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Water

APPLICATION OF SUBSURFACE DAM IN-ORDER TO PROVIDE DRINKING WATER FOR RURAL DEVELOPMENT IN ARID REGION (A CASE STUDY IN YAZD-IRAN)

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Abstract

Construction of underground dams may prevent the wasting of sub surface runoff around the Kavir and deep aquifers with low quality, which leads to sustainable development of basins. Utility of these dams is one of the best and most economical methods of supplying the water needs of villagers living in low population area from the seasonal rivers. A combination of this easy method along with qanat may offer a new method to solve water shortages. Yazd province is surrounded by Kavir and is facing with lacking of water. Kharanagh, which is situated on tertiary marls, is the most damaged area because of fast runoff to Kavir (salt land). Existence of mountains and qanats in the area might be used to supply water for the people. The goals of these investigations are: 1) to study the effects of construction of underground dam of qanats discharge. 2) to study the feasibility of subsurface water storage to develop sustainable water supply in dry lands. 3) to research sustainable development of the basin through the prevention of excessive immigration to the area due to lack of water. In this study, discharge data from Dehouk qanat was collected (before, during and after the construction of a ground dam) and analyzed which shows a rising trend, and the effects of the dam on sustainable development is studied. The result shows that the water level fluctuations were around 1.2 m after the construction of the subsurface dam. It is significant that after construction of the subsurface dam in maximum level the storage capacity of water impounded is about 4383.8 M³/year, which supported 256 persons per year. This initiative project can be useful in decreasing the vulnerability of villages in arid areas to drought.

RUNOFF ESTIMATION USING NRCS-CN METHOD

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Abstract

The GIS and Remote Sensing Techniques facilitate accurate estimation of surface runoff from watershed. In the present study an attempt has been made to evaluate the applicability of the Natural Resources Service Curve Number method using GIS and Remote Sensing Technique in the upper Krishna basin (69,425 Sq.km). Landsat 7 (with resolution 30 m) satellite data for the year 2012 has been used for the preparation of the land use land cover (LU/LC) map. The hydrologic soil group is mapped using GIS platform. The weighted curve numbers (CN) for all the 5 sub-catchments was calculated on the basis of LU/LC type and hydrologic soil class in the area by considering the antecedent moisture condition. Monthly rainfall data was available for 58 rain gauge stations. Overlay technique was adopted for generating weighted curve number. The results of the study show that land use changes determined from satellite images are useful in studying the runoff response of the basin. The results showed that there is no significant difference between the observed and the estimated runoff depths. For each sub-catchment, statistically positive correlations were detected between the observed and the estimated runoff depth ($0.6 < R^2 < 1$). Therefore, the study reveals that the Remote Sensing and GIS-based NRCS-CN model can be used effectively to estimate the runoff from ungauged watersheds when adequate hydrological information is not available.



THE USE OF GIS TO MEASURE CHANGE IN THE GROUND WATER LEVELS IN QATAR BETWEEN 1980 & 2009

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Abstract

For few decades Qatar has been relying on desalinated water from the Arabian Gulf as the main source of fresh water. In the case of natural disasters such as red-tide or manmade ones such as an oil spill, Qatar would not be able to desalinate water for days or months, depending on the magnitude of the disaster. This in itself forms a high hazard to the population of Qatar, since the strategic storage/reserve of fresh water in the country would only last for 2 days. In the case of the oil spill in the Gulf of Mexico, it took 36 days to clean the water. In addition to this, groundwater systems in Qatar are heavily over exploited, mainly for irrigation purposes. The over abstraction have resulted in deterioration of water quantity and quality (due to seawater intrusion from the Gulf). Therefore, groundwater in its current state would be unusable in cases of a water shortage caused by a disaster. Large scale artificial aquifers recharge plans have been proposed in order to use artificial aquifer as strategic storage in case of emergencies. The goal of this plan is to retain the 1980 groundwater levels through recharging. GIS is used in this study to map changes in the levels of the aquifers between 1980 and 2009, using potentiometric surface data, in order to estimate how much water should be injected in the aquifers and where.

SPATIAL-TEMPORAL MODELING THE IMPACT OF LAND COVER CHANGE ON STORM RUNOFF IN KELANTAN AREA, MALAYSIA

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Abstract

Kelantan river basin, a flood-prone area on the east coast of the Malaysian peninsula, has suffered several flood and mudflow events in the recent years. This research project attempted to assess land cover changes' impact on the Kelantan river basin and focused on the runoff contributions from different land cover classes and the potential impact of land cover changes on runoff generation. In this regards, two hydrological regional modeling of rainfall induced runoff events were employed to compute the rate of infiltration and subsequent changes in the discharge volume in this study. The effects of land use changes on peak flow and runoff volume were investigated using storm rainfall events during December 2014. Two hydrological regional modeling of rainfall induced runoff events, the improved transient rainfall infiltration and grid based regional model (Improved-TRIGRS) and HEC-HMS model, were employed in assessing the land cover impact on the runoff volume based on the rate of infiltration, and subsequent changes in the runoff, due to the precipitation event. The usage of the Improved-TRIGRS model and the HEC model showed that land cover changes caused significant differences in hydrological response to surface water. The increasing of runoff volume at Kelantan river basin is a result of deforestation and urbanization, especially the conversion of the forest area to agricultural land (i.e. rubber and mixed agriculture). The urban areas or lower planting density areas tend to have increased runoff and monsoon season floods, whereas the inter flow from forested and secondary jungle areas contributes to normal flow.



SALINIZATION OF GROUNDWATER IN MALIHA AREA- AL SHARJAH, THE UAE, AND IMPACT ON LAND COVER CHANGE

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Abstract

The lack of renewable water resources is one of the critical problems that hinder development in the United Arab Emirates (UAE). Rainfall events are random and infrequent in the UAE, with an average of ~ 100 mm/y, and potential evaporation is very high at ~ 1000 mm/y. Groundwater resources constitute about 70% of the total water production in the country. The Emirates face the problem of increasing salinity in the groundwater and diminishing fresh water due to over-pumping of groundwater mainly for agriculture development. Groundwater in Maliha-Al Sharjah is considered to be one of the best groundwaters in the UAE, with a very good quality, as indicated by the low TDS <1000 ppm. However, groundwater in this area has been overexploited and its quality has degraded in the last few years. This is mainly due to the rapid increase in the number of farms and consequently in the number of the digging wells in this area. This study investigated the change in the groundwater quality and quantity in the Maliha area in the period 2007-2012 and their effects on the land cover over the same period. Groundwater data has been collected, analyzed, and mapped, and Landsat 7 ETM+ images (2007 & 2012) have been analyzed and classified for land cover change. The study showed that excessive water consumption in Maliha in the period 2007 to 2009 led to a drop in the water table and to an increase in groundwater salinity. The water supply of these wells decreased remarkably from 142 million gallons in 2007-2009 to 77 million gallons in 2011 and to 51 million gallons in 2012. Consequently, the ratio of dissolved salts in the groundwater increased remarkably from 12% in 2010 to 32% in 2011. In 2012 the salt ratio increased to 55%, and the groundwater become saturated with salts and unsuitable for agricultural purposes. As a result, the vegetation cover (mainly farms) in Maliha has decreased remarkably from 1.7 km² in 2007 to 1 km² in 2012 while the built-up area increased from 2.2 km² to 4.3 km².

Disaster and Risk

MAPPING AND COMMUNICATING DISASTER RISK REDUCTION PROJECTS

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Abstract

A significant number of disaster risk reduction projects are implemented around the world. Each of these projects can provide guidelines for future projects and can be adopted by other communities if their information is properly communicated and shared. These projects can also become a good source of knowledge for the teaching and training of disaster and emergency management students. This paper describes a web mapping application that has been developed to map and communicate global disaster risk reduction projects better. We have developed this application using ESRI Web AppBuilder. This application allows users to map and see disaster risk mitigation projects in their geographical context. Disaster risk reduction projects have been found through an extensive online search. The current version of the application includes more than 300 various disaster risk reduction projects from around the world.



EXPERIMENTAL STUDY OF THE MECHANICS OF GYPSUM SEAM HAZARD FOR ABU DHABI

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Abstract

Abu Dhabi is predicting a huge growth in population over the next 20 years (Plan Abu Dhabi 2030); further, it seeks to become an international destination for tourists, businesses, and investment while protecting its cultural heritage. A crucial aspect of achieving this goal is the development of a large integrated transportation system, both underground and above ground, to ensure that Abu Dhabi becomes a sustainable city on a global scale. The presence of gypsum rocks that occur within Abu Dhabi's bedrock--persistent quasi-horizontal bands, at different level (top level between 10-15 m, bottom level between 15-25 m) prone to volume change by dissolution or swelling, due to changes in the stress regime and water chemistry and flow--is a major threat to underground construction, and understanding this phenomena is of paramount importance. The dissolution of gypsum has also caused the cavities that can be found in greater Abu Dhabi. In this paper, the description and results of an experimental study aimed at obtaining a better understanding of the gypsum dissolution process, as well determine factors affecting it, are presented. Tests on the dissolution process of gypsum rock were performed using artificially created intact and fractured gypsum samples that are representative of the in-situ fractured gypsum rock samples obtained from Abu Dhabi. The samples were subjected to flow-through tests. Results show that for an initially saturated gypsum specimen, there is a sharp decline in concentration with time (Stage I), followed by a constant concentration (Stage II) before a slight gradual increase is observed (Stage III) with time. This is a fundamental study – part of a larger set of experiments studying the gypsum dissolution process in Abu Dhabi. Using Geographic Information Systems, and the data collected from the field and the aforementioned experiments, gypsum geohazard risk-related maps will be developed, using Geographic Information Systems, that reflect subsidence, swelling, cavity collapse, and cavity flooding associated with gypsum Karst.



DISASTER PREVENTION AND MANAGEMENT OF POULTRY PRODUCTION IN THE UAE

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Abstract

Agricultural production sectors represent a high risk source of biological hazards. Facing disasters begins with preventing and reducing the risks. Huge investments are employed in poultry production to produce poultry products locally. On the other hand, zoonotic diseases, such as H1N5, are spreading around the world. A multidimensional system was developed in order to monitor the performance of poultry production farms, trace poultry products, and associate the collected data with geographical information in GIS maps. The developed prototype consists of three major segments: flock identification system, website application, and a GIS map. The first segment was designed to give a unique identification code to each flock produced locally in the United Arab Emirates, which was integrated into a poultry products identification system. The second segment was developed and hosted by UAE University servers (<http://farmbiosecurity.uaeu.ac.ae/>) to collect information from registered poultry farms on a daily basis. On the other hand, the collected information is stored on the server where it is used to develop a GIS map utilizing ArcGIS 10.1 desktop, which contains additional layers of information such as streets, villages, wind speed, and direction. The developed system was intended as an early warning system to help government authorities predict and control epidemic outbreaks, manage biological disasters originating in poultry farms, and handle food traceability crises. Each segment was examined on a pilot scale to assess its feasibility individually and in conjunction with the other segments. Preliminary results showed that the developed pilot system was very promising as an early warning mechanism to predict poultry-related epidemics and help the corresponding authorities to foresee the spread pattern of a problem according to the collected data and environmental conditions. On the other hand, authorities could allocate new production farms, live birds, and litter transportation routes to minimize the possibility of initiating epidemic propagation. Furthermore, the food control authority could use the traceability system to handle food biosafety problems, and swiftly identify and isolate unsafe foodstuffs in order to prevent them from reaching the consumer. It was concluded that business owners were hesitant to apply such a system as, in their perception, it would place more of a burden on their staff. They were also cautious in revealing detailed information regarding their farms' environmental conditions to control authorities, as it might mean investing more in biosecurity systems. It is recommended that this system be implemented by law to protect human health, the environment, and the economy.

INACHUS: INTEGRATED WIDE AREA SITUATION AWARENESS AND SURVIVOR LOCALIZATION IN SEARCH AND RESCUE OPERATIONS

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Abstract

Emergencies and crises are an inevitable fact of modern life, with extreme weather events, fires, hazmat spills, and traffic accidents happening often and in every jurisdiction. The potential consequences are indisputable: serious injury and/or death to the public and to responding personnel, damage to public and private property, and the risk of long-term financial repercussions, among others. Under the resulting chaotic and difficult working conditions, Urban Search and Rescue (USaR) crews must make quick decisions under stress to determine the location of trapped victims as quickly and as accurately as possible. The EU FP7 project INACHUS presents a holistic approach in providing a system that aims at achieving significant time reduction related to the USaR phase by advancing wide-area situation awareness solutions for improved detection and localization of trapped victims, assisted by simulation tools for predicting structural failures and a decision support mechanism incorporating operational procedures and resources of relevant actors. In the proposed approach, structural damage analysis is performed based on input coming from 3-D airborne and ground-based laser-scanning images and their subsequent analysis through advanced photogrammetric and computer vision techniques and Structural Health Monitoring (SHM) sensors pre-installed inside the buildings. Furthermore, INACHUS involves new types of sensors and technologies for detecting and localizing trapped survivors in disaster situations (among others bio-chemical sensors, ground-based seismic sensors, infrared sensors, real-time locating systems, radars, etc.). Several miniaturized sensors are integrated into a snake robotic system capable of penetrating into rubble and providing useful information in order to locate possible trapped survivors. Robust snake robot design together with a novel control system enable operator-controlled robot operations in complex environments. This paper presents the general concept of the INACHUS solution together with the preliminary evaluation results of the applied techniques, evincing that the proposed system could significantly contribute in successfully addressing the societal demand to increase survival rates in the aftermath of natural or man-made disasters by tackling a plethora of practical operational challenges, including increased effectiveness of USaR operations with the same number of human resources and enhanced situational awareness.



BIG DATA FOR DISASTER MANAGEMENT AT PUBLIC INSTITUTIONS: THE CASE OF EDUCATIONAL FACILITIES

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Abstract

The impact of natural or man-made disasters can be minimized by proper planning and the adoption of preventive measures. The measures are becoming very important, especially in areas with a high population concentration such as educational facilities. In the case of management of humans in any institution, it is very important to know how many people are in the institution at a specific time (when?), and also to know their location within the institution (where?). A big data system is proposed in this study. It will gather data from various sources such as car counter devices, foot counter devices, university calendars, class schedules, student attendance records, CCTVs, GPS chips in IDs, and logins to PCs. The counter devices can be installed at several feasible locations, helping the institution's management to track the number of cars or people that have entered a building. A tracking chip is proposed to be included in the IDs of the students, faculties, and staff, based upon their consent, to monitor their presence only inside the university. When these tags pass through the reader-generated interrogation field, they transit the information about the person's identification. The proposed system will have many benefits for administrators, such as automation of time and attendance by tracking the number of people entering and leaving educational premises, helping in disaster management/emergencies, helping in estimation of energy needed, and providing Short Message Services to parents to keep them updated. The entire system and data processing can be done with minimal human intervention, thus improving the accuracy and automation of the administration process.

UAV-LiDAR-SAR and Image Analysis

DISASTER MANAGEMENT THROUGH IRS 1A LISS II IMAGES IN CONJUNCTION WITH ERS- 1 C-BAND SATELLITES REMOTE SENSING DATA FOR NATURAL DISASTROUS ZONES IN SEMI-ARID ENVIRONMENT

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Abstract

Gathering real geo-information through Indian Remote Sensing Satellite data (IRS-1LISS II) in conjunction with European Space Agency's data (ERS-1, C-BAND, SAR), satellite digital images have been interpreted visually and digitally to access waterlogged information, soil moisture, and associated thematic information for Natural Disaster Management (NDM). Waterlogging is one of the disasters in the Sikandra Rao Tehsil, Hathras district, State of Uttar Pradesh, India. The study area is about 41 km southeast of Aligarh and 35 km east of Hathras and is on the Grand Trunk Road. Its coordinates are 27°41'18"N 78°22'43"E, where the effect of geo-environmental information is clearly observed on satellite images. The Natural Disaster Zones (NDZ) was identified from IRS LISS II & ERS-1(ESA) SAR images. After Field visit, Visual Interpretation & Digital Analysis was done and then compared with extracted information from ERS-1 & IRS 1A LISS II, as shown on images. The information shows that the accuracy of the visual identification varies greatly from 90 per cent for the ERS-1 to 81 per cent for the IRS 1A LISS II. The Remote Sensing Techniques was applied to get information for mapping accuracy, which was incorporated and helped in delineating disastrous zones locations affected by climatic fluctuations and geodynamic variation. To demonstrate further, the usefulness of the IRS 1A images for Geodynamic Environmental investigations on waterlogged-soil moisture and associated features in the area has also been analyzed. The results show that the development of Natural Disaster Zones due to excessive irrigation in areas with poor drainage network conditions causes waterlogging and salinization of the soil. When water does not penetrate deeply, it raises the water table. Air spaces in the soil are filled with water, and plant roots suffocate. Consequently, Natural Disaster Zones adversely affect crop yields, foundations of buildings, and associated infrastructures. This study helped to mitigate future geo-hazard environmental conditions in the area by adopting high resolution satellite and LIDAR data and techniques using modern software. Remote Sensing Information (RSI) & Geographical Information System (GIS) techniques would help for Natural Disaster Zones' preparedness and management plan and can be generated to cope with emergency situations. Thus, information sharing among disaster management and environment monitoring agencies are a must and brings transparency.

ACCURACY ASSESSMENT OF LIDAR MOBILE MAPPING SYSTEM (MMS) FOR BASE MAP UPDATE

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Abstract

Updating of base maps is one of the problems that face mapping departments around the world. Traditionally, this is done by land surveying and such operations consume a lot of resources (time, cost, efforts). Moreover, the data collected are abstract to reality, i.e. location of points based on distances, angles, and elevations. The problem is becoming more acute especially in cities that witnessed rapid development such as those in the United Arab Emirates, where construction of roads, buildings, and utilities is moving at a high rate. Using remote sensing technology for map update is challenged by requirements of accuracy, and using Global Navigation Satellite Systems (GNSS) alone is hindered by the lack of image data (only coordinates). The LiDAR Mobile Mapping System (MMS) offers a chance for collecting positional and image data at the same time, thereby increasing data availability for further analysis. The main objective of this study is to assess the accuracy of spatial data obtained via LiDAR MMS with data obtained via land surveying. Results showed that the Root Mean Square (RMS) error between the measured Ground Control Points (GCPs) by ordinary surveying and their corresponding LiDAR points is within the order of centimeter level. Therefore, the LiDAR MMS could be used to obtain accurate and reliable spatial data for base map updates.



UNMANNED SMART SUBMARINE FOR SHORELINES DATA ACQUISITION

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Abstract

Marine life is the part of the global ecosystem that consists of seas or oceans and living organisms. Lately, the marine environment has been largely affected by human activities (e.g., tourism, industries, waste, desalination), resulting in seawater pollution. Seawater pollution can largely lead to the death of many living organisms (such as fish) and affect the ability to sustain marine-related tourism activities and the local economy. Therefore, many environmental organizations are focusing on protecting marine environments, spending a lot of money and effort to improve water quality and clean shorelines to enhance their aesthetic value. The purpose of this project is to develop an "Unmanned Smart Submarine" (USS) to assist in observing and recording the water and sea life quality around the shorelines of Ras Alkhaimah, UAE. Therefore, the USS body will be supported by a GPS tracking system to record the submarine position coordinates during its movement, as well as real-time recording video cameras to video tape sea life conditions. The recorded video of marine life would enable tracking and detecting signs of pollution without the need for a large number of employees to frequently visit the shorelines. This project is expected to assist many local environmental agencies in monitoring water pollution to maintain water quality, which would prompt water-tourism-related activities in the city. If enough financial support is available, this project can be enhanced by additional useful sensors and devices to expand its applications, such as adding a fish finder device to better guide fishermen.



UNMANNED AERIAL VEHICLE FOR AERIAL PHOTOS AND DATA ACQUISITION

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Abstract

There are a number of companies specialized in producing and supplementing aerial photos to be analyzed and used for different applications by many local government departments in the UAE. Overall, these aerial photos are expensive, depending on the resolution and covered area, which makes them harder for students to obtain. The purpose of this project is to utilize ‘Quadcopter’ to produce photos with lower costs, allowing teachers and students better access to photos for educational purposes. For instance, students can use the photos’ output in analyzing different applications such as crop monitoring, urban development, and traffic congestion. The Quadcopter is equipped with different high-tech components (e.g. Ardupilot, GPS, Gopro Hero 4 camera, video encoder, telemetry receiver and sensors) to provide the user with aerial photos, real time video, coordinates, and pressure. Such a project can be used by schools and universities to support the educational process. In order to get benefits from this project and solve many problems that are associated with the environment and existing infrastructure, one of the most common problems was chosen to study: road cracks, a regular problem that happens due to climate change, poor road surface drainage, lack of proper road maintenance, lack of proper design, and other factors. Road cracks have negative effects on cars and other types of transportation and also affect traffic flow and safety, leading to poor road performance. These problems in turn cause increased fuel costs and environment pollution. A quick and efficient intervention is needed to reduce the magnitude of road cracks. Using the UAVs in solving those types of problems will help to discover the problem, trace it, and then choose appropriate solutions using the output of the UAV (videos, photos, and data).



SPATIO-TEMPORAL ANALYSIS AND IMAGE REGISTRATION FOR STUDYING GROWTH PATTERNS OF TRANSPORTATION INFRASTRUCTURE IN SHARJAH CITY, UAE

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Abstract

Sharjah is the third largest and populous city in the United Arab Emirates (UAE). It is located along the northern coast of the Persian Gulf on the Arabian Peninsula. Throughout the past few decades, Sharjah City has witnessed massive growth in its urban area and infrastructure facilities. Transportation infrastructure, in particular, is a key indicator of growth and development of the city. Transportation is a vital component of the economy and prosperity of any city as it provides easy access to land, moves large volumes of people and vehicles, enables larger markets, and saves time and costs. Recent advances in satellite imagery, in terms of improved spatial and temporal resolutions, have allowed efficient identification of change patterns and the prediction of areas of growth. This paper aims to quantify and analyze the spatial-temporal relationship between urban growth and the transportation development that took place in Sharjah City from 1976 until 2015. For growth detection and quantification, linear features extracted automatically from multi-temporal Landsat registered images were adopted as the basis of change detection where pixel-pixel subtraction has been implemented. Linear features were also chosen for image registration since they can be reliably extracted from imagery with significantly different geometric and radiometric properties. Digitized features of buildings and roads have been used as ground-truth of the adopted algorithm. The results show that the highest range of growth represented by linear features (buildings and roads) has occurred during the 1976-1987 period and accounts for 36.24% of the total urban features inside Sharjah City. Moreover, the cumulative urban expansion inside the city reached 71.9% between 1976 and 2010.

Agriculture

ASSESSMENT OF AGRICULTURAL DROUGHT VULNERABLE AREAS IN COASTAL TRACTS OF THIRUVALLUR DISTRICT, TAMIL NADU, INDIA USING REMOTE SENSING AND GIS TECHNIQUES

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Abstract

Climate has always been a dynamic entity affecting natural systems because of its variability and changing nature. Drought is the most complex but least understood of all natural hazards. This is because it is slow and does not occur suddenly like tsunamis or earthquakes, taking years for its consequences to manifest. In recent years, RS and GIS techniques play a key role in assessing areas vulnerable to agricultural drought. The data from MODIS onboard Terra satellite of fourteen years (2001–2014) have been efficiently used to calculate the digital indices, namely, NDVI elasticity, NDVI co-efficient of variation. Frequency at 85% of max has been generated from the long term mean values of maximum NDVI. Also block wise net sown area, gross irrigated area to gross sown area, number of tube wells used for irrigation (70% of the agricultural land is irrigated by tube wells), and existing gross draft for irrigation have been prepared to assess the severity of agricultural drought. ArcGIS 10.1 acts as a powerful spatial analysis tool to find out the agricultural vulnerable zones in the study area by means of weighted overlay analysis. Each individual parameter of the thematic maps is classified into five classes, which are then ranked and weighted in accordance to their vulnerability to agricultural drought. The severities of agricultural drought in the study area are classified (viz., Severe, Moderate and Mild) with its aerial extent respectively.



FARM SCALE OBJECT-ORIENTED CLASSIFICATION OF HIGH NATURE VALUE FARMLAND USING HIGH RESOLUTION SATELLITE IMAGES

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Abstract

High nature value (HNV) farmland is characterized by low intensity farming, which supports high biodiversity and a range of wildlife habitats. A typical HNV farmland can be recognised on high resolution satellite images by its small-scale mosaic of low intensity agriculture, natural or semi-natural cover, and structural elements such as hedgerows, stone walls, etc. Object-oriented image analysis is an image-processing method where groups of spatially adjacent pixels are classified as if they were behaving as a whole unit. This paper demonstrates an innovative methodology to estimate the probable likelihood of HNV at farm-scale level utilizing very high resolution SPOT 7 satellite images using object-oriented classification of the whole farm within the wider farm landscape. This is applied to an area of 400 km² in Comeragh Mountains, Ireland, using a subset of ground truth HNV farmlands. This is an object-based analysis and the classification is based on Fossit 2000 habitat type. Such method is good for quick retrieval of the information, which may lead to rapid planning and management practices. A similar methodology can be used for other regions with regional-specific inputs for better results.

EFFECTS OF IRRIGATION AND NITROGEN ON MAIZE GROWTH AND YIELD COMPONENTS


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Abstract

The purpose of this study was to investigate the effects of irrigation and nitrogen fertilization on maize growth and yield components. Three irrigation treatments were included (100 mm, 150 mm and 200 mm), and three nitrogen levels were applied as follows: high nitrogen was 240 kg ha⁻¹; medium nitrogen was 180 kg ha⁻¹; and low nitrogen was 120 kg ha⁻¹. The results indicated that the interaction of nitrogen and irrigation had no significant effects on plant height, but the signal factor was a significant effect of plant height in the whole growth period. The change trend of crop growth rate in the whole growth period increased first and then fell, and the CK treatment was always lower than other treatments. The starting point of growth rate decline was related to the fertilizer rate; the higher fertilizer amount, the lower the point of growth rate. In single facto of fertilization, there was a negative correlation between units increased in yield and unit nitrogen. The interaction of nitrogen and irrigation had significant effects on biomass yield. The greatest yield-increasing potential was obtained in MF treatment. Results showed that improving the harvest index could minimize the double effect, which in turn leads to increase in production. The population physiological indices of maize were increased with irrigation amount and fertilizer level, except the harvest index, and the incentive of population physiological indices in irrigation was higher than nitrogen fertilization. Therefore, MFHW treatment may be considered the most efficient for maize production in the rain-fed area of the Loess Plateau, China.



AN INTEGRATED REMOTE SENSING AND GIS APPROACH FOR PRE-MONSOON AND POST-MONSOON GROUNDWATER QUALITY MONITORING FOR RECLAMATION OF WASTELAND IN GOMUKHI NADHI SUB BASIN, SOUTH INDIA

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Abstract

India has 17.5% of the world's population but has only 2% of the total geographical area of the world, as 27.35% of the country is categorized as wasteland due to lack of groundwater or poor groundwater quality. So there is a demand for monitoring groundwater quality to avoid further degradation of land and also for the effective management of wasteland to balance its growth rate. Taking this into consideration, an attempt has been made to find the groundwater quality in Gomukhi river sub-basin of the Vellar River basin, South India, which covers an area of 1146.6 Sq. Km and consists of 9 blocks from Peddanaickanpalayam to Villupuram fall in the sub-basin. In order to study the quality of groundwater in the Gomukhi Nadhi sub-basin, geochemical information for pre-monsoon and post-monsoon observation wells were collected and analyzed. The analyzed data has been considered for preparing groundwater quality distribution maps. For better assessment of groundwater quality, the adjoining wells were also considered. The groundwater quality distribution maps for chlorides, total dissolved solids, and total hardness were generated for the pre-monsoon and post-monsoon period of 2012 using Arc GIS 10.2 software. The essential and desirable water quality parameters (viz., pH, Total hardness, Chloride, Total Dissolved Solids) improved tremendously in the post-monsoon season when compared to the pre-monsoon season of the study area, which shows that the recharge of groundwater plays a major role in improving the quality of groundwater. The Landuse and Landcover map was prepared for the study area using IRS P6 2012 data. Correlation of water quality with land use and land cover to help reclaim the wastelands in affected areas of the Gomukhi Nadhi sub-basin have been suggested.

Climate Change

FUTURE CLIMATE CHANGE PROJECTION USING STATISTICAL DOWNSCALING OF GCMS OUTPUT DURING 2011-2099: A CASE STUDY OF FARS PROVINCE, IRAN

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Abstract

Arid regions are more vulnerable to the impact of climate changes in temperature and precipitation patterns on different sectors. A case study of Fars province illustrates how climate change can affect climate variable changes and their various uncertain aspects. In this study, initially the average precipitation and the mean temperature values of six synoptic stations, namely Shiraz, Abadeh, Firuzabad, Fasa, Lar, and Droodzan, were simulated during three periods (2011-2030, 2046-2065, and 2080-2099) by using the MPEH5, GFCM2.1, and HadCM3 models based on A1B, B1, and A2 scenarios and the LARS-WG Statistical Downscaling method. The results showed that the average precipitation is expected to increase by 13.16, 21.7 and 26.6 percent and the mean temperature by 0.45, 1.68 and 3.25°C in these three future periods, respectively. Moreover, in order to determine the uncertainty of various climate models and their concomitant scenarios, simulations of time series for both precipitation and temperature variables were carried out. The obtained results indicate that the uncertainty of the mean temperature changes for the first, second and third future periods would increase by 0.4, 1.05, and 1.88°C, while the uncertainty of average precipitation changes for these three periods were calculated to be 11.3, 29.8, and 24.7 mm, respectively.



CLIMATE CHANGE DISASTER RISK REDUCTION: A DEVELOPING COUNTRY PERSPECTIVE

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Abstract

Natural disasters' adverse impacts on natural and physical environments have been affected by human-induced climate change. This issue has made risk reduction more complex, especially in developing countries with more vulnerable areas. Disaster risk reduction schemes in developing countries are different than those in developed countries because of differing infrastructures, high vulnerability, and exposure. In order to study all parameters playing a role in this regard, three main issues are important, including disaster risk components, risk management, and level of actions. The first issue includes disaster characteristics (frequency of occurrences, severity, spatial extents, and timing), exposure, and vulnerability. Adaptation and resilience options decrease exposure as well as vulnerability. Mitigation will affect disaster characteristics via climate system in long term. Vulnerability and exposure are high in developing countries. So these communities need more efforts and gain more from these activities. The second issue is disaster risk management. Three phases occur in risk management: pre-occurrence; during-occurrence; and post-occurrence. For each phase suitable actions are necessary. In developing countries most of the actions are related to the during-occurrence and post-occurrence phases. The pre-occurrence activities include adaptation options that should be highlighted. Finally the level or scale of the action is important. From the point of view of scale, three major levels are important, including the global (international) level, regional level, and national (local) level. The national level also consists of four sub-levels, including the central government, state/provincial authorities, local societies (including Nomads) and individual sub-levels. For developing countries the most important actions are regional cooperative activities among neighbors' countries. The climate change-related disaster risk reduction scheme in developing countries includes these three major and important components. Integration of these is a key part of combatting the adverse effects of climate change and also opportunities.



CLIMATE CHANGE AND INSECURITY: AN EXAMINATION OF GOMBE STATE'S PREDICAMENT IN NORTHEASTERN NIGERIA

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Abstract

Insecurity as a result of climate change has become a global phenomenon, which imposes a major challenge to human environments, especially in the 21st century. This phenomenon prompted scholars to conduct scientific investigations with a view to finding solutions to the problems. The overwhelming challenges related to socio-economic activities, migration, and agricultural productions eventually resulted in inadequate employment opportunities and limited means of livelihood for the teeming population. Accordingly, it intensifies social vices, which culminates into general insecurity and causes loss of lives and valuable properties. This study investigated climate change pertaining to insecurity in Gombe state within Northeast Nigeria. The study is guided by three research questions and one null hypothesis was tested at an 0.05 level of significance. A descriptive research design survey type was employed. The research questions raised were answered using mean and standard deviation, while the research hypothesis was verified using t-test with the aid of SPSS. A validated instrument with a reliability coefficient of 0.84 guided the collection of data. The study observed that climate change is a major factor responsible for insecurity in Gombe state within the region, which has resulted in desertification, decrease in water bodies, loss of soil fertility, extinction of flora and fauna, and increase of temperature. The study recommended that nation states, civil society organizations, and individuals should respect international laws, legislations, treaties, policies, programmes, and resolutions regarding our environments and those individuals should also endeavor to imbibe the culture of a friendly environment.



CLIMATE CHANGE AND MIGRATION FROM NGALA AND KALA-BALGE LGAS, N.E. BORNO STATE, NIGERIA

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Abstract

Nigeria, due to its location, size, and population, is very vulnerable to the impact of climate change. However, little effort has been made to address most of the problems emanating from climate change even though the problems are always being propagated and also sufficient understanding has been concluded on the impact of climate change and problems. More especially, migration, one of the resultant effects of climate change, is given less attention in this part of the country. Specifically, the paper explores how the expected high intensity of droughts in the Sudan-Sahel (SS) zone of Nigeria might worsen the crop production situation and lead to widespread forced migrations. This paper focuses on the impact of climate change and one of its resulting effects, migration, along with its associated problems. A purposive sampling technique was adopted by appraising 250 respondents, mainly family members of out-migrants from Ngala and Kala-Balge LGAs, Borno State, Nigeria. Available literatures were consulted for the types of climate change impacts. The results revealed that climate change has led to climatic variation over the area with numerous effects on the environment such as intermittent droughts, desertification/deforestation, and low water table. The establishment of dams up stream across the courses of the main sources of water supply to Lake Chad has led to low agricultural production, especially rain fed. Many people in the study area either migrated to Cameroon's Darrak, Bullaram, Lake Doi, Lake Chad, or Mayo-Mbund for fishing and petty trading or to Southwestern Nigeria, especially Lagos or Oyo states, to serve as security guards or other low-skilled workers, leaving all or some members of their families at home. More than half of respondents (58%) indicated that the head of the households migrated as a result of poor harvests due to diminishing or fluctuating rains/drought and/or drying of the river Surbewel. It is recommended that inter basin water transfers should be embarked upon.



ASSESSMENT OF THE POTENTIAL IMPACTS OF SEA LEVEL RISE ON THE COASTAL PLAIN OF AL BATINAH, SULTANATE OF OMAN

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Abstract

The fourth assessment report of the Intergovernmental Panel on Climate Change concluded that sea level rise (SLR) will range between +18 centimeters and +59 cm by 2100. Furthermore, the report indicates that it is most likely that SLR will be up to +100 cm. The Coastal Plain of Al Batinah extends for more than 200 km and accommodates about 28% of the total population in Oman, considered the economic hub of the country. This paper aims to determine the potential areas that will be affected by SLR using GIS and remote sensing techniques. The investigation is based on IKONOS Images (1m), digital elevation model (DEM 30m), field work, and a database of tide levels from the Hydrographic National Bureau of Oman. According to the following scenarios, SLR inundation level of 1m will result in a shoreline retreat of about 3400m. SLR inundation level of about 2m will result in a shoreline retreat of about 3700m. The worst SLR inundation level of 5m will result in a shoreline retreat of about 5100m.

Mapping and Change Detection

MAPPING SAND DUNE FIELDS IN ABU DHABI EMIRATE OVER THE PERIOD 1985-2013 USING LANDSAT DATA

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Abstract

Up to 90% of the United Arab Emirates' (UAE) surface is covered by sand dunes and intervening inter-dune belts. The country is severely affected by problems related to sand dune movement and aeolian deposits, recognized as a major contributor to desertification. This study discusses the use of publicly available Landsat TM and ETM+ data to detect sand dune fields and enable monitoring of their movements in the Emirate of Abu Dhabi, UAE. The study focuses on developing a classification approach and applying it to historical Landsat data to produce consistent Land cover maps useable in subsequent change detection studies. Landsat scenes acquired over the period 1984-2013 are used to evaluate different multispectral classification approaches and determine the accuracy of resulting maps. The methodology uses several configurations of supervised classification techniques that include different band combinations to determine those that produce the highest accuracy in mapping the predominant land cover classes in the area: Sand dunes, Sand sheets, Urban, Vegetation, Sabkhas, Limestone, and Water. Preliminary results of applying these approaches indicate that the use of Principal Components as input to the classification algorithm leads to improved detection accuracy. However, all methods used exhibit a certain level of confusion between sparse vegetation and other classes. The use of a vegetation index as a discriminator helps improve the classification accuracy. To facilitate the use of resulting classification maps in change detection studies aiming at assessing and modeling sand dune movement, a geodatabase was built containing resulting layers for further GIS analysis.



GEOSPATIAL TECHNOLOGY FOR DETECTING LAND USE/LAND COVER CHANGE OF THE UAE EAST COAST

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Abstract

This study integrated remotely sensed data and techniques with GIS techniques to assess land-use/land cover (LULC) change of the East Coast of the United Arab Emirates (UAE) over a 28-year period. A multi-temporal set of images gathered by various sensors onboard Landsat platforms, Multispectral Scanner (1986), Thematic Mapper (2000), and Operational Land Imager (2014) were processed and analyzed. The LULC changes showed shrinkage of highland areas by 9% (from 296869 hectares in 1986 to 269429 hectares in 2014). In contrast, urban areas exhibited an expansion by 699% (from 3309 to 26444 hectares during the same period of time). Vegetated areas were also increased from 1986 to 2014. The study also found that the barren land has been increased from 1986 to 2000 and decreased from 2000 to 2014, while areas covered by water stayed stable during the study period. The land cover was classified with an overall accuracy of greater than 80% and kappa coefficients of greater than 0.7.



MULTI-TEMPORAL CHANGE DETECTION OF MANGROVE FORESTS ALONG ABU-DHABI COASTAL AREA USING REMOTE SENSING AND GIS

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Abstract

Mangrove forests play an important role in providing ecological and socioeconomic services for human society. Coastal development, which converts mangrove forests to other land uses, has often ignored the services that mangroves may provide, leading to irreversible environmental degradation. Monitoring the spatiotemporal distribution of mangrove forests is thus critical for natural resource management of mangrove ecosystems. This study investigates spatiotemporal changes in Abu Dhabi coastal area mangrove forests using Landsat imagery during the periods 1992–1999, 1999–2002, 2002–2014, and 1992–2014. The remote sensing data were processed through three main steps: (1) data pre-processing; (2) Normalized Difference Vegetation Index (NDVI); and (3) mangrove change detection. The overall change within the study area during the last twenty-two-year period indicated the loss of approximately 8256.8 ha of mangrove forests, while a high number of mangrove forests in the region (12,314.70 ha) were newly planted or rehabilitated. Institutional interventions should be taken for sustainable management of mangrove ecosystems in this coastal region.



MONITORING AND PREDICTING URBAN GROWTH USING REMOTE SENSING AND GIS TECHNIQUES: A CASE STUDY OF THE ABU DHABI REGION

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Abstract

Remote sensing and GIS technology have been widely used for analyzing urban growth and predicting the future of specific areas. The main objective of this paper is to predict and monitor the future urban growth of the Abu Dhabi region by using multi-temporal images from the Landsat satellite for the years of 1990, 2000, and 2014. In addition, training samples have been selected to apply a supervised classification method through using the maximum likelihood technique to identify land cover types. For the accuracy assessment, ground truth locations were used either to accept or reject the results of the land cover classification. Then, change analysis was used to monitor the land cover changes from the result of classification in different periods. Moreover, land change modeler (LCM) has been implemented to visualize the future urban growth based on the Markov chain transition matrix for defining the probabilities of change from one land cover type to another. LCM allows the use and creation of potential layers to enhance the prediction result, such as distance to a built-up area and distance to the highways. The results of this paper show that after applying the classification method, four classes of land cover types have been defined, including built-up area, green area, open area, and water. The change detection result indicated that the built-up area has increased sharply from 1990 to 2014, concentrated in the middle of the Abu Dhabi region, while the green area has slightly increased during the same periods. After the preparation of the transition potential and change prediction model using the Markov chain matrix, the probabilities of future change show that the built-up area will be increased slightly around the metropolitan areas and near the Dubai boundary. The land change modeler is very significant in modeling and forecasting future scenarios, which will be helpful for future planning studies.



CHANGING SPATIOTEMPORAL DISTRIBUTION OF EVAPORATION OVER A LARGE LAKE: REMOTE SENSING OF EVAPORATION IN THE NORTHERN REGIONS

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Abstract

The major difficulty in estimating lake-wide evaporation is the lack of meteorological measurements over lakes, and there is currently no adequate technique to interpolate sparse meteorological data. This study examines the spatiotemporal variability of instantaneous daily lake-wide evaporation over Lake Huron using remotely-sensed data from MODerate resolution Imaging Spectroradiometer (MODIS) onboard NASA's Terra satellite together with field measurements. A good agreement was found between evaporation calculated from satellite data and the measured evaporation from in-situ eddy covariance measurements. Over a time period from 2002-2012, the seasonal and the annual values of the two methods were very close with a correlation coefficient of 0.95. The spatial distribution of the over lake evaporation showed temporal and spatial heterogeneities. About 70% of the annual mean evaporation occurred during the fall (September, October, and November) and winter (December, January, and February) seasons. The highest evaporation rate was in December, with about 16 % of the annual mean 30-minute lake-wide evaporation, particularly in the middle and northern part of the lake, whereas the lowest evaporation rate occurred in June with only 4% of the annual 30-minute mean evaporation, especially in the deep, mid-region of the lake. Here, we discuss variations in the spatial distribution patterns of lake-wide evaporation and the relationship to recent climate change, and present explanations for these patterns. Also, the effect of ice cover on spatiotemporal distribution of evaporation is discussed.

Flood/Landslide/Drought/Earthquake

DETECTION OF AREAS ASSOCIATED WITH FLASH FLOODS AND EROSION CAUSED BY RAINFALL STORM USING TOPOGRAPHIC ATTRIBUTES, HYDROLOGIC INDICES, AND GIS

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Abstract

Storm floods are the most common of natural disasters that can affect infrastructure and cause human casualties, environmental destruction, and economical losses. Increased storm frequency and intensity related to climate change are aggravated by several factors such as the growing occupation of floodplains, increased runoff from hard surfaces, inadequate management policy, and silted up drainage. The objective of this research is the integration of topographic attributes (elevation, slope, curvature, and water catchment), topographic profiles, and hydrologic indices derived from DEM in a geographic information system (GIS) environment to detect areas associated with flash floods and erosion caused by rainfall storm and sediment transport and accumulation. The selected study area is the region of Guelmim city in Morocco. This region has been flooded several times over the past 30 years, and was declared a “disaster area” in December 2014 after violent rainfall storms killed many people and caused significant damage to the infrastructure. GIS was used to extract topographic profiles and attributes as well as for the implementation of the stream power index (SPI), sediment transport index (STI), and compound topographic index (CTI). Moreover, it was used for spatial data management and manipulation, whereas the PCI-Geomatica image processing system was used for fuzzy k-means unsupervised classification for topographic attributes and hydrologic indices. The obtained results show that hydrologic indices demonstrated that the rainfall and the topographic morphology are the major contributing factors for flash flooding and catastrophic inundation in the study area. The runoff water power delivers vulnerable topsoil and contributes strongly to the erosion and land degradation process, and then transports soil material and sediment to the plain areas through natural action, i.e., water power and gravity. The unsupervised classification leads to three homogeneous units of dynamic response to hydrologic processes. The high levels of aggressiveness are encountered in the valleys and over areas with steeper slopes. The valleys are zones of flow accumulation receiving the contribution of large upslope drainage areas, thus allowing high rates of erosion. Conversely, low runoff aggressiveness is connected with areas of low slopes. Likewise, the role of the lithology associated with the terrain morphology is decisive in the erosion risk and land degradation in this region.



THE MAIN CAUSE OF MASS MOVEMENT IN THE MOUNTAINS OF ALBORZ RANGE

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Abstract

Mass movement is one of the natural major disasters. This phenomenon creates great damage in the high mountains of Alborz. Mass movement hazard zonation is of great importance in identifying areas with high-risk potential. Identifying the main causes of this phenomenon is crucial to dealing with it. In this study, by using Geo Information Technology and various software RS and GIS fifteen layers (such as lineaments, precipitation, vegetation, lithology, slope, drainage, land use/land cover, seismic, roads, cohesion, angle of internal friction), roads and faults were studied. These layers were studied in three different parts of the Alborz, using maps of 1: 100000, then, based on the weight of the layers, a mass movement hazard potential map was prepared in different areas. This map has been divided into four regions: a: low risk region b: medium risk region c: high-risk region d: very high-risk region. In the next step, we examined every fifteen layers of the mass movement hazard zonation map combined with field studies. Finally, our research indicates that between fifteen factors in different areas, there are three main factors that have the greatest impact on mass movement in the Alborz Mountains. The three main factors are: slope and aspect, density of fractures, and lithology.



COLLAPSE ASSESSMENT OF SUBSTANDARD CONCRETE STRUCTURES FOR SEISMIC LOSS ESTIMATION OF THE BUILDING INVENTORY IN THE UAE

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Abstract

Regional earthquake loss estimation systems describe the probability of losses that could happen in a certain region due to seismic hazards. In order to develop an efficient loss estimation system, the vulnerability characteristics of the exposed structures in the region should be integrated with earthquake hazards and inventory of the built environment. The accurate definition of structural collapse under earthquake loads is essential for deriving reliable vulnerability functions. In this study, the collapse of concrete buildings is described in terms of both global structural response and member failure, including shear failure modes. Experimentally verified shear strength models that effectively consider the reduction of shear strength with the concrete degradation under cyclic loading are implemented in a post-processor to monitor the shear supply-demand response of concrete structures under earthquake loads. A wide range of reference structures with diverse lateral force resisting systems and building heights is selected to represent substandard buildings in the UAE. Detailed fiber-based numerical models and a diverse set of earthquake records representing different seismic scenarios in the study region are employed in dynamic response simulations at various levels of ground motion intensities up to collapse. The effectiveness of the adopted shear strength models in predicting the brittle failure modes of substandard concrete buildings is demonstrated in this study. It is concluded that shear modeling is essential for reliable earthquake loss estimation of pre-seismic code buildings. The developed vulnerability functions confirm the need for mitigation strategies to reduce the earthquake losses of the substandard building inventory. This comprehensive study represents a step forward in the development of a reliable loss estimation system for the UAE and the region.



DELINEATING FLOOD VULNERABILITY ZONES IN RURAL BLOCKS OF THIRUVALLUR DISTRICT, SOUTH INDIA, USING REMOTE SENSING AND GIS TECHNOLOGIES

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Abstract

Flooding is not simply the flow of water from higher topography to lower topography. Rather, it is the interface dynamics between geo/ terrain system parameters; viz, lithology, geological structures, geomorphology and drainage conditions, slope, land use/ land cover, etc., and flood. Hence the flood vulnerability mapping requires the understanding and mapping of all terrain parameters. With this in mind, an attempt was made to delineate flood vulnerable zones in rural blocks of Thiruvallur District, Tamil Nadu, covering an area of 1566 Sq. Km that consists of 7 blocks from R.K. Pet to Thiruvallur fall in the study area. The thematic maps such as Geology, Geomorphology, Landuse, and Landcover, and the tectonic map with special reference to lineaments and detection of zones of land subsidence on the basis of drainage anomalies along them were prepared using IRS P6 LISS IV - 2012 data. The collateral data includes rainfall for a period of 40 years collected from 1972 to 2012 from 13 rain-gauge stations collected and the Rainfall Isohyet Map was prepared. The digital elevation model (DEM) was generated using SRTM and the slope of the study area was obtained. ArcGIS 10.1 acts as a powerful spatial analysis tool to find out the flood vulnerable zones in the study area by means of weighted overlay analysis. Each individual parameter of the thematic maps are ranked and weighted in accordance with their vulnerability to flood in the study area are classified; viz., Highly Vulnerable, Moderately Vulnerable and Less Vulnerable, with their aerial extent respectively. The GIS-based output result is then validated by obtaining the list of flood-affected villages in real time.



TSUNAMI EVACUATION: USING GIS TO INTEGRATE BEHAVIORAL DATA WITH TRANSPORTATION MODELING

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Abstract

The main objectives of this research is to identify the locations of populations at risk of a tsunami, determine their behavioral responses during an evacuation, predict the number of evacuees and evacuating vehicles, and estimate the clearance time using 10-, 20-, 30-ft tsunami scenarios. In order to identify the location of the population at risk, the Method of Splitting Tsunami (MOST) model's maps for Orange County, California, were used to delineate the evacuation zone. The buffer tool was used to identify the shadow evacuation zone for the same location. A telephone survey was conducted to collect the behavioral responses of 235 samples within the evacuation and shadow evacuation zones for 10-, 20-, 30-ft tsunami scenarios. The logistic regression model was used to identify the significant socioeconomic factors that contribute to the evacuation participation rate for each tsunami scenario. Age, gender, and zone (evacuation and shadow evacuation zone) were the most statistically significant variables based on the behavioral responses for various tsunami scenarios; therefore, these variables were used to predict the evacuation participation rate for each census block group using 2010 census data. The number of evacuating vehicles was predicted based on vehicle occupancy for adults for each tsunami scenario. A GIS evacuation tool—Capacity-Aware Shortest Path Evacuation Routing (CASPER)—was utilized to simulate the evacuation process and calculate the evacuation clearance time using one second initial delay between each evacuation vehicle and seven seconds initial delay. The results indicate that most of the population within the evacuation zone will evacuate in case of tsunami regardless of the tsunami size. As the tsunami wave increases, the evacuation participation rate rises as well. The simulated evacuation clearance time using seven seconds for the initial delay produced realistic results compared with the one-second initial delay scenario. The method presented in this research helps in communicating the outputs of the behavioral analysis to transportation modelers in order to simulate the evacuation process and predict the evacuation clearance time, which in turn will improve evacuation planning.



SPATIAL MAPPING OF EXTREME RAINFALL EVENT AND FLOOD INUNDATION ZONING USING REMOTE SENSING AND GIS-A COASTAL DISTRICT OF TAMILNADU

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Abstract

In the recent years all over the world flash floods have occurred due to extreme rainfall events induced by climate change. This study aimed to map the analysis of extreme rainfall fall events for the year 2008 to identify the spatial distribution of rainfall over the area. MODIS satellite data has been used to delineate the flood inundation area. Digital Elevation Model (DEM) has been generated. The spatial distribution of extreme rainfall over the area and flood inundation of the area has been compared with DEM. This study will give very useful information for disaster management and hydrological planning for rainfall harvesting. This study identified nearly 60 percent of the area receiving more than 150 mm in one day of extreme rainfall event and nearly 41percent of the area has been inundated out of 3,678 Km².

ASSESSING RANGELANDS DROUGHT VULNERABILITY IN ARID AREAS, USING GIS TECHNIQUE: A CASE STUDY FOR TAFT TOWNSHIP, YAZD PROVINCE, IRAN

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Abstract

Drought is considered as one of the major natural hazards with significant impact on the environment, society, agriculture, and economy. Drought impacts are very critical and especially costly, affecting more people than any other type of natural disaster universally. Today in the world, decision makers follow several methods for adaptability and to reduce damages of natural disasters such as drought. They suggest that this issue in drought management should be considered by a risk management approach, and beside it, a combination of disaster management and risk in times different applied concurrent. In order to assess the damage caused by agricultural drought, agricultural drought vulnerability maps should be prepared. In this respect, the use of GIS can provide more accurate and more realistic results. In the study of drought, GIS capabilities are very useful in storing and analyzing large volumes of remotely sensed data and data from other sources. In general, the factors of agricultural drought vulnerability are various. Using these factors to map agricultural drought vulnerability in different regions depends on the availability and reliability of the data. The main object of this study was to evaluate the preparation of a vulnerability map for Rangelands drought in Taft town of Yazd province, Iran.

DEMPSTER-SHAFER THEORY IN LANDSLIDE HAZARD ZONING USING GIS

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Abstract

Landslide hazard zoning has been a common research issue for the last few decades. Different methods were used by various researchers in different parts of the world in order to achieve more precise results. Some of these models are experimental and use a physical basis for a particular landslide occurrence. Although these kinds of methods focus on details, they are not capable of classifying the study area in terms of landslide hazard. Recent advances in spatial analysis, some new methods based on spatial variation, have appeared, and most of them work on using the current collected events in statistical procedures that have been supported by Bayesian rules in order to zone and classify the study area. However, Bayesian-derived models have focused on researchers' knowledge, and they are not able to involve the researchers' belief and ignorance in understanding some physical processes in natural phenomena like landslide. The Bayesian approach reckons ignorance as uncertainty, whereas this might not be true. Therefore, the soft-classify approach rather than hard classification has been applied in some recent landslide hazard zoning. Dempster-Shafer theory, which supports the soft-classifier approach, was introduced in order to better modeling of natural hazards where more problems can be seen because of the essence of these modelings and lack of suitable data. In this study, Dempster-Shafer modeling, which has been implemented in GIS, was used for landslide hazard zoning in Lajim watershed with 140 square kilometers located in the north of Iran. Thematic maps like road, topography, geology and fault line, soil type, stream, and land use/cover collected from various resources as well as edited during the GIS-ready step thence was entered into the geo-database and analyzed based on Dempster-Shafer theory. ROC was hired for estimating the accuracy of results and shows 0.922, which satisfied the requirement of model validation stage.

SLOPE STABILITY RISK MANAGEMENT IN OPEN PIT MINES

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Abstract

The stability of slopes in open pit mines is an issue of great concern because of the significant detrimental consequences instabilities can have. To ensure the safe and continuous economic operation of these mines, it is necessary to systematically assess and manage slope stability risk. This, however, has not been traditionally easy due to the fact that measuring the parameters needed to assess the stability of slopes can be laborious, expensive, and cause disruption to mining operations. This paper presents a framework based on decision theory by which risk can be systematically assessed and managed, and proposes a combination of traditional and remote sensing techniques, both earth- and satellite based, to measure certain parameters. This combination allows one to assess and update risk in a more efficient and cost effective way than is traditionally done, particularly where satellite observation data is already available. The application of such a system at the Nanfen iron open pit mine in China is presented, where a novel technique for monitoring sliding forces on pre-stressed rock bolts was developed and successfully applied. This is the first step in building an automated risk management system, which in the future will include smart sensors for warning systems and stabilization methods based on materials that can self-adjust their properties such as strength and stiffness in response to potential instabilities.



HIGH-RESOLUTION OF DEM-BASED ON ALS TO DETERMINE STREAM GRADIENT INDICES AND LANDSLIDE INVESTIGATIONS IMPROVEMENT

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Abstract

Recognition of landslide signatures is immensely important to scientists and decision makers alike. Remote sensing conventional methods, such as Airborne Laser Scanning (ALS) of high-resolution digital elevation model (HRDEM) and tectonic geomorphic analysis in geographical information system (GIS), has tended to be promising for natural hazard studies. This study presents stream gradients analysis in the RiverTools software to identify signatures, interpret, and to improve landslide investigations. The graded profile (i.e. step-like river profile) of the Dez River in the Zagros Mountains in Iran indicates that the area has been tectonically disturbed, and it triggers landslides hazards. The high gradient index shows that a steeper gradient could be potentially a signature for landslide identification. The Light Detection and Ranging (LiDAR) approach shows that the high quality of ALS data allows the improvement of the interpretational performance of landslide investigations because it provides surface-detailed information as compared to traditional methods despite limitations. Thus, this study indicates that utilizing HRDEM and stream gradient indices interpretational method can potentially improve landslide investigations. The results have been verified based on field observations to determine the performance of the outcomes.

Urban

SPATIO-TEMPORAL ANALYSIS OF URBAN HEAT ISLAND IN AN INDUSTRIAL CITY USING LANDSAT IMAGES: A CASE STUDY OF YANBU INDUSTRIAL CITY

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Abstract

The urban heat island (UHI) effect is a human induced phenomenon that results in higher temperature in urbanized areas as compared to their surroundings. Yanbu Industrial city is one of the highly industrialized cities in Saudi Arabia with petrochemical, energy intensive activities and a growing population. So, it is imperative to study the effect of the industrial activities on the change in temperature. The objective of this study is to decipher the spatio-temporal variations in temperature in different land use/land cover types in Yanbu Industrial city due to the industrial activities. Correlations will be established between the thermal regime and vegetation in the city as well as impervious area. Thermal bands of Landsat satellite images will be used in the study. Multi-temporal images that spread over a period of twenty five years between 1990 and 2015 will be used to extract the land surface temperature of the study area. Land use/land cover will be extracted from the visible bands of the Landsat image and correlations will be sought out, between vegetation and surface temperature, using a vegetation index (NDVI). Normalized difference build index will be derived to analyze the relationship between surface temperature and imperviousness. The results will reflect the thermal regimes of the area in different LULC types and their variations over time.

ANALYSIS OF URBAN CLIMATE IMPACT USING WRF-CHEM AND MICROSYS CFD MODEL FOR RCP 4.5 AND 8.5 SCENARIOS: MADRID (SPAIN) AND LONDON (UK) CASE STUDIES

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Abstract

The impact of climate change at urban scales is a very important issue to assure that the global climate model results are having a real impact at the city level. In this contribution we have used global climate models RCP scenarios to produce climate scenarios at urban scale with 200 m spatial resolution. Global climate models are producing results with around one degree spatial resolution up to year 2100 using different RCP (IPCC) climate scenarios. The coarse resolution of these models prevents using the information at the city level by city environmental authorities. In this research work, we have used the very well-known meso-scale model WRF-Chem (NOAA, US) to produce information on meteorological and air pollution concentrations covering all European domains with 25 km spatial resolution. We have used 2011 as control past year and the RCP scenarios from CCSM global climate model for 4.5 W/m² and 8.5 W/m² and for 2030, 2050, and 2100. After running WRF-Chem model using the boundary conditions provided by RCP scenarios with the emissions of 2011, we have performed a detailed nesting-downscaling process using WRF-CHEM with 5 and 1 km spatial resolution. Finally, a detailed simulation using MICROSYS-CFD model for a smaller area in the urban downtown areas has been performed with 10 m spatial resolution. The health impact indicators include heat waves, EU air quality directives and mortality and morbidity of ozone and PM10 pollution concentrations. We will show the results and the impacts for future RCP IPCC climate scenarios compared with the information for climate and health indicators for control year 2011.



CONTRIBUTION OF EO AND GIS TO IDENTIFY THE IMPACT OF LAND USE/ LAND COVER CHANGES IN THE LAND SURFACE TEMPERATURE RISING: A CASE STUDY OF DOUALA METROPOLIS, CAMEROON

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Abstract

Douala is a sub-Saharan wet coastal environment and intertropical area, where anarchic urbanization is a socio-economic and environmental problem, significantly influencing the local climate. In this study, two Landsat images from 1986 (TM) and 2007 (ETM+) were utilized to investigate the relationships between the Land Surface Temperature (LST) and the main Land Use/Cover categories. The Normalized Difference Vegetation Index (NDVI) and the Urban Index (UI), determined from the Landsat visible and NIR channels, were correlated to LST on both the global and small scale of our study area. It has been shown that on the global scale, the impacts of LULC changes from 1986 to 2007 could not be an acceptable indicator of LST rising in the Douala urban area. On the small scale, a strong correlation between LST and NDVI, UI observed more in 2007 than in 1986, enables us to conclude that the decrease in NDVI from 1986 to 2007 is one of the great indicators of rise in the LST, and the built-up lands strengthen the urban heat island effect in the Douala urban area. Overall, the Earth Observation (EO) images and the Geographic Information System (GIS) techniques were effective approaches for aiming at environment monitoring and analyzing urban growth patterns and evaluating their impacts on urban climates.



THE STUDY OF MULTI-TEMPORAL ANALYSIS OF URBAN DEVELOPMENT AND ENVIRONMENTAL CHANGES OF THE CITY OF ABU DHABI

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Abstract

Abu Dhabi is the capital city of the United Arab Emirates; it is located on the coast of the Arabian Gulf. In the 1960's the city of Abu Dhabi was nothing but a desert area, with the exception of a few buildings lining the coast. In the year 1971 the seven Emirates united, making the nation of the UAE. With the late His Highness Sheikh Zayed Bin Sultan Al Nahyan as President and his vision of making Abu Dhabi specifically and the UAE generally one of the most beautiful countries in the world, the city grew at an impressive rate. Abu Dhabi now has one of the highest GDP (Gross Domestic Production) growth rates in the world, holding almost 9% of the world's proven oil and gas reserves. This has caused the city to have a dramatic urban expansion, building cities, islands, and roads, and vegetation bloomed in the area, turning the land from a desert into a green paradise. This paper studies urban expansion in the city of Abu Dhabi, and the growth of vegetation variation between the years of 1973 till 2010, using satellite imagery and remote sensing techniques. Long range images were taken to identify the detailed growth of Abu Dhabi over the span of these forty years. LandSAT and ALOS images were used here depending on their availability. Statistical data and images are provided and analyzed, portraying the growth of the city. Finally a classification map is drawn up explaining the different classes in the current city of Abu Dhabi, and how the different classes are distributed around the city.

APPLYING REMOTE SENSING AND GIS ON MONITORING AND MEASURING URBAN SPRAWL: A CASE STUDY OF DUBAI

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Abstract

Due to the increase in income level from oil that occurred beginning in the last three decades of the twentieth century, the city of Dubai has undergone huge changes during the process of its urbanization. Thus, it is essential to quantify historic land cover changes, evaluate the impacts of such changes, and use this to define sustainable strategies for future development. This study uses remote sensing and GIS techniques to investigate the magnitude of urban growth and pattern of development in Dubai Emirate from 1975 to 2015. The methodology is divided into three main steps: (1) measuring urban sprawl (2) evaluating the pattern of urban sprawl; and (3) forecasting the future of urban sprawl. The urban growth phenomena rate was revealed. The extension of urban area was taken along the coast and inland. It is noticeable that the majority of the development has occurred along the coastal areas, as Dubai-Al Ain roads did not appear until 1984. Over forty years, a dramatic increase of 976.6km² occurred. However, the majority of this growth occurred after 2000, with the period 2003-2015 experiencing a peak annual growth rate of 13.02%.

Spatial Modeling

ASSESSING ENVIRONMENTAL INEQUITIES NEAR CONTAMINATED SITES USING A GIS DISTANCE-BASED APPROACH: A CASE STUDY IN NIAGARA FALLS, NEW YORK

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Abstract

The spatial distribution of environmentally contaminated sites in many cities of the United States has been closely linked with disproportional vulnerability among minority communities. Census tract level data on ethnicity and socioeconomic factors were collected and analyzed using GIS spatial analysis methods. This study attempts to (1) explore the spatial variability of minority populations and its proximity to federally managed contaminated sites under the Superfund program; (2) examine the relationships between the location of contaminated and socio-economic factors; and (3) evaluate the effectiveness using geospatial approaches in assessing environmental inequity on the census tract level in Niagara Falls, New York. The traditional unit hazard coincidence method along with two distance-based methods, namely the centroid contaminant method and areal appointment method, were adopted for assessing race/ethnicity and socioeconomic characteristics. A buffer analysis was conducted in ArcMap (ESI v.10.3) to identify host (containing a Superfund facility) and non-host tracts. Results from the areal appointment method indicated that host tracts contain 5.7% more Blacks, 1.08% more Hispanics and Latinos, and a lower medium income among the population compared to non-host tracts. A binomial logistic regression (R v.3.1.1) was performed to evaluate the odds ratio for race/ethnicity and median income, and it was found that there are no high likelihoods that a host tract will be associated with a higher minority population compared to a non-host tract. Recommendations include assessing the demographic data surrounding the location of both federal and state managed Brownfield sites, and determine how they would contribute to the exposure experienced by minority populations. Decision makers and authorities can use this information to identify areas of minority vulnerability, and implement procedures to mitigate environmental injustice.



MRF BASED SIMULTANEOUS HIGH RESOLUTION IMAGE SEGMENTATION AND CLASSIFICATION

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Abstract

Object-oriented high spatial resolution remote sensing image classification is the basis of geographic state survey and monitoring, and object-oriented image segmentation plays a key role in it. In practical application, the operators always are confused about how to select the segment scale and parameters; they should try many times to get a fitted segmentation which may still exist in over- and under-segmentation. To solve this problem and with the accumulation of manual interpretation results, we proposed a Markov Random Field (MRF) based method to do segmentation and classification simultaneously. In this method, though using the probabilistic graphical model, we construct a three-level potential function that includes the pixel level, the object level, and the link level between the pixels and the object to model their relations. We transform it to an optimization problem and use the graph cut to get the optimal solution. This method can refine the segmentation while getting good classification results. We do some experiments on the GF-1 satellite and unmanned plane high spatial resolution images. The experiments results show that this is an effective way to improve the classification accuracy and avoid the boring segmentation scale and parameters selection and will highly improve the efficiency of image interpretation.



CONSTRAINED DELAUNAY TRIANGULATION FOR GROUPING FUNCTIONAL AREAS BY LAND USE

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Abstract

Functional land use maps are used for land evaluation, environmental analysis, and resource conservation. Spatial data clustering identifies sparse and crowded places, thus discovering the overall distribution pattern of the dataset. Some clustering methods represent an attribute-oriented approach to knowledge discovery. Other methods rely on natural notions of similarities (e.g., Euclidean distances). These are not appropriate for constructing functional areas. We propose a similarity value to evaluate the closeness between a pair of points based on the total functional area and the proportion of the main land use type for the entire functional area. We develop constrained attributes employing this similarity value and a DT criterion function when merging clusters. Four thresholds are set to ensure that functional areas have acceptable proportions, regular shapes, and no overlap. An experimental study was conducted with cadastral data for Chengdu, China, from 2009. The results show the advantages for objectivity and efficiency in using the proposed algorithm to define functional areas. The areas are created dynamically at any convenient time.

GEOGRAPHY OF SOLIDARITY: SPATIAL AND TEMPORAL PATTERNS

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Abstract

In the new era of data abundance, procedures for crisis and disaster response have changed. As relief forces engage with assistance on the ground, digital humanitarians step in to provide a collective response at unprecedented short time scales, curating valuable bits of information through simple tasks—mapping, tagging, evaluating. This hybrid emergency response leaves behind detailed traces, which inform data scientists about how far and how fast the calls for action reach volunteers around the globe. We perform a study relying on datasets coming from three natural disasters occurring in the Philippines (2014), Vanuatu (2015), and Nepal (2015), for which the platform Micro-Mappers was activated in order to tag short messages and evaluate ground and aerial images. We managed over 440,000 digital records from the volunteers. We focus on IP addresses, which are mapped to a specific location, and timestamps, which describe for us the unfolding of the collective response in time. The volunteer data indicated that only 3,000 unique IP addresses were detected: digital solidarity depends on a few thousand people, each of which contributes, on average, around 150 clicks on the platform. Beyond this, we observe that the geographic distribution of volunteering activity is heavily biased towards English-speaking countries, with large areas with few or no activity (South America, Africa, Russia, and most Asian countries). In terms of the temporal response, each event exhibits a rather unique pattern. We hypothesize that volunteers' response is heavily driven by media attention to the event itself: the more media broadcasters raise awareness about an emergency situation, the larger the population response online will be. We have tested this possibility, collecting data from GDELT and measuring the Pearson correlation between both signals. Indeed, media attention and volunteering action show high levels of correlation (in the range $0.69 < r < 0.96$).

Our results and ongoing research should help decision makers to optimize the potentialities of digital platforms, to overcome geographical boundaries (multilingual systems), and to explore ways to recruit and engage volunteers (beyond media as the main actor to create awareness).

IMPLEMENTATION OF THE DAMAGE INDEX APPROACH TO RAPID EVALUATION BUILDING RESISTANCE FOR EARTHQUAKES AND SOFTWARE DEVELOPMENT

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Abstract

A promising approach to modeling building resistance in the rehabilitation process has been introduced in this paper. The damage index model (DIM) can be interactively calibrated to the Geographical Information Systems (GIS) to compute parameters and analyze data for a quality management purpose. It can perform easy accessibility to the data to evaluate buildings for earthquake mitigation and preparedness. This research intended to introduce a software program using an integration system to design and dissect the data to evaluate a building's resistance against an earthquake. This paper promises a new integrated system for rapid evaluation of buildings, furthering city planning through a combination of GIS, civil engineering, and industrial engineering based on the Federal Emergency Management Agency (FEMA) accompanied with seismic data, structure, parcel, material type, foundation, ceiling, wall, floor, interior and exterior. This software has been programmed upon the Damage Index (DI) algorithm that was developed by Pirasteh et al. (2009). Later, based on the proposed algorithm or model the essential parameters have been adopted in the MATLAB environment to yield a new software program for ameliorating earthquake mitigation and preparedness processes. The software program has the ability to identify the vulnerability of the building ranking from 1 to 100. In addition, this paper recommends establishing a scientific procedure to determine the vulnerability of the buildings for earthquake preparedness within a GIS environment. However, this software program can also aid in detecting weak buildings for rehabilitation.



Remote Sensing and GIS

SUB-PIXEL LEVEL CLASSIFICATION USING REMOTE SENSING FOR ARECANUT CROP

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Abstract


In agriculture, remote sensing is applied for monitoring plant development, evaluating physiological processes and growth conditions. Especially valuable are the spatio-temporal aspects of the remotely sensed data in detecting crop state differences and stress situations. In this study, hyperion imagery is used for classifying arecanut crops based on their age so that these maps can be used for yield estimation of crops, irrigation purposes, applying fertilizers etc. Traditional hard classifiers assign the mixed pixels to the dominant classes. The proposed method uses a sub-pixel level classifier called linear spectral unmixing available in ENVI software. It provides the relative abundance of surface materials and the context within a pixel that may be a potential solution to effectively identifying the land-cover distribution. Validation is done referring to field spectra collected using spectroradiometer and the ground control points obtained from GPS.

SINCE 2012 TO 2015: REMOTE SENSING RESEARCH AT TÜBİTAK UZAY

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Abstract

RASAT was launched on August 27, 2011, from Russia and still continues its mission successfully. By its 1400th day in orbit, RASAT had provided imagery covering approximately 8.000.000 square kilometers from all over the world. After the launch of the RASAT, remote sensing research at TÜBİTAK UZAY has gained importance. Many projects have been started. In this paper, a sort survey of remote sensing research at TÜBİTAK UZAY is presented. One of the projects is GeoPortal. The goal of this project is to enable easy access to satellite images obtained from RASAT. More specifically, the radiometric and geometric calibration of images, generation of an image mosaic encompassing all Turkey, and servicing of all images via an open-source coded GEZGİN GeoPortal are planned. GEZGİN (www.gezgin.gov.tr) is based on giving RASAT satellite images to authorized stakeholders. Research and development activities related to hyperspectral imagery can be regrouped into two main axes at TÜBİTAK UZAY. The first one is the design and manufacture of a space-borne hyperspectral camera. The second one is hyperspectral remote sensing applications. The main topics studied at TÜBİTAK UZAY include basic corrections such as radiometric and geometric correction, specifically smile and keystone corrections, denoising, de-stripping, dimensionality reduction, target and anomaly detection, and classification. Ongoing and upcoming hyperspectral remote sensing projects tackle similar problems with an emphasis on crop monitoring and classification and specifically precision agriculture. TÜBİTAK UZAY participated as a partner in Earth Observation for Economic Empowerment (EOPOWER), a 7th Framework Programme Environment Theme funded project. The purpose of the EOPOWER project was to create conditions for sustainable economic development through the increased use of Earth observation products and services for environmental applications. TÜBİTAK UZAY has conducted a major study on the use of space-based satellite resources in all possible aspects of disaster prediction, disaster monitoring, preparedness, and relief. Many different disasters were considered, including, but not limited to, earthquakes, fire, flood, avalanche, and terrorist events. One of the projects is COGSENSE, which is a European Union 7th Framework Programme Marie Curie project focused on the development of cognitive signal processing algorithms for remote sensing applications.



REMOTE SENSING, SEDIMENTOLOGICAL, AND MINERALOGICAL EVIDENCES FOR SAND SOURCE CONFIRMATION IN THE TARFAYA BASIN (SW OF MOROCCO)


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Abstract

Today, the sand source of the Tarfaya basin (SW of Morocco) is still unconfirmed. This sand is responsible for one of the most common and dangerous environmental problems in this basin (the sand encroachment phenomenon), which affects roads and cities like Tarfaya and Foum l'Oued. The present work aims to confirm the most probable source of sand in this area in order to help local authorities and government agencies focus their strategies on producer sediments. Practically, in this work we used remote sensing, and sedimentological and mineralogical studies to create this study. The first one was used to determine the eroded area and lithological data change with time. The sedimentological study (granulometry of sand and morphoscopy of quartz grains) was explored to determine the sand grain sizes, their proportion, their homogeneity, their classification, their spatial distribution, and the morphoscopy of quartz grains. The last one was used to compare the mineralogical compositions of sand and some sediment respectively collected from dunes and eroded sediments of the study area. The sedimentological results show that the sand of our study area is mostly composed of fine fraction ($2\phi < \Phi < 3\phi$). Spatially, this sand is mostly homogeneous, well classified, and symmetric. From a morphoscopic viewpoint, the quartz grains of this sand are mainly sub-rounded and sub-angular with a lower proportion of rounded and angular grains. The last one typically characterized the beach samples. The remotely sensed data analysis based on changing lithological data reflects that the coastal erosion is more pronounced and that the sand and marl-silt facies increased with time in our study area. The mineralogical analysis confirmed that the sand of our study area has the same mineralogical composition of beach rock (Pleistocene fine sandstone), which is found along the coastal area. We concluded, therefore, that the sand increasing in our study area was locally produced and was related to beach rock erosion.



MAPPING THE CHANGES AND DEGRADATIONS OF MANGROVE FORESTS BETWEEN 1990-2015 IN THE UNITED ARAB EMIRATES (UAE) USING SATELLITE DATA

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Abstract

In the past 30 years the UAE has embarked on an ambitious program of urban and economic development, including major projects related to coastal development. Historically, mangrove forests formed a major land cover on the coastal areas of the UAE. Such forests provide vast ecological and economic functions. Mangroves help to maintain water quality by filtering toxic pollutants, excess plant nutrients, and sediments by absorbing other pollutants. Mangrove forests are rich in biodiversity, providing a habitat for a wide range of marine terrestrial and plant species. Mangrove leaves, live or decaying, and their tree roots provide nutrients that nourish plankton, algae, fish, and shellfish. Furthermore, mangrove forests provide protection and shelter against extreme weather events, such as storm winds, high waves, and floods, as well as tsunamis. Loss of mangroves can lead to polluted drinking water due to the intrusion of saltwater into ground water aquifers and exposes coast lines to erosion. However, mangrove forests in the UAE have been seriously affected and degraded in the past few decades. This research study assesses the ecological status and changes of the historical areal extent of the mangrove forests in the UAE using a set of multi-temporal satellite data set. In addition, the study questions whether the primary reasons for mangroves forest degradation are natural or anthropogenic. The study area focuses on the mangroves in the Emirates of Abu Dhabi, Ajman, Sharjah, and Fujairah. Landsat TM data from the 1990s and 2015 have been acquired for the study. Image processing steps involved radiometric normalization, image cropping, and land cover classification. An unsupervised classification approach was followed to separate mangroves, water, desert, and urban pixels. A post-classification comparison method was applied to investigate the changes in the mangrove areas. Preliminary results showed that mangrove areas have been decreasing tremendously during the 25-year period. The land areas covered by mangroves have declined due to anthropogenic human activities on the coastline, mainly coastal development, construction of sea ports, man-made islands, and other infrastructure features. The Emirate of Abu Dhabi showed the largest decline in mangrove areas in comparison to the other Emirates.



AUTOMATIC HAZE DETECTION AND REMOVAL FOR MULTISPECTRAL HIGH-RESOLUTION IMAGERY

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Abstract

The existence of cloud and haze is a common and troublesome problem in optical remote sensing data, which degrades the quality, reduces the availability, and limits the applications of images, especially for land use/cover changes monitoring and large scale mapping. This paper presents an automatic method for inhomogeneous haze detection and removal based on enhance haze-optimized transformation (EHOT) in High-Resolution Imagery. EHOT first uses MODIS products (MCD43A4) or other cloudless satellite image, which are from the same date or nearby date as the haze-contaminated image, to calculate the clear line. Next, it generates the original HOT map and enhances the HOT map by the characteristic of haze and cloud in principal component transformation map and NDVI map. Then it interpolates the EHOT map, which removes some confused haze or cloud points such as snow/ice points and bare soil points, based on discrete cosine transformation and generalized cross-validation score to fill and smooth the value removal regions. Finally it restores the haze areas utilizing the virtual cloud point method. It took four different GF-1 images to make the experiment and prove the results are better than traditional HOT method and homomorphic filtering method in recovering the color and texture information of land scenes. Comparing with the haze-free reference image illustrates the spectral consistency of the haze-restored image.

Ocean and Marine

PER-SEGMENT ABOVEGROUND BIOMASS ESTIMATION OF AVICENNIA MARINA IN EASTERN MANGROVE LAGOON NATIONAL PARK, ABU DHABI, USING LIDAR-DERIVED HEIGHT PERCENTILE STATISTICS

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Abstract

A biomass model of *Avicennia marina* forest was produced using LIDAR multiple percentile heights to estimate and map aboveground biomass density in Eastern Mangrove Lagoon National Park, Abu Dhabi. After processing small-footprint aerial LIDAR data, multiple percentile heights were calculated using a neighborhood algorithm. Then, an image segmentation algorithm was employed to transform the 2D LIDAR-derived image into structurally homogeneous modeling units. However, the size of the neighborhood affects the calculation of LIDAR-derived height statistics, and thus two different neighborhood sizes, 3 m and 5 m radius, were tested to evaluate the best model performance. The models' performance indicates that the 5 m neighborhood resulted in higher accuracy (RMSE= 10.16713, R= 0.872238, R²= 0.7597432). Aboveground biomass of twenty sampling plots (154 m² each) calculated from in situ measurements were incorporated into a machine-learning algorithm to produce a regression-tree model for aboveground biomass estimation per segment of the entire study area. A biomass map of the study area, with 715 image segments, was created. The segments' size ranges from 42.25 to 20,004.50 m² with an average of 2,445.37± 117.88 m², whereas biomass density per segment ranges from 0.234 to 13.178 (kg/m²) with an average of 5.159 ± 0.144 and a total of 14,850.26 kg. Additionally, about 49% of the study area has relatively low biomass density (≤ 4.15 kg/m²), 23% of the study area has a relatively moderate biomass density (from 4.16 to 8.01 kg/m²), and 28% of the study area has a relatively high biomass density (from 8.02 to 13.17 kg/m²). A canopy height model of the study area was also created with a maximum height of 7.86 m. This means that based on LIDAR observations no trees in the study area exceed 7.86 m in height. The average pixels height is 3.03 m, while the minimum pixels height is 0.12 m.



OIL SPILL DETECTION AND MONITORING OF ABU DHABI COASTAL AND MARINE AREAS USING KOMPSAT-5 SAR

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Abstract

The Abu Dhabi Government endorsed vision for the Maritime Strategy for the Emirate of Abu Dhabi is ‘A safe, secure and sustainable maritime domain for Abu Dhabi.’ This research study shares this vision using the concept of monitoring as tool for marine protection against any possible oil pollution. The best technology to detect and monitor oil pollution, particularly oil spills is “Synthetic Aperture Radar-SAR”. In this case study we chose KOMPSAT-5 SAR, the Korean SAR satellite launched on August 2013. KOMPSAT constellation is a unique combination of VHR optical data and SAR data, including KOMPSAT-2, KOMPSAT-3, and KOMPSAT-5. KOMPSAT-5 carries X-band synthetic aperture radar (SAR) for earth observation, and is capable of day-and-night imaging under all weather conditions. It provides three operation modes: High Resolution Mode (spotlight mode), to provide 1 m resolution with 5 km by 5 km swath; Standard Mode (strip mode), to provide 3 m resolution with 30 km swath; and Wide Swath Mode (ScanSAR mode), to provide 20 m resolution with 100 km swath at 550 km altitude, with four modes of polarization. KOMPSAT-5 provides products for various applications such as security and defense, image interpretation, mapping, land and natural resource management, environmental monitoring, disaster monitoring, and more. For our case study we chose to work with Wide Swath Mode (WS) with Vertical polarization (VV) to cover a wide area of interest located to the north west of Abu Dhabi including some important islands like Zirku Island and areas with oil production activities. The first results of data acquired on 3rd and 4th May 2015 show some spot of oil spill with the length estimated about 3 KM. There will be more acquisition of KOMPSAT-5 data through the last week of July 2015, and more results will be shown during the presentation.

FUTURE COASTAL URBAN SPRAWL IN OMAN AND EXPOSURE TO SEA LEVEL RISE

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Abstract

The Sultanate of Oman has a coastline extending for about 3165 km, including a number of bays and islands. Most of this coastline is low-lying shore composed of soft beach materials and is subject to the dynamics of sediment transport and landward retreat of the shoreline. These dynamics are caused by anthropogenic factors such as coastal engineering structures along the coastline, and natural processes such as sea level rise associated with climate change. In 2010, the general census of Oman shows that 80% of the Omani population lives in low-lying areas such as coastal plains and could be threatened by Sea Level Rise (SLR). Furthermore, 65% of the total population of Oman is concentrated in Muscat and the Al-Bathina coastal plain. The attractiveness of the coastal areas of Oman will continue in the future due to the recent implementation of heavy industrial activities and emerging of a new coastal city in Al-Doqum. Coastal erosion along several stretches of Oman's shoreline has long been recognized as a problem of growing magnitude. During the last seven years the country witnessed four strong tropical cyclones, Gonu (2007), Phet (2010), Nelover (2014) and Ashobaa (2015), which caused damage and revealed the extreme vulnerability of the populated Omani coast to storm surge and flooding. With future climate change-induced SLR, coastal erosion rates are expected to increase, posing even greater challenges to coastal settlements. The Coastal Vulnerability Index (CVI) was calculated to assess the vulnerability of the entire Omani coastal zone to the expected sea level rise. The exposure of the coastal settlements to SLR was assessed based on coastal inundations scenarios. A total of 7 SLR scenarios were considered: 0.2 meters, 0.5 meters, 1 meter, 2 meters, 3 meters, 4 meters, and 5 meters. The results of the assessment show that Oman is highly vulnerable to climate change-induced SLR. At the national scale, nearly 400 km² of total land area is projected to be inundated under the smallest SLR scenario. Under the highest SLR scenario, over 900 km² is potentially inundated. An assessment of the vulnerability of productive land use shows that the Al-Batinah and Muscat governorates are the most vulnerable under all SLR scenarios. The findings of this study show an urgent need to develop a strategic coastal management plan to face the challenges of the climate change, and to provide a clear outlook of the Omani coastal for better adaptive resilience and responses.

EXPLORATORY IMPACT ASSESSMENT OF 2008-2009 RED-TIDE OUTBREAK IN UNITED ARAB EMIRATES

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Abstract

The objectives of this research is to explore the biophysical impacts of the Harmful Algal Blooms (HABs) that occurred at the United Arab Emirates (UAE) Arabian and Oman gulfs from September 2008 to May 2009. This exploratory study relies on secondary images, data, and studies' findings in relation to the bio-physical, socio-economic, and human health impacts of the Red-Tide blooms on coastal communities. The availability of remote sensing satellite multispectral and hyperspectral data offer a cost-effective method to monitor the phytoplankton flows, circulation, and frequency. Previous studies focused on studying the correlation between the bloom spatial distribution and the intensity against economic activities and climatic variables. Satellite remote sensors data were used to measure the red-tide in the Arabian Gulf region and the Gulf of Oman. Due to relatively long flushing time in the Arabian Gulf, which is estimated to be 3-5.5 years, HABs can survive the salinity changes and unusual climatic conditions. There is an agreement among previous studies that temperature and nutrients loading explains the long term persistence and disappearance of the HABs in the two gulfs. Previous studies showed that HAB outbreaks have been more frequent in the Gulf of Oman compared to occurrences in the Arabian Gulf. These studies agreed on the presence of evidence that suggest that HABs and their impacts are increasing in the region. There is lack of detailed studies on the health, societal, and economic impacts of the HABs in the region. However, the UAE Ministry of Environment and Water (MoEW) listed the possible consequences of HABs such as the spread of bad odors and the death of fish and other marine organism. MoEW also showed that desalination plants had to halt operations several times at different locations during the Red-Tide outbreaks. Economic consequences of HABs include losses of coastal tourism and fishing activities. Continued Red Tide phenomena may cause further negative societal and economic impacts. There are few studies that have investigated the human health impact of red-tide including Fleming et al. (2007) who showed human self-reported results of increasing respiratory symptoms. These symptoms have been reported after exposure to Florida red-tide aerosols.



COASTLINE EXTRACTION METHOD BASED ON MORPHOLOGICAL SNAKES

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Abstract

As the boundary between sea and land, coastlines expand and stretch frequently; this unstable state comprehensively reflects changes in natural and human factors. Therefore, figuring out how to generate a higher accurate coastline in a shorter time is of great significance for the study of global environmental change, coastal environmental change, ocean disaster protection, and human coastal activities. Remote sensing has been widely used in monitoring changes of shoreline because of its variety of advantages, such as the convenience of image data acquisition, wide coverage, and relatively lower cost. Besides, as an approach to curve evolution, morphological snakes algorithm is very simple, fast, and stable because it combines the morphological operators associated to the partial differential equation (PDE) components. In this paper, we use the Near-infrared and green band data of Landsat-8 to calculate normalized water index (NDWI) and then extract the water area through a proper threshold. After that, we use edge detection algorithm to extract the borders between land and sea, which will be the initial value of Morphological Snakes algorithm to generate the accurate coastline. This method, compared to conventional coastline extraction algorithm, improved its accuracy significantly, and also has more stable results when the shape of coastline changes complexity and is irregular.

Posters

"التطور المكاني للمكبات غير القانونية بمدينة المعبيلة الجنوبية (2010 – 2015)"

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ملخص الدراسة

تعتبر المكبات غير القانونية ظاهرة سلبية على البيئة حيث تؤثر على البيئة والصحة العامة، وتمتد آثارها لتشمل مجالات عدة، وتعرف مكبات النفايات غير القانوني بأنها رمي كميات كبيرة من المواد غير صالحة للإستخدام في المساحات غير المصرح بها من قبل السلطات الحكومية أي بدون تصريح رسمي من الجهات الحكومية، حيث يقوم الأشخاص برمي مخلفاتهم في تلك المواقع حيث تكون تلك المواقع بعيدة عن أعين الناس عادة وعلى ضفاف الأنهار والأودية وعلى جوانب الطرق خاصة الفرعية والنباتات الطبيعية كالغابات والشجيرات والوحدات السكنية غير الآمنة المتضمنة المدن العشوائية والمباني السكنية المهجورة والطرق الصناعية غير المستعملة. تهدف الدراسة بشكل رئيس إلى كشف التطور المكاني (التوزيع الجغرافي) لمواقع المكبات غير القانونية في الفترة ما بين 2010 و 2015 في مدينة المعبيلة الجنوبية، ولفت انتباه الجهات الحكومية المعنية بسلطنة عمان، إضافة إلى توعية جميع فئات المجتمع المحلي بخطورة هذه المشكلة. وتنتهج هذه الدراسة المنهج التحليلي مستعينة بالعمل الميداني والتحليل الإحصائي للبيانات، واستخدام نظم المعلومات الجغرافية لتتبع المشكلة مكانياً ورصدها، كما تهدف الدراسة إلى تحديد التطور المكاني للمكبات غير القانونية بين عامي (2010 – 2015) مع معرفة تأثير القرب والبعد من التجمعات السكانية والعمرانية عن المكبات بإستخدام أدوات التحليل المكاني (Spatial Analysis). وقد كشفت الدراسة عن وجود 67 موقعاً في منطقة الدراسة في عام 2015 بعد أن كان عدد المكبات في 2010 27 موقعاً، وقد جاءت تلك النفايات على شكل أكوام تنوعت بين الصغيرة بنسبة 19.5%، وكبيرة الحجم 48.6%، ومتوسطة الحجم 33.6%، واحتلت مخلفات مواد البناء الصدارة في مكونات تلك النفايات بالمقارنة مع أنواع المخلفات الأخرى، حيث وجدت في حوالي 35.8% من مجموع الأكوام. توصي الدراسة بتفعيل التعاون المشترك بين القطاعين الحكومي والخاص من أجل انجاز استراتيجيات فعالة للتخلص من تلك المكبات، ودعم أنشطة المتطوعين لتنفيذ مشاريع التوعية وحملات التنظيف، وتأهيل المواقع المتضررة من خلال تخصيص جزء من عائدات الضرائب والمخالفات البلدية وعائدات شركات السيارات المتخصصة في بيع شاحنات نقل النفايات.



SOLVING FOG PROBLEM IN UAE

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Abstract

Fog is an atmospheric phenomenon that is very common in the United Arab Emirates (UAE) during early morning or evening hours due to the influence of nearby water bodies, weather temperatures, humidity, and wind conditions. This phenomenon can affect many human activities like transportation. For instance, various horrific car accidents have occurred in past few years in the UAE due to poor visibility on the roads as a result of bad weather conditions. Local police statistical records indicate that over 700 car crashes happened in the last 6 years simply because of very thick fog, causing many deaths and injuries as well as extreme financial costs and losses. Although car accidents have become a focus of attention for many researchers and decision-makers due to the heavy casualties in life and properties, few researchers have studied the characteristics of fog-related crashes or tried to solve the problem. A few electronic devices and systems have been created to increase road safety in the world such the Doppler radar system available in most new cars and fog detection and warning systems on main roads. Still, fog-related accidents have not been prevented because these are only warning devices that do not decrease the amount and thickness of fog. Therefore, the main goal of this research is to reduce the effect of fog on the main roads of the UAE by creating a new device that actually dissipates fog layers from the atmosphere instead of just warning car drivers about fog using the previously mentioned devices.

IDENTIFYING REGIONAL SPATIAL DEVELOPMENT PATTERNS

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Abstract

Spatial planning includes understanding and representing patterns of spatial development for which both physical and socioeconomic factors must be considered. As these factors may be complex or conflicting, we employ multi-criteria evaluation to identify patterns and structures. This involved the measurement of sets of factors such as ecological sensitivity, development intensity, and development potential. We combined this with the Geographic Information System for manipulation and analysis of such factors. We explained the context and forces behind planning, describe spatial patterns of regional development, and discuss the development typologies of regional structures: development core, development expansion, development integration, and ecological conservation.



INVESTIGATING PUBLIC OPINION REGARDING DEVELOPING AN INNOVATIVE SMART MOBILE CLINIC FOR MEDICAL SERVICES DURING DISASTER SITUATIONS: UAE CASE STUDY

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Abstract

Improving medical services is one of the top priorities of the UAE government. Therefore, this project proposes the development of an innovative smart mobile clinic model that can reach a large share of people at their homes to provide needed basic medical services. The SMC model is proposed to deal with different types of basic medical conditions that can be checked without the need to visit hospitals such as fever, cold symptoms, immunization, simple injuries, and basic medical checkup services. In addition, this project proposes the integration of a GPS tracking system to SMC and the development of a phone-related application to connect SMC with the patient in an easy and effective way. A survey of a convenient population sample was conducted as well as a focus group interview of doctors was constructed. Overall results indicate the need for such SMC services. This project is expected to expand the range of medical services available to a larger geographical area and population.




DEVELOPING AN INNOVATIVE GEOSPATIAL TRAINING PROGRAM FOR 10TH GRADE GEOGRAPHY TEACHERS TO SUPPORT THE ADEC INITIATIVE TOWARD MORE INNOVATIVE GEOSPATIAL CURRICULUM

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Abstract

UAE leaders have considered 2015 to be the year of innovation and have encouraged all governmental institutions to foster further the culture of innovation in their work environments. Therefore, the Abu Dhabi Education Council (ADEC) has taken the initiative of revising the existing school curriculum toward a more innovative learning environment. As a result, significant efforts have been devoted to reengineering the high-school curriculum, pedagogies, and technologies to support the germination of ideas. For example, ADEC has recognized the importance of geospatial sciences and Geographic information System (GIS) in analyzing real-life spatial phenomena. ADEC is empowering the educational skills outcomes of the high-school curriculum by adding more chapters in GIS and GPS Applications. As a result, ADEC will need to train existing human resources in the field of Geography on using ArcGIS software and other geospatial programs. Therefore, the purpose of this project is to investigate Geography high school teacher's current skills and qualification levels in Geospatial science and related software. Constructive questionnaires have been distributed among a sample of 10th grade geography teachers working in Abu Dhabi Emirate to investigate their existing GIS skills, potential challenges, and needed training preparations to allow a more efficient learning environment under the modified curriculum. The survey findings were used to develop an innovative Geo-spatial training program to assist in strengthening Geography teachers' backgrounds in GIS applications using ArcGIS software.



A REVIEW OF THE EFFECTS OF DROUGHT ON THE GRAIN YIELD IN THE VAYS, MOLLASANI, AND SALAMAT REGIONS OF THE KHUZESTAN PROVINCE

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Abstract

The issue of drought and its effect on crops, especially wheat, a strategic crop, is of the utmost importance, particularly when taking into account the complexity and significance of the issue at the present time and in the future. In this research the effects of drought on the yield of irrigated wheat in the northeast irrigation network of the Khuzestan province (the Vays, Mollasani, and Salamat regions) over the years spanning 2006 to 2010 will be taken into account. In order to carry out the research, an SPI index (Standardized Precipitation Index) using the rainfall collection data of 9 metrological stations located in the research area for the specified drought years was used. In order to check the validity of the results obtained from the aforementioned index, the data was cross referenced with ETM+ multispectral images obtained from the Landsat 7 satellite. One of the main difficulties associated with the research were the blurred ETM + images which were due to an SLC-off error during the period under study. However, additional images (images taken before or after the main image) and the application of a mathematical algorithm using an attached module to the software ENVI (gap fill) were used in order to modify the band gaps in the blurred image. This resulted in the recovery of most of the information in the images after which the NDVI Index (Normalized Difference Vegetation Index) was applied to the images during the study period in order to determine the crop concentration in the area. Since the yield of irrigated wheat was the objective, another problem faced by the researchers was the fact that the low resolution of the multispectral images of the Landsat satellite (with a resolution of 30 meters) did not allow for determining the boundary between the various plots or types of crops. In order to rectify the problem, agricultural cadastral images and descriptive information (such as ownership documents) of the region were used. By superimposing the data related to the boundaries of the farmland and the images related to the Normalized Difference Vegetation Index with the information related to the plots of land where wheat was cultivated during the study period, the amount of wheat yield during the drought years was determined. The obtained results were then compared with the analyzed data obtained from GIS imagery, and its juxtaposition using SPI indices showed a correlation between the occurrence of drought in the study period and a decrease in the amount of irrigated wheat yield. With due consideration to the repetition and duration of the drought in the future, it is necessary that drought preventive management strategies be applied in the agricultural sector, and in addition to the optimal use of water in the irrigation network, modern irrigation techniques should be applied in the farms. Furthermore, it is proposed that existing agricultural patterns be changed and that a sturdier and more resistant variety be used during low water periods.



OPTIMUM FLYING ALTITUDE FOR UAVS IN TRANSPORTATION STUDIES

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Abstract

Unmanned aerial vehicles have been effectively used as a viable remote sensing data collection platform for earth observation in the past few years. UAVs can be flown at various altitudes depending on the type and capability of the UAV and the application and information products derived from its data. Of particular interest in this research is the application of UAVs data in transportation studies. This research attempts to find the optimum flying altitude for a UAV for detecting and mapping transportation network asphalt cracks and deformations. A quad captor F550 with a 12 megapixel camera was flown at different altitudes, 5, 10, 15 and 20 meters. Data over street asphalt cracks were collected at each flying altitude. The collected data was analyzed to identify and map the street asphalt deformations. Data collected at 5 and 10 meters proved to be the most ideal for mapping the asphalt deformations. Errors of omission and commission at these two altitudes were the lowest in comparison to altitudes of 15 and 20 meters. It is recommended that for mapping streets' asphalt deformations with a 12 megapixel camera, flying altitudes between 5 and 10 meters be employed.

DEVELOPING A VIRTUAL ADVISOR FOR UAEU STUDENTS

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Abstract

Virtual reality technology can play a major role in students' education and orientation at the academic universities. The goal of this project is to introduce an interactive high technology application to assist in educating and guiding students at UAE University. This project will be applied as a case study to the Geography and Urban Planning Department. Therefore, this project focuses on developing an innovative interactive device that would attract students' attention using smart technology in an entertaining way to have a better understanding about the field of Geography and its market. More specifically, this project will develop a virtual device with three-dimensional structures supported with a smart application (app can be downloaded from the app store). The application will include: welcoming statements; a brief description of the geography field; students' admission requirements to the department; department major tracks, faculty/instructors' names and contacts; department news and activities; students' geography club membership and activities; and a GPS tracking system to guide students to their classrooms. The expected outcome of this project is to illuminate students' needs to physically meet their advisors to get basic information. The output model can be used as well to recruit new students during the University Orientation Programs for New Students.



RAPID VISUAL SCREENING OF AVAILABLE MASONRY BUILDING BY SHAKHES SAZAN METHOD–CASE STUDY: SHOUSH CITY

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Abstract

Iran is a seismic country. Many cities have been damaged by this unpredictable natural occurrence that often results in structures' demolition. Thus, building improvement using seismic evaluation can reduce a large percentage of damages. Quantitative detailed valuation methods are costly and time consuming. Given that 75% of structures in Iran are masonry, these methods have restrictions and sometimes achievements might not be favorable. The use of (RVS) rapid visual screening methods is a suitable substitute for them. The province of Khuzestan has a total population of 4,000,000 people, and 65% of them live in seismic urban zones. Additionally, a lot of economic activity occurs in this district. Seismic valuation of masonry buildings in the city of Susa is this paper's subject. Shakhes-Sazan method is one of the rapid visual screening methods. This is an analytical research with practical results. After collecting data by library methods and visual observations, the average vulnerability level was calculated for masonry buildings in the city of Susa.

DEVELOPING A SMART AND INNOVATIVE UAEU BUS SYSTEM: PROPOSING A GPS TRACKING SYSTEM AND INTERACTIVE SCREENS

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Abstract

Many students from various countries complain about wasting time during their commuting trip on school buses. This research project explores the potential of developing a Smart and Innovative Bus system (SIB) that will include a GPS tracking system and a smart/innovative screen for students. UAEU students are continuously increasing, creating additional difficulties for the bus drivers in memorizing the locations of students' homes, resulting in a longer commute time for students to arrive home. The proposed smart and innovative bus system for UAEU students living in Al Ain City is expected to better structure bus drivers' route maps of students' homes locations by using a GPS tracking system, as a result reducing the overall bus commuting trip time. Moreover, students are expected to enjoy their commuting time through their experience with an innovative and interactive touch screen where they can access the latest university news and illustrations of worldwide innovation projects. Therefore, a questionnaire was distributed among UAEU students (N=100) and a focus group of bus drivers was interviewed. The overall findings were supportive of the need for shortening the bus commuting time and using the GPS tracking system. Surveyed students' feedbacks and suggestions were used in designing the smart and innovative bus system model for UAEU.

DUBAI EXPO 2020: PROPOSED UAEU CONTRIBUTION

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Abstract

The United Arab Emirates won the right to host the World Expo 2020 in Dubai in Nov. 2013, which is the first time it was conducted in the MEASA region. Therefore, the government of Dubai is continually investing in its infrastructure to accommodate the expected 25 million visits (70% of them international) and to make it a memorable experience, where, as H.H. Mohamed Bin Rashid stated, "Dubai Expo 2020 will stand out as the best edition in the event's history in terms of preparation and presentation" (Gulfbusiness, 2013). It is expected that Expo Dubai 2020 will attract additional job opportunities and increase partnerships and cooperation that will highlight Dubai as a business center in the region. The purpose of this project is to explore possible contribution by students, faculty members and staff from United Arab Emirates University in supporting Expo Dubai 2020. Survey questionnaires were distributed to the UAEU community (N=100) and analyzed using the Excel program and ArcGIS software. The overall finding indicates that the surveyed UAEU students and faculty members support Expo Dubai 2020 and are willing to contribute through their innovative projects, as well as assist with organization of the event.

PROPOSING ECO-FRIENDLY AND INNOVATIVE SMART CAMPING AT UAE

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Abstract

The tourism sector plays a big role in many countries' economy, and several authorities have started to foster eco-tourism activities. Eco-tourism is one way to develop the local economy while protecting the environment. From this point of view, eco-friendly camping supported with a smart and innovative technology might help protect the environment while providing an entertaining camping experience. More specifically, this project focuses on reducing the usage of nonrenewable energy resources and providing the camps with a smart and innovative service experience. Therefore, surveys were conducted to explore people's opinions on the idea of developing environmentally friendly camping, as well as the services they preferred to see as part of these activities. The overall results validate our assumption that both the public and government authorities support the smart camping idea. The adoption of such a model is expected to protect the environment and lead to a more sustainable environment and economy.

SMART WATER RECYCLING: START FROM YOUR KITCHEN

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Abstract

Freshwater is the one of the most expensive necessities in the UAE. This project aims to develop a Smart Recycling Wastewater System from home kitchens by reusing kitchen wastewater for other purposes such as gardening and washing cars. The idea is derived from the continuous decrease in the overall amount of clean fresh/ground water in the UAE, where several citizens in the city of Al Ain depend on digging wells for their daily water uses. To help reduce water consumption, this project suggests developing an innovative application band filter for water used in the kitchen. The project also proposes developing hydropower energy through the movement of used water through the kitchen tube. Energy production would take place through the lucid energy system by placing a fan in the water pipe where water moves. Surveys were conducted on a sample of local citizens living in the *Al Towaya* District in city of Al Ain to explore the frequency and purposes of their daily water usage as well as their opinions on the proposed water recycling system. Overall results indicate that local residents support the idea of Smart Water Recycling, and they expect it would benefit them though irrigation activities and electricity generation.



DEVELOPING AN INNOVATIVE ECO-FRIENDLY PARKING FACILITY AT UAEU CAMPUS AS A PART OF THE UAEU STRATEGIC PLAN OF 2017-2021

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Abstract

Transportation modes with a high reliance on fossil fuel energy are unsustainable and can lead to several environmental, economic, and health problems, which have become a major concern for city and transport planners. The number of staff and students on the UAEU campus is increasing, where a substantial number are self-drivers. To align with a government initiative for clean environment and renewable energy usage in order to reduce air pollution and oil consumption, this project investigates UAEU community awareness on clean energy as well as its members' willingness to switch their mode of transport to an electrical power car that highly depends on renewable energy. Therefore, 80 Surveys were distributed among UAEU students and faculty members to investigate their opinions regards using electrical cars and related parking facilities at the UAEU campus. Also, 60 surveys were distributed among car companies to explore the renewable energy transportation market. Overall results indicated that the UAEU community supports the idea of using clean energy modes of transportation. A simulated model was created to illustrate the electrical charging station and related parking locations on the UAEU campus.

UNMANNED SMART BOAT

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Abstract

The United Arab Emirates' government aspires to be the most innovative country in the world. Progress in technology and lower costs has led to an increased use of unmanned vehicles (e.g., UAV) that are mainly used by government organizations. However, few studies have focused on developing unmanned boats for marine applications. Therefore, the purpose of this project is to develop an "unmanned smart boat" that can be used to produce images and create spatial maps for certain areas on the sea shoreline with lower costs. The output data and images can carry critical information regarding specific locations related to seawater conditions that can be used by coast guards, transportation and environmental agencies, and fishermen. Surveys were conducted and distributed to environmental agencies to investigate their marine-related problems. Moreover, in this research project a prototype was developed to test the idea application. The smart boat model was developed by assembling a number of electronic devices such as arduinos, cameras, GPS, and solar energy panels. The project is expected to benefit many companies' focus on developing seawater databases and producing related maps that can be used for different applications such as fish clusters and water pollution. Moreover, coast guards can use the unmanned smart boats to detect illegal migration through seas and control ship movement paths.

URBAN SPRAWL GROWTH AND TRANSPORTATION NETWORK IN AL AIN CITY

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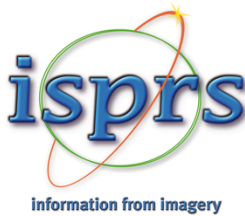
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Abstract

The city of Al Ain has seen tremendous landscape changes and development during the period of 1978-2015. Many of these changes are in the network transportation system, urban sprawl, and population changes resulting from urban growth. The developing of the city of Al Ain from sprawl growth has impacted the transportation network system. This research project aimed to study the relationship between sprawl growth and the transportation network and how each has impacted the other for development. The research methods are analytical, descriptive, and cartographic techniques. The approaches that used are the topical and historical. The study of the city of Al Ain provides information to show the importance of the area geographically. Al Ain is a developing area and aspiring for growth. The results from the maps show that there have been increases in the length of the main roads between 1978 and 2015. These roads have increased greatly, about 65% between 1978 and 2000. Also, the results show huge increases in the urban area of Al Ain. The percentage of increase between 1978 and 2000 is around 41%, while the percentage of increase between 2000 and 2015 is about 50%. According to the population growth and transportation network, the results showed the per capita roads for 1978, 2000, and 2015. The per capita roads for 2015 reached 860. Urban growth in the city of Al Ain has extended through the years in different directions except to the east because of the borders between the UAE and Oman. In conclusion, this study shows that there are relationships between population growth, urban sprawl, and the transportation network, as the population increased the urban area and the transportation network increased. The researcher suggests the development is important but also needs to consider the environment.

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