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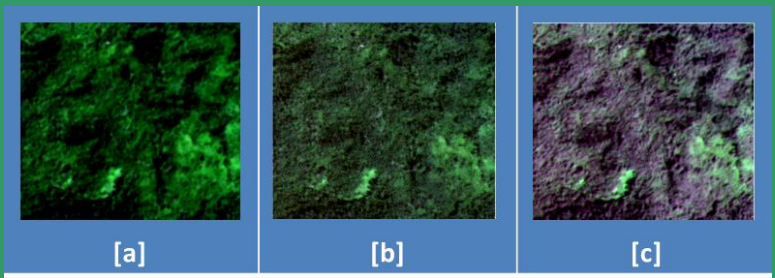

Figure. Forest: (a) SPOT-6 MS, (b) Gram-Schimdt and (c) PC in north Kluet, South Aceh.

Figure. Settlement: (a) SPOT-6 MS, (b) Gram-Schimdt and (c) PC in north Kluet, South Aceh.

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Editorial Committee Preface

Dear Readers,

Welcome to the International Journal of Remote Sensing and Earth Sciences Vol. 10 No 2, December 2013. This journal is expected to enrich the serial publications on earth sciences, in general, and remote sensing in particular, not only in Indonesia and Asian countries, but also worldwide.

The contents of this journal are particular interest to remote sensing as the main data for geosciences, oceanography, marine biology, fisheries, meteorology, etc. Inside this tenth edition, there are varieties of topics discussed, including study of flood inundation, SPOT-6 data fusion, Vulnerability level mapping, relationship between total suspended solid (TSS) and coral reef growth, environment quality changes, downwelling diffuse attenuation coefficients, forest classification, and identification of inundated area.

This journal is intended, among others, to complement information on Remote Sensing and Earth Sciences, and also encourage young scientists in Indonesia and Asian countries to contribute their research results. Therefore, we would like to invite scientists to manifest their ideas through scientific research papers. We are looking forward to receiving your manuscripts for the next edition of this journal.

Editor-in-Chief,

Dr. Bidawi Hasyim

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ABSTRACT

DERIVING INHERENT OPTICAL PROPERTIES FROM MERIS IMAGERY AND *IN SITU* MEASUREMENT USING QUASI-ANALYTICAL ALGORITHM/Wiwin Ambarwulan; Widiatmaka; Syarif Budhiman
IJReses, 10 (1) : 1-8

The paper describes inherent optical properties (IOP) of the Berau coastal waters derived from *in situ* measurements and Medium Resolution Imaging Spectrometer (MERIS) satellite data. Field measurements of optical water, total suspended matter (TSM), and chlorophyll-a (Chl-a) concentrations were carried out during the dry season of 2007. During this periode, only four MERIS data were coincided with *in situ* measurements on 31 August 2007. The MERIS top-of-atmosphere radiances were atmospherically corrected using the MODTRAN radiative transfer model. The *in situ* optical measurement have been processed into apparent optical properties (AOP) and sub surface irradiance. The remote sensing reflectance of *in situ* measurement as well as MERIS data were inverted into the IOP using quasi-analytical algorithm (QAA). The result indicated that coefficient of determination (R^2) of backscattering coefficients of suspended particles (b_{bp}) increased with increasing wavelength, however the R^2 of absorption spectra of phytoplankton (a_{ph}) decreased with increasing wavelength.

Keywords: *QAA, MODTRAN, MERIS, Remote sensing reflectance, Berau estuary water*

LAND COVER CLASSIFICATION OF ALOS PALSAR DATA USING SUPPORT VECTOR MACHINE/ Katmoko Ari Sambodo; Novie Indriasari
IJReses, 10 (1) : 8-18

Land cover classification is one of the extensive used applications in the field of remote sensing. Recently, Synthetic Aperture Radar (SAR) data has become an increasing popular data source because its capability to penetrate through clouds, haze, and smoke. This study showed on an alternative method for land cover classification of ALOS-PALSAR data using Support Vector Machine (SVM) classifier. SVM discriminates two classes by fitting an optimal separating hyperplane to the training data in a multidimensional feature space, by using only the closest training samples. In order to minimize the presence of outliers in the training samples and to increase inter-class separabilities, prior to classification, a training sample selection and evaluation technique by identifying its position in a horizontal vertical–vertical horizontal polarization (HV-HH) feature space was applied. The effectiveness of our method was demonstrated using ALOS PALSAR data (25 m mosaic, dual polarization) acquired in Jambi and South Sumatra, Indonesia. There were nine different classes discriminated: forest, rubber plantation, mangrove & shrubs with trees, oilpalm & coconut, shrubs, cropland, bare soil, settlement, and water. Overall accuracy of 87.79% was obtained, with producer's accuracies for forest, rubber plantation, mangrove & shrubs with trees, cropland, and water class were greater than 92%.

Keywords: *Land cover, ALOS-PALSAR, support vector machine (SVM), classification, Jambi, South Sumatra.*

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ABSTRACT

MULTITEMPORAL LANDSAT DATA TO QUICK MAPPING OF PADDY FIELD BASED ON STATISTICAL PARAMETERS OF VEGETATION INDEX (CASE STUDY: TANGGAMUS, LAMPUNG) / I Made Parsa; Dede Dirgahayu
IJReses, 10 (1) : 19-24

Paddy field has unique characteristics that distinguish it from other plants. Before it planting, paddy field is always flooded so that the appearance is dominated by water (aqueous phase). Within the growth of rice, field conditions will be increasingly dominated by greenish rice plants. While at the end, the rice plants will turn yellow indicating for harvesting. During flooding stage, the normalized difference vegetation index (NDVI) of pady field is negative. The negative value of NDVI of paddy field will ultimately increase to the maximum value at the maximum vegetative growth. The NDVI of paddy field will decrease from generative phase until harvest and after harvest. The objective of this study was to perform the vegetation index analyses for multitemporal Landsat imagery of paddy field. The results showed that the difference of vegetation index values (maximum - minimum) of paddy field were greater than the difference of vegetation index values of other land uses. Such differences values can be used as indicator to map land for rice. The evaluation results with reference data showed that the mapping accuracy (overall accuracy) was of 87.4 percent.

Keywords: *NDVI, Landsat, paddy field, maximum and minimum vegetation index, Lampung*

FISHPOND AQUACULTURE INVENTORY IN MAROS REGENCY OF SOUTH SULAWESI PROVINCE /Yennie Marini; Emiyati; Teguh Prayogo; Rossi hamzah; Bidawi Hasyim
IJReses, 10 (1) : 25-35

Currently, fishpond aquaculture becomes an interesting business for investors because of its profit, and a source of livelihood for coastal communities. Inventory and monitoring of fishpond aquaculture provide important baseline data to determine the policy of expansion and revitalization of the fishpond. The aim of this research was to conduct an inventory and monitoring of fishpond area in Maros regency of South Sulawesi province using Satellite Pour l'Observation de la Terre (SPOT-4) and Advanced Land Observing Satellite (ALOS) Phased Array type L-band Synthetic Apeture Radar (PALSAR). SPOT image classification process was performed using maximum likelihood supervised classification method and the density slice method for ALOS PALSAR. Fishpond area from SPOT data was 9693.58 hectares (ha), this results have been through the process of validation and verification by the ground truth data. The fishponds area from PALSAR was 7080.5 Ha, less than the result from SPOT data. This was due to the classification result of PALSAR data showing some objects around fishponds (dike, mangrove, and scrub) separately and were not combined in fishponds area calculation. Meanwhile, the result of SPOT-4 image classification combined object around fishponds area.

Keywords: *Fishpond aquaculture, Optic remote sensing, Satellite imaging radar, SPOT-4, PALSAR*

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ABSTRACT

GROWTH RATE AND PRODUCTIVITY DYNAMICS OF *ENHALUS ACOROIDES* LEAVES AT THE SEAGRASS ECOSYSTEM IN PARI ISLANDS BASED ON *IN SITU* AND ALOS SATELLITE DATA / Agustin Rustam; Dietriech Geoffrey Bengen; Zainal Arifin; Jonson Lumban Gaol; Risti Endriani Arhatin
IJReses, 10 (1) : 37-46

Enhalus acoroides is the largest population of seagrasses in Indonesia. However, growth rate and productivity analyses of *Enhalus acoroides* and the use of satellite data to estimate its the productivity are still rare. The goal of the research was to analyze the growth rate, productivity rate, seasonal productivity of *Enhalus acoroides* in Pari island and its surroundings. The study was divided into two phases i.e., *in situ* measurments and satellite image processing. The field study was conducted to obtain the coverage percentage, density, growth rate, and productivity rate, while the satellite image processing was used to estimate the extent of seagrass. The study was conducted in August 2011 to July 2012 to accommodate all four seasons. Results showed that the highest growth rate and productivity occurred during the transitional season from west Monsoon to the east Monsoon of 5.6 cm/day and 15.75 mgC/day, respectively. While, the lowest growth rate and productivity occurred during the transition from east Monsoon to the west Monsoon of 3.93 cm/day and 11.4 mgC/day, respectively. *Enhalus acoroides* productivity reached its maximum during the west Monsoon at 1081.71 mgC/day/m^2 and minimum during east Monsoon with 774.85 mgC/day/m^2. Based on ALOS data in 2008 and 2009, total production of *Enhalus acoroides* in the proximity of Pari islands reached its maximum occur during the west Monsoon (48.73 – 49.59 Ton C) and minimum during transitional season (16.4-16.69 Ton C). Potential atmospheric CO_2 absorption by *Enhalus acoroides* in Pari island was estimated at the number 60.14 – 181.82 Ton C.

Keywords: *Enhalus acoroides, growth rate, productivity rate, productivity, ALOS, Pari island*

DEVELOPMENT OF LAND MOISTURE ESTIMATION MODEL USING MODIS INFRARED, THERMAL, AND EVI TO DETECT DROUGHT AT PADDY FIELD / Dede Dirgahayu Domiri
IJReses, 10 (1) : 47-54

The drought phenomena often occurs in summer season at paddy field of Java island. The drought phenomena causes decrease in rice production. This research was aimed to develop a model of land moisture (LM) estimation at agricultural field, especially for paddy field based on Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data which has seven reflectance and two thermal bands. The method used in this study included data correction, advance processing of MODIS data (land indices transformation), extraction of land indices value at location of field survey, and regression analysis to make the best model of land moisture estimation. The result showed that reflectance of 2nd channel (NIR) and rasio of Enhanced Vegetation Index (EVI) with Land Surface Temperature (LST) had high correlation with surface soil moisture (% weight) at 0 – 20 cm depth with formula: LM = 15.9*EVI/LST – 0.934*R2 – 16.8 (SE=9.6%; R^2=76.2%). Based on the model, land moisture was derived spatially at the agricultural field, especially at paddy field to detect and monitor drought events. Information of land moisture can be used as an indicator to detect drought condition and early growing season of paddy crop.

Keywords: *MODIS, Reflectances, EVI, LST, land moisture, paddy*

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ABSTRACT

DETERMINATION OF STRATIFICATION BOUNDARY FOR FOREST AND NON FOREST MULTITEMPORAL CLASSIFICATION TO SUPPORT REDD+ IN SUMATERA ISLAND /Tatik Kartika; Inggit Lolita Sari; Bambang Trisakti
IJReses, 10 (1) : 55-64

Multi-temporal classification is a method to determine forest and non-forest by considering a missing data, such as cloud cover using correlations value from the other data. This circumstances is frequently occured in a tropical area such as in Indonesia. To gain an optimum result of forest and non-forest classification, it is needed a stratification zone that describes the difference of vegetation condition due to different of vegetation type, soil type, climate, and land use/cover associations. This stratification zone will be useful to indicate the different biomass volume relating to carbon content for supporting the REDD+ project. The objective of this study was to determine stratification boundary by performing multi temporal classification in Sumatera Island using Landsat imagery in 25 meter resolution and Quick Bird imagery in 0.6 meter. Rough stratification was made by considering land use/cover, DEM and landform, using visual interpretation of moderate spatial resolution of satellite data. High spatial resolution data was also provided in some areas to increase the accuracy level of stratification zone. The stratification boundary was evaluated using forest classification indices, and it was redetermined to obtain the final stratification zone. The indices was generated by Canonical Variate Analysis (CVA) method, which was depend on training samples of forest and non-forest in each previous stratification zone. The amount of indices used in each zone were two or three indices depending on the separability of the forest and non-forest classification. The suitable indices used in each zone described forest as 100, non-forest as 0, and uncertain forest between 50-99. The result showed 20 stratification zones in Sumatera spreading out in coastal, mountain, flat area, and group of small islands. The stratification zone will improve the accuracy of forest and non-forest classification result and their change based on multi temporal classification.

Keywords: *Muti temporal Classificatioon, Stratification zone, Forest, CVA, Landsat, Quick Bird*

UTILIZATION OF MULTI TEMPORAL SAR DATA FOR FOREST MAPPING MODEL DEVELOPMENT / Bambang Trisakti; Rossi Hamzah
IJReses, 10 (1) : 65-74

Utilization of optical satellite data in tropical region was limited to free cloud cover. Therefore, Synthetic Aperture Radar (SAR) becomes an alternative solution for forest mapping in Indonesia due to its capability to penetrate cloud. The objective of this research was to develop a forest mapping model based on multi temporal SAR data. Multi temporal ALOS PALSAR data for 2007 and 2008 were used for forest mapping, and one year mosaic LANDSAT data in 2008 was used as references data to obtain training sample and to verify the final forest classification. PALSAR processing was done using gamma naught conversion and Lee filtering. Samples were made in forest and water area, and the statistical values of the each object were calculated. Some thresholds were determined based on the average and standard deviation, and the best threshold was selected to classify forest and water in 2008. It was assumed that forest could not change in 1-2 years period. The classification of forest, water, and the change were combined to produce final forest in 2008, and then it was visually verified with mosaic LANDSAT in 2008. The result showed that forest, water, and the change could be well classified using threshold method. The forest derived from PALSAR was visually consistent with forest appearance in LANDSAT and forest produced from INCAS. It has better performance than forest derived from INCAS for separating oil palm plantation from the forest.

Keywords: *Forest mapping, Multi temporal, ALOS PALSAR, Threshold, LANDSAT*

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ABSTRACT

STUDY ON FLOOD INUNDATION IN PEKALONGAN, CENTRAL JAVA/Syams Nashrrullah; Aprijanto;Junita Monika Pasaribu; Manzul K. Hazarika; Lal Samarakoon
IJReses, 10 (2) : 76-83

Tidal flood or 'rob' is a serious problem in many coastal areas in Indonesia, including Pekalongan in the northern coast of Java island. This study aimed to simulate the flood inundation area for different scenarios of sea level rise, also to investigate the possibility of land subsidence that may further aggravate the problem of flooding in Pekalongan. In this study, the MIKE-21 model was used to simulate and predict the flood inundation area. Tidal data were generated from the Tide Model Drive (TMD). The tidal flood simulations were carried out for three different scenarios of sea level rise: 1) current situation, 2) next 50 years, assuming no sea level rise, and 3) next 50 years, assuming 50 cm of sea level rise. Based on the results, the ranges of water level rise in Pekalongan for each scenario were 0.23-1.27 m, 0.36-1.38 m, and 0.65-1.53 m, respectively. Meanwhile, ground displacement maps were derived from the ALOS/PALSAR data using Differential Interferometric Synthetic Aperture Radar (D-InSAR) technique. Twelve level 1.0 images of ALOS/PALSAR data acquired in ascending mode during 2008 to 2009 were collected and processed in time-series analyses. In total, 11 pairs of interferogram were produced by taking the first image in 2008 as the master image. The results showed that the average of land subsidence rate in Pekalongan city was 3 cm/year, and the subsidence mainly occurred in the western part of the city.

Keywords: *Tidal flood, MIKE-21, InSAR, Pekalongan, ALOS/PALSAR*

ANALYSIS OF SPOT-6 DATA FUSION USING GRAM-SCHMIDT SPECTRAL SHARPENING ON RURAL AREAS / Danang Surya Candra
IJReses, 10 (2) : 84-89

Image fusion is a process to generate higher spatial resolution multispectral images by fusion of lower resolution multispectral images and higher resolution panchromatic images. It is used to generate not only visually appealing images but also provide detailed images to support applications in remote sensing field, including rural area. The aim of this study was to evaluate the performance of SPOT-6 data fusion using Gram-Schmidt Spectral Sharpening (GS) method on rural areas. GS method was compared with Principle Component Spectral Sharpening (PC) method to evaluate the reliability of GS method. In this study, the performance of GS was presented based on multispectral and panchromatic of SPOT-6 images. The spatial resolution of the multispectral (MS) image was enhanced by merging the high resolution Panchromatic (Pan) image in GS method. The fused image of GS and PC were assessed visually and statistically. Relative Mean Difference (RMD), Relative Variation Difference (RVD), and Peak Signal to Noise Ratio (PSNR) Index were used to assess the fused image statistically. The test sites of rural areas were devided into four main areas i.e., whole area, rice field area, forest area, and settlement. Based on the results, the visual quality of the fused image using GS method was better than using PC method. The color of the fused image using GS was better and more natural than using PC. In the statistical assessment, the RMD results of both methods were similar. In the RVD results, GS method was better then PC method especially in band 1 and band 3. GS method was better than PC method in PSNR result for each test site. It was observed that the Gram-Schmidt method provides the best performance for each band and test site. Thus, GS was a robust method for SPOT-6 data fusion especially on rural areas.

Keywords: *Data fusion, SPOT-6, Gram-Schmidt, PSNR, rural area*

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ABSTRACT

VULNERABILITY LEVEL MAP OF TSUNAMI DISASTER IN PANGANDARAN BEACH, WEST JAVA/Iqoh Faiqoh; Jonson Lumban Gaol; Marisa Mei Ling
IJReses, 10 (2) : 90-103

Indonesia is located in a seismic active region where tsunami often occur. One of tsunami prone areas in Indonesia is southern coast of Java, such as the coastal areas of Pangandaran, West Java. One of the instruments in the tsunami disaster mitigation is the vulnerability map of coastal region on tsunami. Analyses of tsunami vulnerability assessment was performed by using merger or overlay methods in Geographic Information Systems (GIS). The parameters used to analyze tsunami vulnerability level were elevation, topography, landuse, coastal border, and river banks. The vulnerability were divided into five classes i.e., very high, high, medium, low, and very low. Results showed that Pananjung, Babakan, Pangandaran (Pangandaran District); and Sukaresik and Cikembulan (Sidamulih District) sub-districts were identified as areas of very high level of tsunami vulnerability with total area of 737.703 hectares. Areas with low level of vulnerability were Pagergunung, Putrapinggan, and Kersaratu sub-districts with total area of 4,816.204 hectares.

Keywords: *Coastal vulnerability, Tsunami, GIS, Pangandaran*

THE RELATIONSHIP BETWEEN TOTAL SUSPENDED SOLID (TSS) AND CORAL REEF GROWTH (CASE STUDY OF DERAWAN ISLAND, DELTA BERAU WATERS) /Ety Parwati; Mahdi Kartasasmita; Kadarwan Soewardi;Tridoyo Kusumastanto; I Wayan Nurjaya
IJReses, 10 (2) : 104-113

Total suspended solid (TSS) is one of the water quality parameters and limiting factor affecting coral reef growth. In this study, we used the algorithm of TSS= $3.3238*e^{(34.099*\text{ Green band})}$ (where green band is reflectance band 2) to extract TSS from Landsat satellite data. The algorithm was validated with field data. Water column correction method developed by Lyzenga was used to map coral reef. The result showed that the coral reef area in Berau waters decreased significantly (about 12,805 ha or around 36 %) from the year of 1979 to 2002. The most coral reef reduced area was detected around Derawan Island (about 5,685 ha). Further, some areas changed into sand dune. TSS concentration around Delta Berau and Derawan Island increased aproximately twice from 15-35 mg/l in 1979 to 20-65 mg/l in 2002. The increase of TSS concentration was followed by the decrease of coral reef area.

Keywords: *Landsat,, total suspended solid (TSS), coral reef, Berau waters*

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ABSTRACT

IDENTIFICATION OF INUNDATED AREA USING NORMALIZED DIFFERENCE WATER INDEX (NDWI) ON LOWLAND REGION OF JAVA ISLAND / Suwarsono; Jalu Tejo Nugroho; Wiweka
IJReses, 10 (2) : 114-121

Flood disaster is a major issues due to its frequently events on several areas in Indonesia. Delineation of inundated area caused by flood is needed to support disaster emergency response. The objective of this research was to identify inundated areas using NDWI methos from Landsat TM/ETM+ data on lowland regions of Java island. A pair of the data (before and during the flood) were in each observation areas. Observation areas were selected in several location of lowland regions of Java island where great event of flood occurred during the last decades. The thresholds values of NDWI change were used to separate the flood and non flood areas. The results showed that the extent of inundated area caused by flood on lowland regions can be identifyed and separated based on NDWI variables extracted from Landsat TM/ETM+.

Keywords: *Inundated area, NDWI, Landsat, Lowland region, Java Island*

DOWNWELLING DIFFUSE ATTENUATION COEFFICIENTS FROM *IN SITU* MEASUREMENTS OF DIFFERENT WATER TYPES / Bisman Nababan; Veronica S.A. Louhenapessy; Risti E. Arhatin
IJReses, 10 (2) : 122-133

Process of light reduction or loss (attenuation) by scattering and absorption is affected by solar zenith, time, depth, and seawater constituents. Downwelling diffuse attenuation coefficient (K_d) is important to understand for light penetration and biological processes in ocean ecosystem. It is, therefore, important to know the K_d value and its variability in ocean ecosystem. The objective of this study was to determine downwelling diffuse attenuation coefficients and its variability form in situ measurements of different water types. *In situ* downwelling irradiances (E_d) were measured using a submersible marine environmental radiometer instrument (MER) during a clear sky, calm water condition, and at the time range of 10:30 a.m. up to 14:00 p.m. local time in the northeastern Gulf of Mexico in April 2000. In general, E_d values decreases exponentially with depth. E_d at 380 nm exhibited the lowest attenuation (the most penetrative light), while E_d at 683 nm exhibited the highest attenuation (the most light loss at the top of water column). Overall, the K_d patterns tended to decrease from 380 nm to 490 nm (blue-green wavelength), and increase from 490 nm to 683 nm (green-red wavelength). K_d values in offshore region were relatively lower than in coastal region. K_d can be used to determine the depth of euphotic zone in offshore or teh case-1 water type and the depth of one optical depth (the water column depth where the ocean color satellite can possibly sense).

Keywords: *E_d, K_d, euphotic zone, One optical depth, NEGOM.*

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ABSTRACT

RANDOM FOREST CLASSIFICATION OF JAMBI AND SOUTH SUMATERA USING ALOS PALSAR DATA / Mulia Inda Rahayu; Katmoko Ari Sambodo
IJReses, 10 (2) : 134-141

Recently, Synthetic Aperture Radar (SAR) satellite imaging has become an increasing popular data source especially for land cover mapping because its sensor can penetrate clouds, haze, and smoke which a serious problem for optical satellite sensor observations in the tropical areas. The objective of this study was to determine an alternative method for land cover classification of ALOS-PALSAR data using Random Forest (RF) classifier. RF is a combination (ensemble) of tree predictors that each tree predictor depends on the values of a random vector sampled independently and with the same distribution for all trees in the forest. In this paper, the performance of the RF classifier for land cover classification of a complex area was explored using ALOS PALSAR data (25m mosaic, dual polarization) in the area of Jambi and South Sumatra, Indonesia. Overall accuracy of this method was 88.93%, with producer's accuracies for forest, rubber, mangrove & shrubs with trees, cropland, and water classes were greater than 92%.

Keywords: *Land cover, ALOS-PALSAR, random forest (RF), classification, remote sensing*

ENVIRONMENTAL QUALITY CHANGES OF SINGKARAK WATER CATCHMENT AREA USING REMOTE SENSING DATA / Ita Carolita; Bambang Trisakti; Heru Noviar
IJReses, 10 (2) : 142-148

Lake Singkarak in west Sumatera is currently in very poor condition and become one of the priorities in the government lake rescue program. High sedimentation rate from soil erosion has caused siltation, decreasing of quality and quantity of lake water. Monitoring of the environment quality changes of the lake and its surrounding are required. This study used Landsat and SPOT satellite data in periods of 2000-2011 to evaluate environmental quality parameters of the lake such as land cover, lake water quality (total suspended solid), water run-off, and water discharge in Singkarak lake catchment area. Maximum likelihood classifier was used to obtain land cover. Total suspended solid was extracted using Doxaran algorithm. The look up table and rational method were used to estimate run-off and water discharge. The results showed that the decreasing of forest area and the increasing of settlement were consistent with the increasing of average run-off and water discharge in Paninggahan and Sumpur sub-catchment area. The results were also consistent with the increasing of TSS in Singkarak lake, where TSS increased from around 2-3 mg/l up to 5-6 mg/l in the periods of 2000-2011.

Keywords: *Singkarak lake, total suspended solid, run off, water discharge, Landsat, SPOT*