

Release of heavy metals after spiking and leaching from different sediment fractions

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Abstract

Measurement of availability and mobility of heavy metals in river sediments is required in order to understand the behavior of these metals and to prevent potential toxic hazards. Leaching column experiments were conducted for four sediment samples to determine the degree of mobility and the distribution of Zn, Cd, Ni, Cu, and Pb because of an application of spiked heavy metals in sediments. Sequential extraction results showed that in spiked sediments the major proportion of Zn, Ni and Cu were associated with residual fraction and major fractions of Cd was associated with exchangeable and mineral fractions and major fraction of Pb was associated with residual and mineral fractions. In sediment (1) distill water mobilized more Cd, Zn and Ni than Cu and Pb. In sediment (3) and (4) distill water mobilized more Pb and Cu than Cd, Zn and Ni. Therefore, Cu and Pb were least affected by the pore water pH volatility. The release of Pb and Cu were considerable from organic matter fraction in sediment (4). Based on relative percent in exchangeable fraction, the order of solubility was Cd > Ni = Zn > Pb > Cu for spiked sediments before and after leaching indicating possible mobility of Cd, Ni, and Zn. Among sediment properties the pH in pore water influences the behavior of heavy metals in sediments. Spiking and leaching approach is conducive for evaluating of heavy metals toxicity and mobility tests.

Keywords: heavy metals, sediment, spiking, release.

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Monthly zoning of the air pollution and surveying its relationship with climatic factors (Case study: Mashhad City)

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Abstract

Urbanization expanse and population growth, as well as pilgrim's possibility of some cities provide overuse of vehicles and consequently increased air pollution. Thus by considering the importance of the impact of air pollution on human health, in this study, air pollution in terms of PM₁₀ using PSI standard index and inverse distance weighting is zoned in Mashhad. On the other hand, meteorological parameters such as wind speed, wind direction and rainfall have also been analyzed, by comparing and overlapping in geographic information system and also by evaluation the relationship between climatic factors and PSI index using Pearson's correlation coefficient, the impact of climatic factors on air pollution reduction is partially visible. So that in end of March and early of April has reduced the amount of air pollution due to spring rainfall and in the months of January and February, air pollution levels have risen than warm months due to less precipitation and temperature inversion. In addition, the wind direction had the greatest impact on reducing of air pollution and in the end of March and early of April and December, appear the highest correlation between them ($r = -0.902$, $P = 0.014$, $r = -0.817$, $P = 0.04$ respectively). The most of air pollution have been seen in the city center around Sadaf, Lashgar and Nakhresi stations in majority of months, having more traffic, as well as less rainfall and wind speed and favorable wind direction.

Key words: air pollution Zoning, climatic factors, correlation analysis, GIS and PSI.

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Cu, Zn and Cr accumulation in hair and liver tissues of the Persian Jird (*Meriones persicus*) in Darreh Zereshk, Yazd

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Abstract

Rodents are sensitive species to environmental pollutant in particular to heavy metals and considered to be proper monitors of heavy metals in the environment. This study was conducted to measure the accumulation of copper (Cu), zinc (Zn) and chrome (Cr) by wet digestion method and using an ICP-OES instrument in hair and liver of Persian Jird (*Meriones persicus*) in Darreh Zereshk copper mine, Yazd without considering the effects of surrounded mines. The results showed that the concentrations of heavy metals between hair and liver were statistically different ($P < 0.01$). The order of heavy metal concentrations in studied tissues was as $Zn > Cu > Cr$. A significant difference was observed between heavy metals concentrations of studied tissues between males and females ($P < 0.01$). The results of Pearson correlation showed that there were no significant differences between the accumulation of heavy metals in tissues ($P > 0.05$), therefore regression equation cannot be established between them. Due to the lack of significant differences between hair and liver, hair cannot be easily applied as a proper bioindicator of heavy metals in the liver, and its application needs further investigation. Differences in the accumulation of heavy metals in liver and hair of different sexes of Persian Jird indicate that sex plays an important role in the accumulation of heavy metals in this species and must be noticed in forthcoming studies.

Keywords: Dare Zereshk, heavy metals, Persian Jird *Meriones persicus*, pollution.

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Change detection and land use/cover dynamics in the Arasbaran biosphere reserve

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Abstract

Large scale land use/cover changes and habitat fragmentation is a major factor in the distribution and functioning of ecosystems. For analysis the relationship between land use changes and their impacts on biodiversity, land cover and land use information is needed at different scales. The main goal of this study was to quantify the land use/ cover changes in Arasbaran Biosphere Reserve, Northwest of Iran in a period of 24 years (1987–2011). Arasbaran is one of the most important protected areas in Iran. We used Landsat Thematic Mapper (TM) satellite image from 1987, 2011, and ETM⁺ from 2001 for providing the land use /cover maps. Eight classes of land use/cover including irrigated agricultural land, non-irrigated agricultural land, dense forest, sparse forest, range lands (dominated by Astragalus), other grassland types, bare land and waters were identified. The results indicated that during the last 24 years (1987-2011), the proportion of forest was significantly decreased (12.3%), while grassland (5.4%), rangeland (3.7%), and bare land (4.9%) were increased in the study period. Altitude and residential land, were identified as the main driving forces of land use changes in the study area, as between 1987-2011, the area of dense forests was decreased by 96% in the low altitudinal class of the study area (260-700 m a.s.l). The results of this study provided quantitative data on significant current land use/cover trends and habitat loss in Arasbaran Biosphere reserve that could be useful in establishing and implementing effective management at landscape scale that maintain ecological function while minimizing restrictions on human land use.

Keywords: Arasbaran, forest, human impacts, land cover changes, protected area..

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Investigating the quality of wildlife and biodiversity terms of reference in environmental impact statements

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Abstract

Human activities due to implementation of projects have caused significant concerns on biodiversity in human societies. Hence, assessing the environmental impacts of those projects has been considered as a tool to help environmental managers to prevent emergence of those adverse impacts in general and those impacts which are related to biodiversity, in particular. It is provided that all components of the environment including biodiversity to be considered and integrated into environmental impact assessment process properly. The present study revealed that Iranian environmental impact assessment guidelines, which has been ratified in 1994 suffers lack of sufficient and effective approach in integrating biodiversity, as has been stated in UN Biodiversity Convention, in its environmental impact assessment process. In our study, we have applied a quantitative evaluation approach to investigate the quality of 50 environmental impact statements out of more than 1171 which have been ratified by Iran Environmental Protection Agency standpoint of biodiversity. Having analyzed sample-based data, binomial test has been applied for deducting population-based inferences relying on our sampling-based data. Findings of the present study have indicated that biodiversity-related concerns are properly not addressed in more than half of the environmental impact statements at significance level of 95%. Accordingly, more attention on the biodiversity-related concerns should be paid by EIA practitioners considering the significance of biodiversity in general and wildlife in particular in our national environmental impact assessment system.

Keywords: EIA, EIS, quantitative, wildlife, biodiversity.

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Removal efficiency of some organic sorbents in removing of cadmium from aqueous solution

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Abstract

The application of organic sorbents for removing heavy metal from water, replacing expensive sorbents, is particularly appropriate for developing countries. To investigate the efficiency of some organic sorbents in removing of Cd²⁺ from aqueous solution, an experiment was conducted with three organic sorbents (sunflower stalks, apple and grapevine pruning residues) and 11 initial concentration of Cd²⁺ (0- 200 mg L⁻¹) at three pH (4, 6, 8). The results showed that three organic sorbents have relatively high removal efficiency (RE) for cadmium from aqueous solution, and RE increased with increasing of pH but initial concentration of cadmium showed invers effect. The highest RE was obtained at pH 8 and low initial concentration of Cd (≤ 10 mg L⁻¹) for all three organic sorbents. Among sorption models (Langmuir, Temkin and Freundlich), Langmuir model was better fitted for experimental data ($R^2= 0.99$). At pH8, maximum mono layer adsorption (q_{max}) of sunflower stalks, apple and grape pruning residues were obtained 8905, 8155 and 7895 mg kg⁻¹, respectively. All sorption parameters (q_{max} , A, K_F , K_T , K_L , n) of sunflower stalks was more than those of apple and grape pruning residues. Therefore, sunflower stalks in comparison to apple and grape pruning residues, have a high efficiency in removing of cadmium from aqueous solution. The Gibbs free energy of reaction (ΔGr) and separation factor of Langmuir (R_L) indicated that the sorption reactions of Cd²⁺ by all three biosorbents are spontaneous and favorable.

Keywords: adsorption isotherm, aqueous system, cadmium, organic sorbents, pH.

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Measuring water use efficiency and productivity of Tehran using data envelopment analysis

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Abstract

The input-oriented Data Envelopment Analysis was used to measure the water use efficiency and productivity indices of Tehran over the period 2005-13. Meanwhile, the correlation between water uses and regional economic activities was examined using the gross regional domestic product index. The results indicated that the total productivity was improved 1.8% and 1.68% aspect of technical efficiency change and scale efficiency change respectively. Furthermore, it was improved 12.32% aspect of technology change due to accumulation and treatment of wastewater and applying water use management to increase annual water storage since 2011. The mentioned indices confirmed that a 22 million cubic meters decrease is possible in water uses without decreasing in the level of gross products related to Tehran.

Keywords: data envelopment analysis, efficiency, productivity, water use efficiency.

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Impact of Cr (VI), Cd and Pb contamination on nutrient composition of one-year old *Populus* ssp. seedlings

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Abstract

Heavy metals are aggressive environmental pollutants. They are easily taken up by plants and they are strong stress factors for plant metabolisms. Heavy metals influence includes also disturbances in plant mineral nutrition by competition with other nutrients. The objective of this research work was to study whether elevated Cr (VI), Cd and Pb Contamination caused an unbalanced nutritional status of leaves and stems/shoots in two poplar species (*P. nigra* L. and *P. alba* L.). The experiment was carried out on a pot culture of poplars, growing in an enriched heavy metal soil. The results indicated that Heavy metal enrichments reduced the concentration of all foliar and stem/shoot nutrients ($P \leq 0.05$). *P. nigra* L. in comparison with *P. alba* L. was more sensitive to Cd and Cr (VI) contamination. The highest and the lowest negative effects on nutrient uptake were belonging to Cd and Pb respectively. Cd contamination at 150 mg kg^{-1} level lead to 65% reduction in foliar concentration of K in *P. nigra* L. In presence of 150 mg kg^{-1} Cd, 78% reduction was observed in *P. nigra* L. P uptake compare to control. The knowledge about regulatory mechanisms in plant mineral nutrition may help us to solve the problem of plant detoxification during heavy metal stress. However the mechanisms of heavy metal interactions are very complex and still only fragmentarily known.

Keywords: heavy metal, interaction, plant detoxification, plant metabolism, pollutant.

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Hydrogeochemistry and concentration of heavy metals in the Kaka-Reza River water (Lorestan Province)

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Abstract

The main purpose of this research is to evaluate the hydrochemical properties, controlling processes and metal concentrations in Kaka-Reza river water (Lorestan province). To this end, 15 water samples were collected and physicochemical properties (pH-EC), cation-anion contents along with concentrations of some heavy metals were determined using the standard analytical methods. The results revealed that major cations and anions concentration varied as following sequences $Ca > Mg > Na+K$ and $HCO_3 > Cl > SO_4$, respectively. According to piper diagram, the hydrochemical type of the water samples are found as bicarbonate-calcic, due to carbonate nature of the exposed rocks in the region. Based on the results of hydrochemical analyses, it was also revealed that rock dissolution and reverse ion exchange are dominant processes which control the chemistry of river water. In terms of heavy metal concentrations, it was found that cadmium and arsenic concentration tend to increase along the river, probably due to their anthropogenic inputs (agricultural activities). By considering the variation of other metals in the river water and taking into account the results of principal component analysis (PCA), it was assumed that these metals are mostly of natural (geogenic) source. It was also found that river water quality is currently suitable for irrigation purposes.

Keywords: Kaka-Reza river water, Lorestan province, heavy metals, hydrogeochemistry.

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Application of *Vetiver* system for treatment and improvement of unconventional water quality

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Abstract

The aims of this study were to evaluate the treatment efficiency and effectiveness of *Vetiveria zizanioides* of two samples of unconventional water of Golgohar Mining and Industrial Company. The experimental samples were included mine wastewater and saline ground water. This research was conducted in a greenhouse at Central Water Research Laboratory of University of Tehran. This experiment was designed as Completely Randomized Design (CRD) including two salinity levels with three replications during four weeks. Results showed that treatment efficiencies of Total Dissolved Solids (TDS) and Electrical Conductivity (EC) were equal 31.5 and 28.3 percentages for mine wastewater and 33 and 28 percentage for ground water on fourth week respectively. Also results indicated that among Cations and Anions, SO₄ and K parameters have shown highest and lowest rates at the end of fourth week respectively. It concluded vetiver treatment system include valuable potential for unconventional water treatment.

Keywords: completely randomized design, iron mine, unconventional water treatment, Vetivergrass.

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Trophic niche segregation between two closely related sympatric Rock Nuthatch (*Sitta tephronota* and *S. neumayer*) in Zagros Mountain range

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Abstract

Eastern Rock Nuthatch (*Sitta tephronota*) and Western Rock Nuthatch (*S. neumayer*) are two closely related and sympatric species in Iran, which have been known as the classical case of character displacement since 1950. Nevertheless, some questions related their niche partitioning is still unanswered. This study was conducted to determine the diet differentiation, as an important niche dimension, between the two species in their sympatric zone along the Zagros Mountains. The dietary composition of the two species was studied by analyzing stomach contents, using a stereo-microscope. The result showed that the most diet of the two species in spring was insects. Eastern Rock Nuthatch fed predominantly on beetles (Coleoptera), bugs (Hemiptera), and grasshoppers (Orthoptera) whereas Western Rock Nuthatch fed mostly on bugs (Hemiptera), beetles (Coleoptera), and butterfly's (Lepidoptera). We used analysis of covariance for finding differences in two measurement traits (length of head in bugs and length of mandible in beetles). Covariance analysis revealed that the relationships between body and prey size differ between the two species only in one measurement (length of head in bugs), so that Eastern Rock Nuthatch captured larger prey size. Furthermore our result showed that the Niche breadth of these species is almost equal but their niche overlap is high. Result of this study showed the relative importance of body size of consumed prey as an important factor to trophic niche partitioning and stable coexistence of two closely sympatric species (*Sitta tephronota* and *S. neumayer*).

Keywords: character displacement, *S. Neumayer*, *Sitta tephronota*, trophic niche segregation.

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Sustainability assessment process at the local level based on IUCN approach (Case study: Mondje customary region in Lordegan township)

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Abstarct

Local areas are fundamental constituent parts of planning at national and international levels. These areas are the first foundation of centraliozation and non-centralization of sustainable development. In the present study, the consistency condition of customary areas in Mondje region, located in Lordegan city- Chahar Mahal Bakhteyari province, was assessed using of the IUCN model. In this approach, seven stage including determination of assessment target, showing of systems, clarify of consistency dimensions and elements, selection of criteria and indicators, categorize and measurement of indicators, combine indicators for each system and mapping of sustainability barometer, were considered. In this study, two human and natural systems, four dimensions of land cover, using of resources, wilth and population, as different dimensions, and seven criteria with ninteen indicators were regarded to the assessment of region consistency. On basis of the results of indicators assessment, pay attention to local experts opinion, 48% of all indicators and 66% in natural system are unstable and almost unstable. The indicators of firewood, farming in the forest and livestock are in unstable situation. The results and barometer analysis showed that the consistency condition in study area is as unstable.

Keywords: customary region, IUCN approach, Lordegan township, sustainability assessment, sustainability barometer.

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Assessment of bioclimatic comfort condition in Miankale wildlife refuge for ecotourism development

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Abstract

The recognition of human bioclimatic comfort in geographical area is an important factor for planning of ecotourism. Climate is a very important component to identify natural landscape values. For better planning and management of landscape units such as recreational purposes, there is a need for emphasis on the visual aesthetic aspects, and also for understanding the climatic effects on recreation-seeking humans. Becker and TCI are models for assessment of human bioclimatic comfort and for this research both have been used for MianKaleh wildlife refuge. Climatic normal statistics were gathered from three synoptic stations covering the period 2001-2011. The result showed that bioclimatic comfort in the study area changed during the year from tolerable to excellent condition. Optimal conditions were seen in May, June, July, August, September and October. In the remaining months of the year we need measures to eliminate discomfort brought about by inclement climatic conditions such as cold air for tourism.

Keywords: becker, bioclimatic comfort, ecotourism, Miankaleh wildlife refuge, TCI.

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Comparison of zinc and chromium bioaccumulation in the internal organs of freshwater mussel *Anodonta cygnea* (Bivalvia: Unionidae)

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Abstract

Nowadays, bivalves are used in monitoring levels of heavy metals in aquatic environments. The aim of this study was to investigate bioaccumulation of heavy metals zinc (Zn) and chromium (Cr) in the internal organs of *Anodonta cygnea*. For this purpose, bivalve specimens were collected from Semeskandeh region, Sari, and then in laboratory, were exposed to 125 $\mu\text{g l}^{-1}$ concentrations of each metal for 27 days. Basal levels, accumulated amounts and $\Delta C/C_0$ of both metals in mantle, gill, hepatopancreas and foot of the mussel during study period were measured. Zn basal levels in all studied organs were significantly ($P < 0/01$) higher than Cr. There were no difference in Zn basal levels between different organs, but for the case of Cr, basal levels were different: gill > hepatopancreas \approx foot > mantle. Highest accumulation of both metals were observed in gill and hepatopancreas and minimum accumulation were belonged to the mantle. Calculated ratios of $\Delta C/C_0$ for Cr were significantly ($P < 0.01$) higher than Zn in all studied organs: Zn: hepatopancreas > foot > mantle > gill; Cr: mantle > hepatopancreas \approx foot > gill. Based on our results, it can be said that *A. cygnea*, is a good species for biomonitoring Zn and Cr levels in aquatic ecosystems.

Keywords: aquatic environments, bioaccumulation, Bivalves, heavy metal.

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