flood, flood damage, flood management, preventive measures.

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Comparison of Different Approaches to Seprating Human and Climatic Impacts on Run-off Changes in Basins

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Abstract

Climate variations and human activities are among the most important factors affecting water resources and they have played a major role in river flow changes over the past decades. Therefore, determining the contribution of each of these two factors to river flow changes can help to manage regional water resources in policy and development of consistent strategies. To determine the contribution of each of the human and climatic factors in river flow changes, there are different approaches, each of which have their own assumptions and uncertainties in determining the contribution of each of the factors. Accordingly, in this study, using three conventional approaches used to distinguish between human and climatic effects including data-driven modeling, statistical and analytical approaches, the contribution of human and climatic impacts to changes in run-off in the Karkheh dam basin and its four main sub-basins during the period 1980-2014 is estimated and the range of changes in results and the sensitivity and reliability of their outcomes have been analyzed. The results show that all three approaches are sensitive to the duration of the statistical period and the extreme events and demonstrate a high range of uncertainty in their results in terms of the contribution of human activities and climate fluctuations to reducing river flow. Thus, the contribution of human activities in reducing river flow, based on these three approaches across the basin, is between 60 to 83 percent, and the contribution of climate variations is between 17 to 40 percent.

Keywords: Climate variations, Human activities, artificial neural network, Climate elasticity, Karkheh basin.

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Exact Solution of Groundwater Flow Response in a Confined Aquifer to Variation in River Level

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Abstract

In this paper a mathematical model is developed to investigate the effects of tidal river fluctuations on the groundwater head of confined aquifer. To simulate the interaction between groundwater flow of the confined aquifer near tidal river in a unsteady flow, we used the separation method. This model is for simulating groundwater level and it requires estimation of hydrogeological parameters of transmissivity and storage coefficient. Two elements of falling and rising water levels have been studied in this paper. To verify the analytical solution of the model, GMS software Modflow is used and the results of the survey conducted comparing the effectiveness of analytical and numerical model solved by separation of variables and methods of proposed model for the hydraulic confined aquifer and river tidal is shown. Compared with an analytical solution based on a sinusoidal assumption and a numerical solution generated by MODFLOW, this solution provided better performance in groundwater-level prediction in a confined aquifer According to the investigation done, if the coefficient of transmissibility increases, water level rises. Evaluations of analytical solutions show that the effect of changes in levels of transmission capability between 1 and 2 km from the border tidal was remarkable. And with increased transmission capability, head of the underground water level also rises away from the border reduced and it creates a wave whit with lesser amplitude and needs more time to create it.

Keywords: Unsteady groundwater flow, Confined aquifer, Mathematical model, Method of separation of variables, River -aquifer interaction.

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Evaluation and Comparison of the Anomaly of Fluoride in Rock, Soil and Water Bodies in the Northern Axis of Zangmar River, North of West Azarbaijan, Northwest of Iran

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Abstract

Determination of fluoride distribution within the northern part of the Zangmar River is the main objective of this research. The bodies of water, soil and rocks of the area were sampled and analyzed to show the area with fluoride anomaly. For this purpose, 51 samples of water from wells, springs, qanats and surface waters and 101 samples from soil and rock were collected. The results of the study showed a different maximum value of fluoride in surface waters, wells, Springs, Qanats 5.22, 3.3, 2.54, 1.6 mg/L, respectively. Because of that, the most water resources which are being used for agriculture and drinking has been polluted by fluoride with concentrations in excess of the permissible level. Concentration of fluoride reduces from surface water to the springs, wells and qanats, respectively. This can be due to the effect of surface processes, such as surface rocks weathering which may release fluoride ion in water. According to result, metamorphic complexes, shale sediments, carbonate deposits of the upper Triassic and Colored Melanges with concentration less than 1 mg/L and Permian carbonates, sediments equivalent with Upper Red and Qom formation, basaltic complexes and modern sediments are associated with water bearing fluoride more than 1.5mg/L. Despite the important role of geological formations in increasing of fluoride in the waters, the fluoride transport from eastern of Turkey (near the Ararat volcano) by Sari Sou and Zangmar rivers is also considered as an important source.

Keywords: fluoride, water bodies, Zangmar River, northwest of Iran.

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Using Shuffled Frog-Leaping Algorithm (SFLA) And Geospatial Information System (GIS) To Help Optimally Operation of The Dam Reservoir (Case Study: Dorudzan Dam Reservoir)

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Abstract

Freshwater resources are limited in the world and long-term exploitation will cause aridity or drought. Iran is geographically located in the dry and semi-arid region of the world, with an average rainfall of about one-third the world average. In this regard, increased competition for water, the need for food for the growing population and the increase in aridity in many regions, require the use of management practices to prevent water crisis and the resulting impacts. On the other hand, the consequences of successive droughts have increased the importance of proper water resources management. Considering the momentous role of reservoirs in supplying water needs for different sectors of consumption, optimal utilization of them is one of the important solutions to the problems of water resources and the lack of appropriate distribution of time and space. In this research, a Shuffled Frog-Leaping Algorithm is proposed as a meta-heuristic method for solving optimization problems in water resource systems, and a Geospatial Information System is used to optimize the operation of the Dorudzan Dam reservoir. The combination of these two to solve the dam reservoir optimization problem was first carried out in the country in this paper. The result of the research in the area indicated that the algorithm is well able to optimize and allocate the reservoir water downstream in such a way that 99.9% of the need for the downstream of the Dorudzan dam during the studied period, was provided for. Also, the combination of this algorithm with the Geospatial Information System provides an opportunity for a more precise examination of optimization results.

Keywords: Dam Reservoir, Optimal Operation, Shuffled Frog-Leaping Algorithm, Geospatial Information System.

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Landslide Hazard Assessment and Zonation Using a Network Analysis (ANP) and the Fuzzy Logic Model (Case Study: Salavat Abad Basin Sanandaj)

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Abstract

Identifying areas susceptible to landslide through risk zoning is one of the most effective and necessary measures to reduce potential hazards and manage risks. Providing a landslide zoning map allows vulnerable areas to be identified and considered in environmental planning. The purpose of this study was to determine the landslide hazard zonation in Salavat Abad Basin of Sanandaj by providing information layers and effective factors on landslide hazard using fuzzy method and network analysis process (ANP). In order to zone the risk of landslide in Salavat Abad basin, slope, gradient, geology, land use, rainfall, distance from the river, distance from the fault, distance from the road were used for landslide risk zoning. The standard fuzzy layers are overlapped and organized in the GIS environment, and then the weight of effective factors is calculated by the ANP model and applied to the information layers for the GIS environment. By overlapping them, the landslide landslide zoning map in 5 floors is as follows: very sensitive, High, medium, low, and very low. The results of this assessment showed that the total area of the Salavat Abad Basin with an average risk area of 804.77 ha (32.18%). Among the eight factors surveyed, the incidence of landslide was the gradient with weight (0.224) and the geological criterion with weight (0.194), the highest weight, and the distance from the fault with weight (0.036), the criterion of distance from The river with weight (0.058) and precipitation with weight (0.056) had the lowest weight for zoning the risk of landslide. The greatest risk of landslide is towards the slopes of the south, south east and east. Also, slopes higher than 10% had the highest risk of landslide.

Keywords: Landslide, ANP, Salavat Abad Basin, Super Decision, zoning.

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Flood Reduction in Urban Basins Using LID- BMPs IN SWMM Model and Selecting The Best Option With AHP- TOPSIS (Case Study: Golestan Area in Semnan)

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Abstract

With the passage of time and progress of civilizations, access to sufficient and high-quality water resources in order to provide the needs of human societies, becomes ever more important. With increasing impenetrable surfaces in urban areas and its resulting flood hazards, the new prespective of management methods of LID- BMPS has been considered in order to use surface run-off, decreasing peak discharge and preventing floods in urban areas on developed or developing parts. In this research, the effect of correction of channel dimensions, reservoir design for flood control and provision of required water for the green area and the use of LID facilities including implementation 100% of permeable pavement for sidewalk areas and rain barrels in two conditions (using 100% of the surface of the roof) and (using 50% of the surface of the roof) on decreasing peak discharge and the volume of flooding 12 sub-basing in the study area of Golestan settlement in Semnan city was evaluated using SWMM model. Finally, by using AHP- TOPSIS methods, rain barrels (using 50% of the surface of the roof) with about 81% reduction of peak discharge flood for the return period of deasining 5 year and 78% reduction of peak discharge flood for the return period of designing 10 years have been allocated themselves the first and the last rank of correction of channel dimensions.

Keywords: LID- BMPS methods, Reduce flood, SWMM, AHP- TOPSIS.

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Assessment of Water Saving Efficiency Index in Iran/Iraq through Virtual Water Trade with Turkey

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Abstract

Importing of agricultural products can be one of the most effective strategies for saving water in Iran and Iraq. In this regard, the virtual water trade can be used to reduce the pressure on water resources in these countries. The Tigris and Euphrates in Turkey originate from the Diyarbakır and Elâzığ provinces. In this research, these provinces have been selected to investigate the virtual water trade between Turkey and Iran/ Iraq. The volume of virtual water trade has been studied by the flow of trade in goods from these provinces to Iran and Iraq over the 2015-2018 period. The water saving efficiency index showed that the water resources have been saved 3.2, 2.1, 3.1 and 2 in Iran and Iraq, respectively, by the imports of wheat and lentil from these provinces. On the other hand, the environmental problems have been created by the high water consumption for agriculture in this basin. Although the imports of products from Turkey to Iran and Iraq will cause saving water resources in these two countries, the commercial policies should be revised based on saving water in the whole of basin. The commercial policies and the effects of these crops' trade on the environment can be improved by the approach presented in this paper. In addition, the approach presented here can actuate to the formation of commercial policies based on saving of water resources through the virtual exchange of water in the world.

Keywords: Virtual water trade, Tigris and Euphrates, Water saving efficiency index.

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Challenges and Solutions for the Groundwater Governance in Yazd-Ardakan Plain using DPSIR

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Abstract

In this research, by using participatory approach, governance challenges have been evaluated from the perspective of influential and influenced actors in the Yazd-Ardakan plain. According to the water, food, energy nexus and considering interdependencies of these three sectors, in the first step, key players were identified. In the next step, according to the viewpoints of actors, the factors that led to excessive withdrawal of groundwater resources in each water, food and energy sector were identified as governance challenges. DPSIR framework was then used to assess the governance challenges specified by participatory approach. Eventually, the rules and infrastructure of the water, food, and energy sectors were evaluated. The results showed that in the water, food and energy, respectively, 11, 8, 2 challenges were identified which have led to pressure on groundwater resources. Finally, for the 21 identified challenges, 28 strategies for modifying groundwater governance were introduced that 11, 15 and 2 strategies related to water, food and energy sectors. The most important strategies identified in water, food and energy sectors are: improvement of legal structures for sealing of all unauthorized wells, establishment of formal water market, empowerment of actors, convergence of assessment criteria of water and food organizations, modification of planting plans and food market control, pricing of water and energy resources. The results of this study can help planners and policymakers to reform the laws and infrastructure for modifying groundwater governance and improving the status of aquifers.

Keywords: Aquifer, Actors, Water-Food-Energy Nexus, Governance, DPSIR.

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Choosing a Suitable Area for Wheat Production Through the Concept of Water Footprint and Social Decision-making Methods (Case study: Esfahan Province)

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Abstract

The use of water resources can be managed by examining the water footprint of agricultural products more precisely, as well as its long-term variations. The present study aims to determine the annual water footprint trend of wheat production in Esfahan province from 1982 to 2016. To investigate the trend of water footprint time series of wheat production, the Mann-Kendall Trend test, and Sen's slope estimator were applied. After ranking the cities in terms of the water footprint and water footprint trend using the Social Choice Rules (SCR), Esfahan province was identified as the best city for wheat cultivation. The results showed that the average total water footprint of wheat production in Esfahan province was 4122.73 m3/ton and according to Mann-Kendall statistics, there was an insignificant decreasing and increasing trend. According to the value of Sen's slope estimator, the range of this slope was 93 (m3 / ton) for the total water footprint. The results also indicated that the amount of water footprint indicator in producing a product was not an acceptable criterion to choose that area for cultivating that product. By using the trend of this indicator and decision-making methods, e.g., social choice rules, it is possible to identify the best region for cultivating each product, change the pattern of cultivation in its policy of work, preserve water resources, and increase productivity. In this study, Fereydun Shahr, a city in Esfahan province, was selected as the best place for wheat cultivation in terms of the water footprint.

Keywords: water footprint, Trend analysis, Mann-Kendall, Sen's slope estimator, Social Choice Rules, Esfahan.

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Assessment and Zoning of Flood Risk in Golestan National Park

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Abstract

Identifying the flood susceptible areas is a vital and substantial element of disaster management to control and mitigate injuries of the natural hazards. The purpose of this study was to identify the important variables in creating flood areas and to present the potential hazard of flood in Golestan National Park (GNP) using machine learning techniques including random forest (RF), boosted regression tree (BRT) and maximum entropy (ME) models. In order to achieve these purposes, firstly, factors were determined by reviewing the relevant sources, and the databases were created by sorting out these factors. Finally, Flood risk modeling was done using machine learning techniques and the accuracy assessment were determined using the ROC method and real data recorded in nature. The results of the models showed the importance of elevation, distance from the river and transit road, moisture and maximum temperature variables in the event of flood hazard. So that the results of the BRT showed role elevation variable to be 38.9%, mean temperature 19/2 %, Rainfall 13/6 % and distance from the rivers 13% and the results of ME showed role elevation, mean temperature and distance of road variables to be respectively 35.7, 22/4 and 13.8%. The results of the accuracy assessment models using 30% of the data that were not included in the modeling the ROC value showed BRT and RF model with 0.99 values, and the proper accuracy ME was with value of 0.89. The maps obtained from these models estimated 4,500 hectares of park area among the high risk areas.

Keywords: Flood Hazards, Maximum Entropy, Random Forest, Boosted Regression Tree, Crisis Management.

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Flood Survey of Khuzestan Province in 97-98 and Providing Solutions for its Control and Management in the Future

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Abstract

Considering the occurrence of a devastating flood this year in the Khuzestan province, it is important to study and rotate the various aspects of this flood. The flood was the result of severe, extensive and simultaneous rainfall in the basins, and it was predicted to be at least 10 days before the incident. The floods have caused extensive waterlogging of cities, villages, roads, railways and agricultural lands, and long-term damage to all sectors, including oil and energy, transportation and commerce, and industry and agriculture. After reviewing the different aspects of the floods, it was found that the main problem in the flood intensification was the lack confidence of the flood management authorities in the predictions and results of the simulations related to the floods and the use of all capacities of the reservoirs to control this phenomenon. So establishment of an overarching comprehensive flood management and control system, attention to watershed management and aquaculture, attention to the principles of bio-river engineering, establishing strict rules for compliance with the boundary of the river bed and, if necessary, reviewing the relevant law to increase the limits, principal review and design of intersecting structures, rehabilitation of watercourses and eliminating violations against them, getting enough information and comprehensive area identification, increasing the capacity of dams and preventing storage capacity reduction, more precise management and control of basins with multiple dams, embedding flood alert systems in flood plain areas and performing basic measures is one of the most urgent undertakings to prevent, improve and control this natural disaster.

Keywords: Flood, Flood damage, Flood Management, Preventive measures.

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The Zoning of Quality Parameters in the River Using Satellite Imagery for Aquaculture

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Abstract

In order to exploit the potential of surface water for aquaculture, the choice of suitable river reach with allowable water quality and pollutant concentrations was important, which has the least negative environmental impact. This study was performed to designate a river reach with a lower concentration of river pollutant parameters. Landsat satellite imagery was used to adapt the water quality and was analyzed with sampled water quality data over four time periods at 12 stations along the Beshar River in Kohgiluyeh and Boyer Ahmad Province. Correlation analysis between satellite imagery reflectance and pollutant concentrations were evaluated by two methods. In the first method, the correlation between the interpolated quality parameters along the river and the reflectance values was evaluated. In the second method, the correlation between the sampled qualitative parameters at the stations and the reflectance values at the same station was investigated. The results showed that different bands of satellite images are appropriate for evaluating each of the water quality parameters. Imagery bands that are suitable for water quality parameters were obtained as the thermal band for temperature, 5, 4, 4 and 2 for pH and nitrate, respectively, in hot and cold seasons, 3 for TDS and 3 or 5 for turbidity. The regression relationships were determined by two linear univariate and multivariate regression methods, and then by using them, water quality parameters along the river were estimated. Based on the results, the river areas that have good water quality were selected as fish breeding and aquaculture areas.

Keywords: Aquaculture, Remote Sensing, Beshar River, Water Quality Parameters Correlation.

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Groundwater Dating Using Radioisotopes of ^{3}H and ^{14}C in Kashan Plain Aquifer

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Abstract

Radioisotopes, as a new achievement in the environmental sciences, have found significant development in water resources management, especially in dating, aquifer recharge management, and the role of contaminants in water resources pollution. Due to the quantitative and qualitative critical condition of groundwater resources in Kashan plain, having accurate isotopic data from water resources can be effective in proper management of water resources in this region. In this paper, while presenting the groundwater sampling, preparation and analysis methods for measuring ^{3}H and ^{14}C, we have investigated the age of groundwater resources in Kashan plain. For this aim, 11 groundwater samples for tritium were analyzed by enrichment method and 3 samples for carbon-14 were analyzed. The results showed that the amount of tritium in the groundwater resources of Kashan plain is less than 0.08 TU which indicates that the water resources are old. Also, carbon-14 results showed that the age of groundwater resources in Kashan plain varies between 10,000 and 21,000 years. The results showed that by moving toward the northeast of the aquifer (aquifer's outlet), the age of the water resources decreased, which indicates that the paleo deep-waters were mixed with the freshwater waters. In general, by mowing from the southwest and west of the aquifer to northeast of the aquifer, groundwater age decreases.

Keywords: Radioactive Isotope, Tritium, Carbon-14, AMS, Kashan Aquifer.

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Water Resources Management of Qom Province by Using the Concept of Water Footprint

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Lack of adequate rainfall, lack of management and demand for water in arid and semi-arid regions such as Qom, and also management of water resourcesin the agricultural sector have all been difficult. According to the water balance received from the Qom regional water company, agriculture is challenged as the largest consumer of water. The purpose of this study was to use the concept of water footprint and virtual water trading in (2004-2014) to reduce pressure on water resources and better management. Due to the low irrigation systems, the white-water footprint was very high. Also, the blue water footprint calculated more than the green and gray water footprint. The white-water footprint in cotton estimated to be 5267 m^3/ton, that includes 48% of the total water footprint and the amount of blue water footprint in cotton calculated to be 46% of the total water footprint. After cotton, watermelon has the highest amount of white water footprint that is 64% of the total water footprint, and the amount of blue water footprint in this product was 32%. The amount of white-water footprint in barely, wheat, hay, onion, tomato, melon and corn, is respectively 55%, 49%, 48%, 51%, 46%, 54% and 37/5% of the total water footprint. Rainfall decreases the amount of green water footprint in Qom. The green water footprint in barelyand wheat was more than other products that represents the symmetry of the rainy season and cultivation, the green water footprint in barely 12% and in wheat was 11% of the total water footprint. The exports of Qom are from cotton and barely. The virtual water of cotton and barely which goes out from the Qom was 250.41 MCM and economic income of cotton and barely was 429 billion Rials. Wheat, onion, tomato, melon and watermelon imported to the Province and the Qom Province virtual water imports, amount to 683 MCM. Finally, to better understand the status of water resources, ability indicators were calculated. The low index of Qom is 33% and the intake intensity index was 30%.

Keywords: Blue Water, Green Water, Virtual Water Trading, Water Deficit Index.

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