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## **The causes of and management strategies for restoring rivers by using SWOT analysis (Case study: Gamasyab river)**

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(Received: April 30, 2015 - Accepted: June 15, 2015)

### **Abstract**

Lack of water and drying up of rivers, wetlands, lakes, etc. are mian issues currently the country and even the world is facing. In this context, it is necessary to investigate the reasons, effects and consequences of this phenomenon. In this study, we have tried to use the SWOT matrix to examine the reason of the drying river Gamasyab. In this regard, using the rating scale to the fundamental causes of the crisis was Gamasyab River based on weighted scores given by experts to be the most important strengths, weaknesses, opportunities and threats found. Investigation showed that the total internal factors evaluation matrix weighted rating strengths and weaknesses (3.02) from the mean value, which indicates that more companies and individuals in the management of the river and respond appropriately to internal factors of points it has used force against weaknesses. Also check matrix of external factors or environmental assessment showed that the total weighted scoring opportunities and threats (2.54) was lower than the mean value, which represents the companies and individuals involved in river management Gamasyab appropriate response to external factors Do not show weakness, and good use of the opportunities and deal with threats not yet well. With regard to the issues raised by the strengths, weaknesses, opportunities and threats to internal and external factors stated SO, WO, ST and WT Gamasyab river was proposed to solve the crisis at the end of the plot, or a variety of competitive strategy best proposals to solve the crisis and the proper management of the river was Gamasyab.

**Keywords:** Gamasyab river, management strategies, strengths and weaknesses points, SWOT matrix, water crisis.

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## **Landfill development in Rasht and its latex management in order to reduce Anzali Lagoon pollution**

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(Received: April 5, 2015 - Accepted: June 18, 2015)

### **Abstract**

Anzali lagoon is the most important aquatic ecosystems of northern Iran. This lagoon is very important in environmental and economic terms. Deforestation in the Anzali lagoon is the most important environmental concern for the researchers. One of the polluting factors of Anzali lagoon is entrance of the polluted river to the lagoon. By examining the landfill in Rasht, management process of the latex was investigated. Moreover, through improving the existing landfill, the amount of methane produced by the new landfill is studied. Latex from the landfill by creating new output will increase from 1.5% to 20%. In this case, groundwater pollution will be prevented. Due to the high amount of rainfall in the city of Rasht, latex discharge will be 120 cubic meters per day. Methane produced from landfill can be used to produce energy. In 2015, the amount of methane produced was more than  $10^5$  cubic meters per year. Assuming a constant amount of waste entering the landfill, methane production by 2050 will be  $1.4 \times 10^5$ . The amount of wastewater produced by the anaerobic digester is 210,000 cubic meters per day.

**Keywords:** Anzali lagoon, Rasht, Latex, landfill, LANDgem.

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## **Ecological monitoring and assessment of spatial-temporal changes in land cover with an emphasis on agricultural water consumption in Zayandeh Rood region**

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(Received: April 21, 2015 - Accepted: June 14, 2015)

### **Abstract**

Over the recent years, human activities have led to changes in land use and land cover, consequently, in the structure and function of ecosystems. Spatial-Temporal Change Detection of land use is important to understand the relationships and interactions between human and natural resources and to make appropriate decisions; given that the changes in land use and land cover occur in broad surfaces, therefore, remote sensing technology is a useful tool for evaluating these changes. This study aims to investigate trend change of land use and land cover around the Zayandeh Rood River, as well as to investigate the water demand for agricultural land use of remote sensing and GIS techniques. For this purpose, the OLI images in 1392 and ETM+ Landsat images of 1382, after correction and preprocessing required, land use /land cover map were produced using the hybrid classification, based on maximum likelihood image processing in 10 classes. The post-classification method was used to monitor changes over the period of 10 years. The results showed that over this period, in addition to the damage to the structure and the physical, social and ecological sustainability, more than 40 percent of the Gavkhooni wetland and Zayandeh Rood dried. A 19.2% increase was observed in the agricultural land in the western part of the study area when the amount of water consumption in the western part over the period 1382 -1392, was 52.59 and 60.22%, respectively. The central part ranked next, and the lowest water consumption for irrigation was shown to be in the eastern part. Salty lands have been developed during this period, more than 90%. Urban expansion has occurred over the period 1382 -1392 with an area of 552 hectares per year.

**Keywords:** ecological monitoring, landsat, remote sensing, water demand, Zayandeh Rood.

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## Water allocation in irrigation networks by using Decision Support System based on the Geospatial Information System (GIS) and Particle Swarm Optimization (PSO)

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(Received: February 2, 2015 - Accepted: June 3, 2015)

### Abstract

Limitation of water resources on the earth has caused water to become a valuable economic commodity. Accordingly, the agricultural sector, which according to studies has the largest wasted water, should be managed. Therefore, it is advisable to apply methods and programming models such as the decision support system along with the abilities of GIS for management of water resources. The simultaneous use and combination of these two modern systems will bring into existence integrated management and correct decision in the allocation and distribution of water. In the previous researches, the investigators studied water allocation management in its statistical and descriptive field. Therefore, in this study, using decision support system along with the capabilities of GIS, a strategy has been presented for correct allocation and proper and optimized use of water in agricultural lands on the spatiality basis. For this purpose, process of the temporal program of cultivation has been optimized primarily in irrigation networks by using Particle Swarm Optimization (PSO) algorithm. Then, descriptive data has been modeled in GIS and consequently, the procedures of performing spatial optimization algorithm and water allocation have been provided, automatically. The results of this study, after optimizing water allocation to the studied lands, indicates that the amount of water shortage has considerably reduced in the optimal allocation in comparison with the traditional and non-optimal allocation.

**Keywords:** Decision Support Systems (DSS), Geospatial Information Systems (GIS), Particle Swarm Algorithm (PSO), water allocation.

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## **A calculation of Geomorphologic Instantaneous Unit Hydrograph (GIUH) and Width-Function based Instantaneous Unit Hydrograph (WFIUH) in the ungauged watershed**

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(Received: February 5, 2015 - Accepted: May 24, 2015)

### **Abstract**

Unit hydrograph plays an important role in prediction of floods in the rivers, design protection and control structures in the catchment area. Therefore, in the basin without hydrometric stations, by using mathematical and empirical relationship and based on climatic data, the water level in the basin is estimated. Two methods including Geomorphologic Instantaneous Unit Hydrograph and Width Function Instantaneous Unit Hydrograph, due to use of the watershed physical characteristics and GIS software, estimate the instantaneous unit hydrograph in ungauged basin with reasonable accuracy. WFIUH method for allocating different flow rate in hillslope and the main canal basin is more consistent with reality. In this article, instantaneous unit hydrograph of Ghorveh basin with an area equal to 14/67 km in Kurdistan, using GIS and ArcHydro extension and PEM4PIT was extracted. The results of these two methods were compared and it was shown that concentration time was estimated approximately the same by each method, almost 4.6 hours. But WFIUH method by utilizing the flow rate proportional to slope, covers more details.

**Keywords:** Geomorphologic Instantaneous Unit Hydrograph (GIUH), Ghorveh basin, PEM4PIT, ungauged basins, Width Function Instantaneous Unit Hydrograph (WFIUH).

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## **Evaluation and comparison of geostatistical and fuzzy interpolation methods in estimation of groundwater arsenic (Case study: Khoy plain aquifer)**

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(Received: October 18, 2014 - Accepted: February 7, 2015)

### **Abstract**

Accurate analysis and interpolation of heavy metals, especially arsenic concentration in ground water can play a significant role in planning and continuous monitoring of water resources. The analysis may also prevent human health issues. The purpose of this paper was to evaluate newly published Sugeno type fuzzy inference system as an interpolation method for estimating the amount of arsenic in Khoy Aquifer. It is done by assessing inverse distance weighting (IDW), Kriging (simple, ordinary and universal), Cokriging and Sugeno type fuzzy inference system. The results after optimization of the influencing factors in the interpolation methods indicated that RMSE, due to the low density and odd arrangement of wells, for all of the interpolation methods is high. Among the methods that did not use the auxiliary data, soft computing and IDW, with 53ppb and 56ppb RMSE respectively, lays better estimation than Kriging methods. Chlorine (Cl), Sodium (Na) and Iron (Fe) were used as auxiliary data. These data further improved the accuracy of kriging and fuzzy methods by 46% and 51% than single univariate methods. The main cause of 19% improvement of the fuzzy method is attributed to its independence from normal distribution. The results showed that fuzzy Sugeno in the modeling of interpolation is more flexible and easier to execute (in terms of both user's knowledge and software development).

**Keywords:** arsenic, fuzzy sugeno, geostatistical, interpolation.

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## **Investigation of chaos and dynamical phase space reconstruction of precipitation in daily, weekly and monthly scales (Case study: Qarah-Soo Watershed in Kermanshah)**

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(Received: April 18, 2015 - Accepted: May 30, 2015)

### **Abstract**

In this research the chaocity of precipitation time series in daily, weekly and monthly scales in the Pole-Kohneh and Ghourbaghestan Stations located in Qarah-Soo watershed is investigated. In order to ensure the absence of stochastic behavior of the time series, surrogate data method is applied. Then, the aperiodicity of the time series is investigated using power spectrum analysis. The results of chaocity investigation indicates that according to correlation dimension method and Lyapunov exponent, the daily scale is not chaotic but weekly and monthly scales are chaotic (existence of the largest Lyapunov exponent and correlation dimension between 4 to 7). Also, the phase space reconstruction is done using time delay and embedding dimension method (embedding dimensions of 7 to 10 and time delay of 2 to 4 for Pole-Kohneh Station; embedding dimensions of 9 to 19 and time delay of 2 to 3 for Ghourbaghestan Station). Findings of the research indicate the stochasticity of short term precipitation time series (daily) and chaocity of medium term precipitation time series (weekly and monthly).

**Keywords:** chaos theory, correlation dimension, lyapunov exponent, Qara-soo watershed, precipitation time series.

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## Sub-basin prioritization using morphometric analysis and GIS for watershed management measures (Case study: Maraveh Tappeh watershed, Golestan)

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(Received: April 7, 2015 - Accepted: June 5, 2015)

### Abstract

Sub basin prioritization is one of the integrated watershed management and sustainable development strategies. Protection of natural resources through marking zones of potential damage in small areas is a primary need for sustainable development. Degradation potential zones project for watershed protection measures is not cost-effective economically. So this is a prerequisite for sub basin prioritization. Morphometric analysis has received great deal of attention, thanks to its low cost and productivity. So the present research aims to prioritize subbasins of Maraveh Tappeh basin in Golestan province using morphometric and GIS. In morphometric analysis, parameters including compression ratio, roundness factor, form factor, elongation factor, frequency, channels, drainage density, branching ratio, drainage texture, shape, area, length and duration of current flow are calculated through the ground and Arc Hydro ARCGIS. These parameters are divided into linear (directly related to erosion) and shape parameters (inversely related to erosion). Finally, each sub-basin was prioritized given total morphometric parameters and sub-basin C3 was found to be critical and C1 was much more suitable than others. Field studies illustrate that subbasin C3 has the highest erosion rate and poor soil condition (Hydrological group C). So such researches are low-cost and fast by which watersheds are prioritized to management measures.

**Keywords:** comprehensive management, Maraveh Tappeh watershed, morphometry, potential zone, prioritization.

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## Landslide hazard assessment using information value and LNRF models

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(Received: February 20, 2015 - Accepted: June 15, 2015)

### Abstract

The main purpose of this study is landslide Hazard assessment in the Ziarat watershed (Golestan province) using Information value and LNRF models within geographic information. At first stage, a landslide inventory map was prepared in the study area using earlier reports and aerial photographs, and a total of 50 landslides was mapped and out of which 35 (70%) were randomly selected for building landslide susceptibility model, while the remaining 15 (30%) were used for validating the model. In the second stage, fourteen data layers were used as landslide conditioning factors for Hazard mapping. These factors are slope percent and aspect, altitude, plan curvature, precipitation amount, lithology, land use, soil texture, distance from faults, distance from rivers, distance from roads, topographic wetness index (TWI) and stream power, CTI (Sediment Transport Index) and stream power index (SPI). Afterward, landslide Hazard zoning map was produced using information value and LNRF models. For verification, the receiver operating characteristic (ROC) curves were drawn and the areas under the curve (AUC) were calculated. The Verification results showed that the area under the curve for Information value and LNRF is equal to 98.2 and 80.4 % with standard errors of 0.018 and 0.08, respectively. So, the produced Hazard maps will be useful for general land use planning and hazard mitigation purpose. Thus, the landslide hazard mapping produced from this study will be useful to the planners and engineers to reorganize the areas which are susceptible for landslide hazard and they may evolve suitable remedial measures for Hazard reduction and management.

**Keywords:** information value, landslide hazard, LNRF, Ziarat.

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## **Role of geological structures and lithology in the quantitative and qualitative changes of Eshtehard Aquifers**

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(Received: May 22, 2015 - Accepted: June 19, 2015)

### **Abstract**

Eshtehard aquifers are Shoor River's catchment basin and water potential in different areas. Eshtehard aquifers, because of the diversity of geological formations and structures have different quality and quantity. This paper aims to determine the relationship between quantitative and qualitative characteristics of water resources with the lithology and structural geological features of the area. For this purpose, determining the scope of the area, a survey, identification and distribution analysis of geological formations and faults location was performed using available geological maps. Then, identifying the wells location using the results of water samples analysis, the maps of the concentration of chlorine, sulfate, calcium, magnesium, etc. were traced. Interpretation of the drawn map showed that the highest concentration of plains is in the northern half, and their change trend is from the North to the East and center, which is consistent with passion Shoor River. According to the results of water quality analysis, northern plain is of sodium chloride type; moreover, this region has moderate-very unpleasant drinking water while harmful and salty water for agriculture. According to the findings, salt in the northern part of Plain, along with the drop in water levels in the central of plain, have had a great impact on water quality of the region.

**Keywords:** Eshtehard, hydrology, lithology, salt zones, water source.

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