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24th February 2021

9:00 Opening Greeting from Werapong Koedsin

9:20～12:00 Presentation Session (10~15 min of presentation with 5 min of discussion)

1	Pixel-Based and Object-Based of Land Cover Classification and Change Detection of Mandalay City Using Remote Sensing Data	Aye Mya Thein, Zin Mar Lwin and Myint Myint Sein
2	Sentinel-2 and Landsat-8 bands Sensitivity Analysis for Mapping of Suspended Sediment Concentration in Pao River, Thailand	Jurawan Nontapon and Siwa Kaewplang
3	Spatial Variability of Soil Fertility and Rice Yield by Using Remote Sensing and GIS Technology: A Case Study in Nay Pyi Taw Region	Aung Naing Oo
4	Application of Spatial Interpolation for Soil Salinity Monitoring: A Case Study of Lower Bang Pakong and Mae Klong River Basins	Premsiri Kongseng, Oraya Somroop and Pariwate Varnakovida
5	Historical Climate Change, Climate Vulnerability, and Climate Change Projections for Cambodia	Sopheak Thav and Kim Soben
6	Deep Learning for Coral Reef Classification	Werapong Koedsin and Surachet Pinkaew
7	Study of fluorescence emission variation by plant chlorophyll using field spectrometer	Andrés Quintana, José Moreno, M. Pilar Cendrero-Mateu
8	Hyperspectral Image Classification with Spatial Consistence Using Fully Convolutional Spatial Propagation Network	Yenan Jiang, Ying Li, Shanrong Zou, Haokui Zhang, Yunpeng Bai

25th February 2021

9:30～12:00 Presentation Session (10~15 min of presentation with 5 min of discussion)

9	Flood Risk Area Mapping, with flood occurrence frequency, with its extent and depth, using Geographic Information System Applied in Nong Han Catchment	Rossukon Intaratap, Pariwate Varnakovida and Premsiri Kongseng
10	Locating Highly Suitable Sites for Electric Vehicle Fast Charging Infrastructure: A Country-wide Analysis	Pariwate Varnakovida, Premsiri Kongseng, Arinnat Kitsamai and Oraya Somroop
11	GIS-based Multi-Criteria Decision Approach for Identification of Potential Flood Hazard Areas in Mandalay City	Zin Mar Lwin, Aye Mya Thein, Paing Nyo Nyo Thinn, Kyaw San, Myint Myint Sein and Swe Hnin Maung
12	Online Facility Mapping for Community Health Service: A Case Study of Kathu Municipality, Phuket	Phornnarong Aonchart, Jutaporn Keson and Surachet Pinkaew
13	Modelling canopy fuel properties and understory vegetation with full-waveform LiDAR	Luis Ángel Ruiz, Pablo Crespo, Jesús Torralba
14	Machine learning applied to the classification of riverine species using UAV-based photogrammetric point clouds	Juan Pedro Carbonell Rivera, Javier Estornell, Luis Ángel Ruiz, Jesús Torralba, Pablo Crespo-Peremarch
15	Intended wilderness as a Nature-based Solution: status, identification and management of urban spontaneous vegetation in cities	Daria Sikorska, Wojciech Ciężkowski, Piotr Babańczyk, Jarosław Chormański, Piotr Sikorski

Presentation #1

Pixel-Based and Object-Based of Land Cover Classification and Change Detection of Mandalay City Using Remote Sensing Data

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Abstract

Myanmar is a developing country and very little data on the environment and faces many difficulties due to a lack of data management. Nowadays, satellite images and open social data are widely available to use for research. Landcover classification of Mandalay city area was classified on the results using the pixel-based and object-based classification through image analysis approaches. This research is aimed to compare the result of land cover classification and its change detection between pixel-based and object-based classification. In this research, the pixel-based classification was carried out by the Maximum Likelihood algorithm and Minimum Distance to Mean algorithm. On the other hand, object-based classification was performed through eCognition Developer software. The classification change detection technique has been used to analyze the Land cover change during 2002 and 2014. Water, Vegetation Buildup, and Bare land were classified as land cover classes. Based on accuracy assessment land cover classification through pixel-based classification using the Maximum Likelihood algorithm and Minimum Distance to Mean algorithm it shows that the total accuracy value is 82.00% and 80.00% in 2002 and 83.30% and 81.30% in 2014. In the case of object-oriented land cover classification, it shows that total accuracy is 86.38% in 2002, and 88.50% in 2014 respectively Change Detection between both the images for all land cover classes was computed.

Keywords

pixel-based, object-based and land cover classification, change detection

Presentation #2

Sentinel-2 and Landsat-8 bands Sensitivity Analysis for Mapping of Suspended Sediment Concentration in Pao River, Thailand

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Abstract

The objective of this study focuses on exploring the possibility of using Landsat-8 and Sentinel-2 satellite data to map suspended sediment concentration (SSC) in pao river, Thailand. Suspended sediment concentration was correlated with reflectance values of different band and result has indicated that SWIR bands of both satellite showed significant positive correlation with SSC (r = 0.12 to 0.14) whereas visible and NIR bands from Landsat-8 showed significant positive correlation with SSC (r = 0.07 to 0.48) and visible and NIR bands from sentinel-2 showed significant negative correlation with SSC (r = -0.20 to -0.36). This study developed a method for quantifying SSC based on Landsat-8 and Sentinel-2 by corresponding SSC data obtained from SSC monitoring stations. The presented methodology uses spectral information and then trains a predictive reflectance–SSC model using three learning machines (generalized linear model, random forest and support vector machine). The trained models are then used to predict SSC along the pao river. Results demonstrated that the spectral information-based technique generated R2 > 0.68 for Landsat 8 and sentinel-2 sensors and accurately predicted SSC. This study demonstrates the benefit of Landsat-8 and sentinel-2 sensors modeling methods for the prediction of SSC and monitoring along pao river systems.

Keywords

Machine learning, Suspended sediment concentration, Landsat-8, Sentinel-2.

Presentation #3

Spatial Variability of Soil Fertility and Rice Yield by Using Remote Sensing and GIS Technology: A Case Study in Nay Pyi Taw Region

Aung Naing Oo, Htay Htay Oo, Aung Kyaw Myint, Moe Hnin Phyu,
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Abstract

Remote sensing of farmland has been used to obtain information on the nutrient status of growing crops, and hence to make management decisions based on this information. This study aims to monitor spatial variability of soil fertility and rice grain yield and to provide the analysis of gathered information for decision making on rice production. The study area was selected in the rice farmland of Kyeeinn village, Pyinmana Township, Nay Pyi Taw Union Territory, Myanmar during the rice growing season of 2020. Chlorophyll content in rice plant was collected at early growth, tillering and panicle imitation stages of rice. Rice grain yield was also measured at harvest. Multispectral sensor and Sentinel-2 satellite imagery was collected for normalized difference vegetation index (NDVI) at three different growth stages of rice. The acquired images analysis was employed with ArcGIS 10.7 software. The results revealed that soil chemical properties varied within a farmland and relatively low in the study area. The huge distribution areas of the high NDVI value were observed in the tillering and panicle initiation stages of rice when compared with the early growth stage. The chlorophyll content and rice yield were highly correlated to NDVI values in general. The distribution map of soil chemical property would be very applicable to be used by farmers for using a proper amount of fertilizer to their farmlands.

Keywords

Rice, Soil chemical property, Multispectral sensor, Sentinel-2, NDVI.

Presentation #4

Monitoring: A Case Study of Lower Bang Pakong and Mae Klong River Basins

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Abstract

Problems of saltwater intrusion in the coastal zone of the Gulf of Thailand resulting in increased salinity in water and soil which affects agricultural areas and water to use. This study evaluated several semivariogram models for the study of spatial distribution of soil salinity in lower Bang Pakong and Mae Klong river basins. Soil salinity tests were performed with two periods during 29 Sep - 2 Aug and 28 Oct - 1 Nov in 2019 at two levels of depth are 30 and 100 cm. Stratified and systematic sampling method were used to determine the location of measuring points. Totally 60 sampling points across both basins were selected. Suitable semivariogram model was selected from a comparison result of geostatistical analysis. Four models of semivariogram were compared: circular, spherical, exponential and Gaussian. Kriging interpolation method was used to estimating soil salinity values of unknown area. There is a clear gradient of soil salinity at both depths; higher along the shore and gradually decreases towards inland. Evaluation of semivariogram model performance reveals that the Gaussian model and spherical model were the best for estimating the salinity value in soil at 30 cm and 100 cm depth with smallest root mean square error (RMSE) that less than 1.

Keywords

soil salinity, Bang Pakong river basins, Mae Klong river basins, kriging, semivariogram

Presentation #5

Historical Climate Change, Climate Vulnerability, and Climate Change Projections for Cambodia

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Abstract

The climate change analysis in Cambodia mostly depends on General Circulation Modeling (GCM) output, with the analyses being conducted in the context of the wider ranging Mekong Basin level assessments. One study indicated that Cambodian temperature would rise by between 0.7 to 2.7°C by the 2060s and mean annual rainfall would increase, mainly due to a wetter rainy season (-11 to +31%), which would be partially offset by drier dry-seasons (-54 to +35%). However, over the short-term no significant changes are predicted.

Cambodia's Initial National Communication to the UNFCCC includes the first attempt to assess the country's future climate using the two General Circulation Models (GCM) , (MoE, 2002). The GCM models used in this analysis (CCSR and CSIRO) were developed for use in Japan and Australia, which are very different geographical regions. However, at the time of the assessment, there was a lack of more suitable models. The analyses showed that the deviation of the GCM models from the observed rainfall data was very significant (MoE, 2001). The projections conducted were in relation to changes in the average temperatures and rainfall. With the caution that there was significant deviation between observed rainfall data and GCM model output, the following projections were made for Cambodia: (i) Mean annual temperatures could increase between 0.3 to 0.6 ^{0}C by 2025 and by 1.6 to 2.0 ^{0}C by 2100; (ii) Mean annual rainfall could increase between 3% to 35% by year 2100 with the magnitude of change varying with time and location. Lowland areas were projected to have a higher increase in rainfall than in the highlands.

Cambodia has developed climate change scenarios and their impact on different sectors. The climate change scenarios were developed using MAGICC-SCENGEN (Hulme *et al.,* 2000 and MoE, 2002), a program which links emission scenarios with global and regional climate change. All the impact models used in the INC are statistically based impact models, and most use a regression approach. In the second national communication, Cambodia adopted the regional climate model (PRECIS) in combination with a number of GCM model run by the Climate Risk Assessment Division, Center for Global Environmental Research, National Institute for Environmental Studies (NIES), with resolution of 100 x 100 km (Masutomi, 2009). To cope with scarcity of historical climate data in evaluating the impact of current climate variability on different sectors, long-term historical climate data for the whole of Cambodia was reconstructed using PRECIS. A dynamic-based impact model was adopted for the agricultural sector.

Cambodia is among a group of 52 developing countries for which Oxford University has completed climate change country profiles (McSweeney, New & Lizcano 2008). The profiles are based on data collected from national weather stations through the World Climate Research Programme (WCRP) and available on the Global Historical Climatology Network (GHCN). Cambodia's profile includes average time series of observed data over the period 1960-2006, and projected future climate under three IPCC emission scenarios (A2, A1B and B1). The respective storylines of the scenarios are a differentiated world, market oriented world, and a convergent world. The climate models consists of a subset of 15 from the 22 used by the IPCC in its Fourth Assessment Report. Maps depict the projected changes for decade long time slices in 2013, 2060 and 2090, on a 2.5 x 2.5 degrees grid.

The modeling of changes in precipitation projected that the precipitation increase would be mainly in the central agricultural plains stretching from the southeast to the northwest, where rainfall has historically been below the national average. An adjustment was necessary because the RCM data for this period includes some extreme values; for example, some daily precipitation RCM values are between 500 – 1,000 mm and some are even over 1,000 mm. Such values which were not recorded in the observed dataset. These values result in too high water yields and river flows in several catchments in the model outputs. The adjustment was first applied to the precipitation data, then for other parameters, such as maximum and minimum temperatures, wind speed and solar radiation. After running the SWAT model for all sub-basins, the Integrated Quantity Quality Model (IQQM) was also run for the whole Mekong River Basin. In addition, the ISIS model was run for Tonle Sap and the Delta (MRC-IWMI, 2010).

Using the downscaled data for the PRECIS regional climate model for the Mekong River Basin, projections were were averaged over 30 year periods, from 1960 to 2099 (SEASTART RC, 2009). The results of the analysis shows a clear increasing trend in mean temperatures. A rapid increase in temperature is expected to occur after 2030. The variation of mean temperatures may also increase in the future. Based on the results of the rescaling of temperature data of all grids from PRECIS, it was found that the rate of mean monthly temperature increase ranged from 0.013ºC to 0.036ºC per year, depending on the location (MoE, 2015 and Heng C.T, 2015). The rate of temperature increase is projected to be high in low altitude areas, such as in the Central and in the North East of Cambodia (0.036ºC per year) and low in the high altitude areas, such as in South West of Cambodia (0.013ºC per year).

In relation to the projections on rainfall trends, a rapid increase in annual rainfall is expected to occur after 2010, which is projected to continue to 2050, with a slight decrease from 2070 to 2099. The results of the analysis shows a clear increasing trend in average rainfall. By using all data downscaled by the PRECIS regional climate model for both scenarios A2 and B2, the projected annual precipitation from 2008 to 2099 of PRECIS SRESA2 is for increasing rainfall after 2008, with the rate of increase contining to rise in year 2050 and year 2074, as reflected in the projected annual precipitation from 2008 to 2099 of PRECIS SRESB2 (Heng C.T, 2015).

Presentation #6

Deep Learning for Coral Reef Classification

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Abstract

Deep learning (DL) is a powerful state-of-the-art technique for image processing techniques include Remote Sensing (RS) images. In this study, we investigated the basic use of Convolutional Neural Network (CNNs) for coral reef (i.e., *Acropora spp*) classification in high-resolution (i.e., UAV) remote sensing imagery. The coral reef image was accompanied by their ground truth annotations. Coastal ecosystems are complex scenes and hence quite difficult to tackle from a computer vision perspective. This study shows the potential of solving this problem efficiently by yielding the target accuracies more than 85%.

Keywords

UAV image, Remote Sensing, Deep Learning, Coral Reef.

Presentation #7

Study of fluorescence emission variation by plant chlorophyll using field spectrometer

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Abstract

Recent studies have demonstrated that CO2 absorption by vegetation and its growth is directly related with its fluorescence emission by vegetable chlorophyll induced by solar radiation. The relation between fluorescence emission and CO2 assimilation is highly dynamic and it shows seasonal changes in function of climate and environmental conditions. We study seasonal changes of fluorescence emission for three varieties of barley, and the effect of CO2 absorption and water deficit. The experiments are conducted using spectra acquired by ASD field spectrometer (400-2500 nm). We also analyze the relation between reflection indexes and water deficit.

Keywords

fluorescence emission, chlorophyll, field spectrometer

Presentation #8

Hyperspectral Image Classification with Spatial Consistence Using Fully Convolutional Spatial Propagation Network

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Abstract

In this work, we propose a novel end-to-end, pixel-to-pixel fully convolutional spatial propagation network (FCSPN) for hyperspectral image (HSI) classification. Our FCSPN consists of a 3D fully convolution network (3D-FCN) and a convolutional spatial propagation network (CSPN). Specifically, the 3D-FCN is firstly introduced for reliable preliminary classification, in which a novel dual separable residual (DSR) unit is proposed to effectively capture spectral and spatial information simultaneously with fewer parameters. Moreover, the channel-wise attention mechanism is adapted in the 3D-FCN to grasp the most informative channels from redundant channel information. Finally, the CSPN is introduced to capture the spatial correlations of HSI via learning a local linear spatial propagation, which allows maintaining the HSI spatial consistency and further refining the classification results.

Keywords

Hyperspectral, classification, Fully Convolutional Spatial Propagation Network.

Presentation #9

Flood Risk Area Mapping, with flood occurrence frequency, with its extent and depth, using Geographic Information System Applied in Nong Han Catchment

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Abstract

The sudden flooding in Sakon Nakhon Province is the most affected by the influence of the tropical storm named "Senka" in 2017. The objective of this research is to prevent the flooding disaster in the future, the return period of flood frequency and many related hydrological data that influencing by the Senka - tropical storm were studied in this case. In this study, the widely used in term of hydrological model “HEC-RAS” was integrated with geoinformatics software to model the risk of flooding situation. In HEC-RAS model, the flooding return period calculated from Gumbel distribution method. The results from HEC-RAS model showed that the storm made the amount of water flowing into the Nong Han reservoir at the maximum flow rate of 594.7 m3/s and the return period of flood frequency is equal to 82 year. In addition, the results from HEC-RAS model were used to create a flooding risk area map based on the flood hazard rating calculation. The totally flooding risk area in Nong Han catchment is approximately 181,660 rai (290.66 km2), most of the affected area were water reservoirs, agricultural, miscellaneous and forest that cover an area as percentage by 42.2, 39.4, 15.2 and 0.6 respectively.

Keywords

HEC-RAS model, Flood risk assessment, Spatial analysis

Presentation #10

Locating Highly Suitable Sites for Electric Vehicle Fast Charging Infrastructure: A Country-wide Analysis

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Abstract

In a world threatened by climate change as well as a global health crisis due to air pollution, electrically powered vehicles (EV) have become an increasingly attractive transportation option. Fully electric, battery-powered vehicles (BEV) do not produce greenhouse gases or dangerous particulates. However, widespread adoption of BEV depends on the availability of charging infrastructure, in locations where it is most likely to be needed. Hence, considerable effort has been devoted to forecasting what charging facilities will be needed in the near future and where these facilities should be locate, in order to encourage BEV adoption.

This paper describes our efforts to identify the most favourable locations for fast charging infrastructure across the entire country of Thailand, using the Analytic Hierarchy Process (AHP) plus GIS-based spatial multi-criteria analysis (SMCA). Experts from a variety of fields rated the relative importance of both suitabilityfocused and demand-focused criteria. The resulting weights were then used to identify the best 10% of available sites in each of Thailand's 77 provinces. We found that proximity to major roads and to the medium voltage electricity grid were among the most important factors governing site suitability. Because our method used mostly public datasets, open source software, and straightforward algorithms, we believe it can be applied to other national-level analyses, as well as being replicated in Thailand as the EV ecosystems evolves.

Keywords

Electric Vehicle, Fast Charging Stations, Analytical Hierarchy Process, Geographic Information Systems, Thailand

Presentation #11

Decision Approach for Identification of Potential Flood Hazard Areas in Mandalay City

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Abstract

Myanmar is very vulnerable to natural disasters such as floods, landslides, earthquakes, fires, cyclones, storm surges, and tsunamis according to its geomorphology. Flooding is the common disaster during the monsoon season. Flooding is used to occur at the rainy season due to heavy rainfall and poor drainage system, and other factors in Mandalay. Hence, the flood risk analysis is important to study to explore the potential flood vulnerable areas. It can also result in the health problem and safety risk to the local people. In this study, four digital input layers are used to produce flood hazard map using Multi-criteria decision analysis (MCDA) with the integration of GIS. Flood vulnerability map is also produced by flood hazard multiplied by exposure factors of road infrastructure and population density. According to the flood vulnerability map, flood risk is classified as five categories which are very low, low, moderate, high and very high areas with 33.15%,29.72%,27.5% , 7.28%, 2.35% respectively. The flood inundation mapping using Sentinel 1 data and SNAP software is also carried out to visualize the flooded area during historic flood event in study area, and compared with the result map generated using MCDA analysis. This study would provide the required information to the decision maker for proper urban management and flood mitigation.

Keywords

Flood Risk, GIS, Multi-Criteria Decision Analysis, Flood Hazard, Vulnerability

Presentation #12

Online Facility Mapping for Community Health Service: A Case Study of Kathu Municipality, Phuket

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Abstract

The purpose of this study is to create an online facility map by applying web technology and geo-informatics technology in Kathu sub-district, Phuket province, Thailand. The community health is assessed, and facility information is collected by a questionnaire survey; those two pieces of information are used in creating a relational database and community health map (web mapping application), to help in search, navigate, and track areas of proactive. The three categories of data used are points of interest; boundaries of Phuket administrative areas; the medical information/historical statistics of diseases in Kathu district that are provided by Kathu Health Promoting Hospital. The web map application was developed using open-source basemaps and JavaScript library for mobile-friendly interactive maps; the website was published using the WordPress platform. The facility map contains five layers including 1) medical services 2) rescue and volunteer offices 3) government offices and references 4) community service offices and 5) drug and convenience stores. The map infoWindow shows the information of the places such as name, type, and location (latitude and longitude) which can be used to navigate to the point. The results can be used for surveillance, formulate health promotion plans, disease prevention, and taking care of health issues in the community to make the community a healthy community.

Keywords

Community Health Service, Facility mapping, GIS

Presentation #13

Modelling canopy fuel properties and understory vegetation with full-waveform LiDAR

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Abstract

Canopy fuel variables, such as canopy height (CH), canopy fuel load (CFL) or canopy base height (CBH) have been successfully estimated from discrete airborne LiDAR data. These variables are used as input for fire behaviour models (FARSITE, BehavePlus, etc.). In some forest ecosystems, shrub and understory vegetation play an important role in the propagation of fire from surface to canopy, facilitating crown wildfires, which are much more difficult to control. Full-waveform LiDAR systems can register the complete wave after its interaction with vegetation, and they provide more information about vertical structure of vegetation than discrete LiDAR systems.

In this study, we evaluated the capacity of LiDAR full-waveform to estimate fuel and understory vegetation variables, such as volume, cover, mean and maximum height, in a Mediterranean area in Spain, using terrestrial laser scanner measurements as reference data. Full-waveform data were voxelized and pseudo-vertical waveforms were obtained. Then, specific metrics were computed and fuel variables models obtained using linear regression using data from a set of 21 field plots. They were evaluated by cross-validation, obtaining R^2 values ranging from 0.75 to 0.95. It can be concluded that full-waveform LiDAR data can be used to predict not only canopy fuel variables, but also understory vegetation variables useful for modelling fire behaviour in Mediterranean ecosystems.

Keywords

full-waveform, ALS, forest structure, understory, wildfires.

Presentation #14

Machine learning applied to the classification of riverine species using UAV-based photogrammetric point clouds

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Abstract

Riverine areas are of great importance for their high nature conservation and biodiversity value. These zones are also areas of high human activity, negatively affecting the ecosystem with the modification of riverbeds, construction of dams, or introduction of invasive species. In this sense, to achieve balance in the riverbed it is essential to have periodic information on the area to be able to implement management plans for the area. In this sense, changes occur very rapidly in these zones due to human pressure and river mechanics, making necessary to obtain data with high temporal and spatial resolution.

In recent years, advances in unmanned aerial vehicles (UAVs) have enabled their use for the acquisition of high-resolution images at low cost. Algorithms such as Structure from Motion (SfM) allow the obtention of three-dimensional point clouds with spectral information from UAV imagery. This study proposes a workflow to map riverine species using Unmanned Aerial Vehicle (UAV) derived images. From photogrammetric RGB point clouds, our study conducted a classification of species using geometric and spectral metrics to classify the predominant species of a stretch of the river Palancia (Spain). These species were *Arundo donax* L., *Tamarix gallica* L., *Pinus halepensis* Miller, other riverine species, and ground. Using the geometric and spectral variables derived from the point cloud, we performed a point classification of the point cloud using Random Forest, obtaining a mean score cross-validation close to 0.8. Subsequently, with the aim of improving this classification by point, we proceeded to carry out a classification by object. This classification by object was based on the segmentation of the point cloud, obtaining an overall accuracy of 84%, and individually by species a producer's accuracy of 74% for giant reed, 83% for French tamarisk, 88% for Aleppo pine, 94% for ground and 80% for other riverine species. The good results obtained show the feasibility of using UAVs for periodic monitoring of river species, improving the information provided to river administrators to implement management plans.

Keywords

Point cloud classification, UAV-DAP, Random forest, Riverine species

Presentation #15

Intended wilderness as a Nature-based Solution: status, identification and management of urban spontaneous vegetation in cities.

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Abstract

Nature-based Solutions (NbS) have been an increasingly recognized framework that uses naturally occurring processes to maximise the provisioning of ecosystem services and improve the life quality of city dwellers. One of the more widely applied NbS is an intentional abandonment of green space cultivation and promoting wilderness. In this study, we developed urban spontaneous vegetation (USV) identification algorithm based on NDVI from Sentinel-2 data in Warsaw's green spaces, Poland. We verified the study in an on-site survey where we collected 2863 field reference plots for USV and cultivated vegetation identification. We achieved 74% accuracy for USV and 70% for cultivated vegetation identification. The study assessed the spatial resources and extent of USV in the scale of the city and within various types of urban greenery. We identified the vegetation development persistence over 3 years and assessed the spontaneity levels of urban greenery. Classification of Warsaw's vegetation revealed that 54% of Warsaw's greenery is cultivated while the remaining part is characterized by various levels of spontaneity. Only in 34.7% of USV, we found no interruption of vegetation development due to cultivation for at least 3 years. USV was common in both commonly cultivated parks where it accounted for 46.6% of vegetation, as well as in the vacant lots, where it occurred in 55.3% of the area. The proposed USV detection methodology can be an effective tool for restoration effectiveness assessment and can support cultivation abandonment as NbS - an intended action promoting wilderness.

Keywords

ecosystem services, informal green spaces, rewilding, urban remote sensing, urban greenspace, vegetation mapping.