

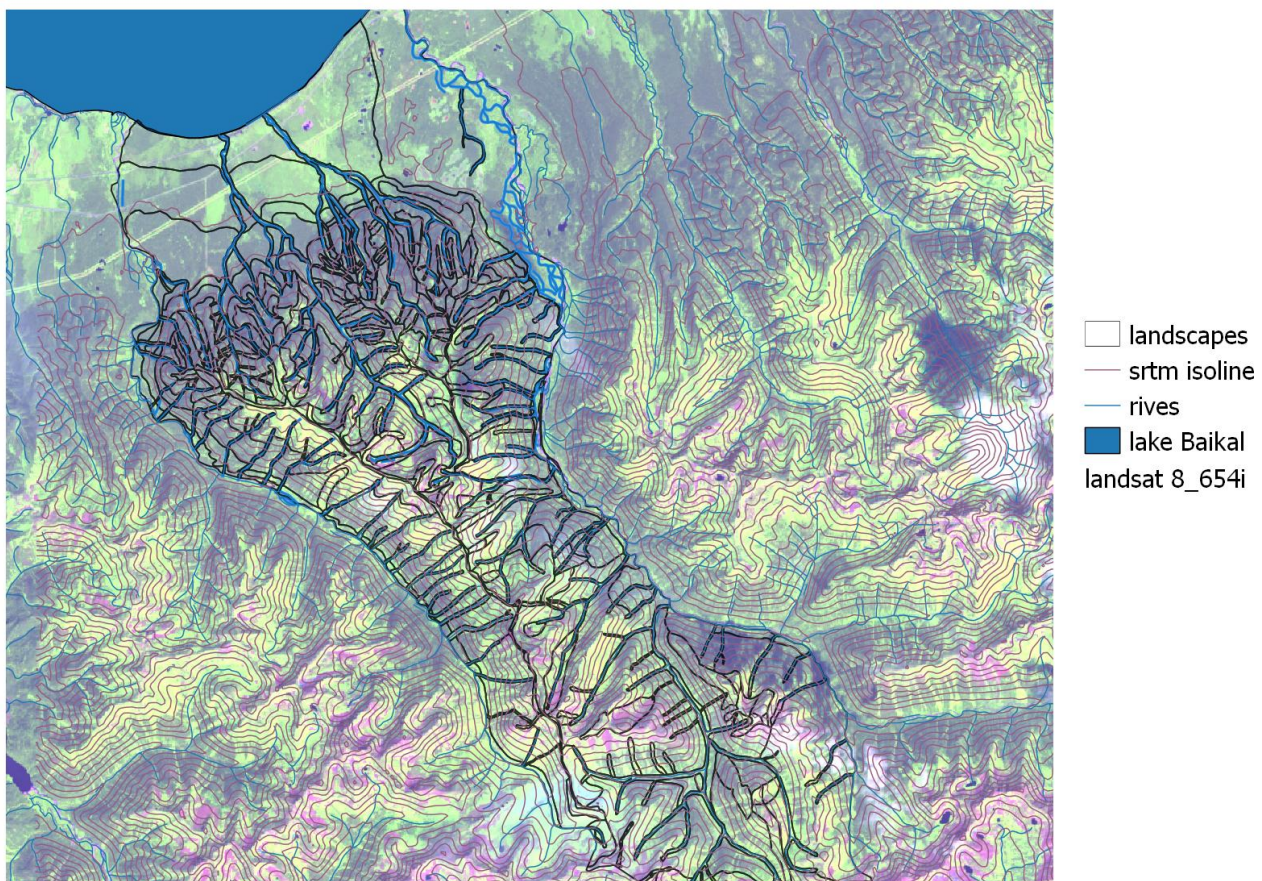
High scale landscape mapping for mountain of Khamar-Daban (near Lake Baikal, Russia)

*Polina A Rusanova¹, Svetlana V Solodyankina²

1.Irkutsk State University, 2.The V.B. Sochava Institute of Geography SB RAS

Classification of homogeneous geosystems (landscapes) and its reflection on the map could be a base for effective organization of economic activity. Landscape patterns and landscape units can be used in the assessment of ecosystem service supply. Geosystem defined as uniform territory, with regular and typical repetition of some interrelated combinations of geological structures, landforms, surface and groundwater, microclimates, soil types, phytocoenoses and zoocoenoses. The aim of research is analysis and mapping of the landscape diversity of the key area (125.3 km²) of the Khamar -Daban mountain range which actively used for mountain tourism. This mountain range distinguished by the uniqueness of vegetation related to climate features: significant moisturizing, high snow cover and other. We used the following data: fieldwork (73 test areas), Digital elevation model (SRTM), and remote sensing (Landsat 8). Fieldworks were conducted in summer seasons 2010 and 2015 years where collected data about wood and grass species and their projective cover, soil characteristics. Software Quantum GIS (Qgis) 2.10 was used to create the landscape map. At the first step the area was divided on the base of SRTM data on categories of landform: surface of drainage divide, river and stream valleys for their definition were added to the vector layer to the information of the natural drainage system of the territory which was made on the basis of the topographic map 1: 50000 scale, several classes of slopes according their steepness (min steepness value 0, max steepness value 40.05), exposure (8 different categories have been allocated for different, exposure: north, northeast, east, southeast, south, southwest , west , northwest. Then these patterns divided on the base of Landsat 8 image (2014 year) in band combination 753 (picture 1). This combination allow to get high color contrasts: healthy vegetation appears as bright green, the soil - mauve. This information was very useful for the vegetation studying and for the analyzing of health condition of forest communities. Results of fieldworks and the geoinformation analysis were used to form the classification of the landscapes which became the map legend. In classification 38 types of geosystem defined. On the map 654 homogeneous geosystem patterns digitized. Map accuracy was tested under field conditions.

Keywords: landscape mapping, geosystem classification, Khamar-Daban mountain range



Evaluation of Erosion Rates on a Global Scale

*Hagar Hecht¹, Takashi Oguchi¹

1. Graduate School of Frontier Science, the University of Tokyo

Understanding the mechanisms and controlling factors of erosion rates is of great importance as it is a vital component of both geochemical and sediment mass balance studies, and a deep understanding of these processes will enable us to develop accurate landscape evolution models. During the past decades scientists have been studying and measuring erosion rates using different methods. Some examples use sediment yield, measure the rates of active surface processes, and estimate exhumation rates through fission tracks, denudation rates using cosmogenic isotopes and even erosion rates through mass land wasting. A major objective of these studies is to try and discover what the controlling factors of erosion rates are.

Although erosion rates and sediment yield on a global scale have been studied in relation to topographic conditions, due to lack of available data in the past, the analysis was relatively basic. Thanks to abundant newly obtained erosion rates data, combined with new high resolution DEM data, a more complete and comprehensive analysis can be made, and correlation of erosion rates with factors such as basin morphometry, climate or tectonic plate boundaries is possible.

This study is based on previously obtained and published erosion rate data and sediment yield measurements published by the U.S. Geological Survey. It uses the ASTR GDEM, a 30-m DEM, and ArcGIS in order to analyze the relationship between basin morphometry and erosion rates. In addition, tectonic plate data published by Nordpil based on Bird (2003), and the WorldClim, global climate data based on Hijmans et al. (2005), are used in order to examine any correlation between erosion rates and tectonic plate boundaries, and erosion rates and climate.

Preliminary results show that: 1) Erosion rates are positively correlated to basin relief and mean slope; 2) they are also positively correlated to the precipitation amount and range; and 3) they are negatively correlated to distance to tectonic plate boundary.

Keywords: Erosion Rates , Sediment Yield, Basin Morphometry, GIS

Estimation of the antecedent rainfall period for mass movements in Taiwan

*CHIWEN CHEN¹, Takashi Oguchi¹, Lun-Wei Wei²

1.Center for Spatial Information Science, The University of Tokyo, 2.Department of Geosciences, National Taiwan University

Antecedent rainfall plays an important role in rainfall-induced mass movements. However, it is difficult to define the period of antecedent rainfall for mass movement assessment. To solve this problem, this study provides a simple approach that combines calibrated antecedent rainfall (*CAR*) and 24-hour rainfall for 283 mass movements that occurred in Taiwan during 2006–2013. The 24-hour rainfall at the time of each mass movement was compared with the total cumulative rainfall from various days before the event. The lowest value of the correlation coefficient occurred for the total cumulative rainfall from 15 to 20 days before a mass movements day. The 24-hour rainfall was compared with the cumulative *CAR* values for various days of antecedent rainfall. The effect of cumulative *CAR* on mass movements increased from 22.0% to 39.7% when the considered days increased from three to 30 days. However, the increase became gentle after 15–18 days. In addition, the critical antecedent rainfall conditions occurred within 18 days before mass movements for all cases. These results suggest that the antecedent rainfall of 15–18 days is useful for mass movement assessment in Taiwan. This study also established a critical antecedent rainfall threshold for mass movements in Taiwan useful for early-warnings: $I = 28.7D^{-1.24}$, where I is critical mean rainfall intensity during the antecedent rainfall period (up to 18 days) (mm/day) and D is the length of the antecedent rainfall period. According to the relationship between 24-hour rainfall and the critical antecedent rainfall conditions, low antecedent rainfall intensity continued for a long time leads to a gradual increase in soil moisture so that a small amount of 24-hour rainfall can trigger mass movements. On the other hand, high antecedent rainfall intensity for a short time is not enough to increase soil moisture, and a large amount of 24-hour rainfall is needed to flush surface materials and cause mass movements.

Keywords: mass movements, calibrated antecedent rainfall, rainfall threshold, critical rainfall, soil moisture

Statistical analysis on topography of mountain watersheds with frequent debris flows using multi-temporal high-resolution DEMs

*Hiroki Mori¹, Takashi Oguchi², Yuichi S. Hayakawa², Fumitoshi Imaizumi³

1.Graduate School of Science, the University of Tokyo, 2.CSIS, the University of Tokyo, 3.Faculty of Agriculture, Shizuoka University

Ohya Landslide, located along the uppermost reach of the Abe River, is a gigantic landslide generated in the early 18th century. It has been producing abundant clastic sediments, which may increase the risk of sediment disasters in the Abe River basin. Quantitative estimation of sediment supply from the landslide is important for effective sediment control. The landslide can also be regarded as a natural laboratory of rapid geomorphic change; therefore, investigating the landslide and the surrounding area is of geomorphological importance. The objective of this study is to examine topographic changes and the relationship between the topography and the frequency of debris flows and sediment transportation in the area. For quantitative analyses, high-resolution digital elevation models (DEMs) for eight periods from 2005 to 2013 were used, and the areas of generated debris flows were extracted. A parameter *DF* was defined as the debris flow frequency in each raster cell, and it was used for statistical analyses. The results revealed the important characteristic of the watersheds with frequent debris flows: they have V-shaped valleys with enhanced erosion, and both longitudinal and transversal inclinations of watersheds are sufficiently high. The DEMs were also used for differentiation to obtain erosion and deposition amounts and rates. The result shows that the average erosion rate of the landslide for the eight years is 23.7 mm/yr, which is significantly high even for Japanese mountains known for very rapid erosion rates.

Keywords: Ohya landslide, geomorphology, airborne LiDAR, high-resolution DEM, debris flow

Spatio-temporal analysis of disaster risk in Sumida ward, Tokyo

*MAYCHEE LIAN¹

1.University of Tsukuba

The understanding of disaster risk in a spatiotemporal perspective helps to mitigate the potential damages of disasters effectively. In this study, the Data Envelopment Analysis (DEA) technique and people flow data are integrated to develop a disaster risk assessment to understand the disaster risks in both spatial and temporal manner. In doing so, Sumida ward, located in the northern part of Tokyo bay is selected as the case study. Geographically, Sumida ward is situated in an alluvial lowland area and there are many places below the mean sea level with high population density and several urban features. Most of the man-made features of this area are made out of wood faces and having a higher potential for extreme damages. Generally, the damage by disaster is strongly related to the population density of the area. But the population density of the area is varying with the people movement within a day. Thus, the present study assesses the disaster risk levels with the different time periods of the day based on people flow and its spatial pattern through the developed assessment.

Keywords: Disaster, Disaster risk assessment, Sumida ward

Relationship between Urban Traffic Accidents and Urban Structures from Spatial Perspective

*Niloofer Haji Mirza Aghasi¹

1.Division of Spatial Information Science,Department of Geoenvironmental Sciences,University of Tsukuba

Urban Traffic Accidents have been and continuing to be a major contributor of human and economic costs to requiring concerted multi-disciplinary efforts for sustainable effective prevention. Traffic accidents rank in the top ten causes of the global burden of disease and injury, and will probably be in third place by 2020, when measured in disability-adjusted life years lost (WHO, 2013). Urban structure and urban activities in a city or metropolitan area, make a significant involvement in generating interactions and accidents. Investigation of traffic accidents and urban structures such as road networks, land use patterns, public facilities, etc. from spatial perspective is important for future urban planning processes. The urban interactions and activities can happen between districts or within a district, on different roads and different time and space. The study area of this study is Tehran city which include 22 districts. Tehran is the largest city in Iran and also its capital. Its population is close to 12 million during day time and over 8.5 million people at night. The analysis in this study is based on data obtained from the Police Department of the Islamic Republic of Iran, Tehran. The main database contains information about all police-reported urban traffic accidents that occurred in 2011 in Tehran. Tehran has experienced a rapid growth of urban population. With the expansion of the city boundaries, even though there is an occurrence of urban transportation and large usage of cars for daily urban trips and large number of accidents, make the Tehran accident problem more serious. The Tehran spatial structure has a high density structure combined with a several central pattern. The lack of strong and unique essence, as easily as the spatial distribution of employment, are mostly associated with the build-up density and accidents but less dangerous accidents. The current spatial structure of Tehran, which is a high density city unaccompanied by influential Central Business District (CBD) creates several limitations, so that we can see the distribution of the accidents whole of the city. A rapid and continued rise in living accommodations and land costs is expected in cities with transportation improvements and rapid economic and population growth. Humans, nations, regions and the world would be seriously limited in development without transportation, which is a central element for physical and economic growth. Urban growth occurred as physical and functional changes took place, due to the transition of the rural landscape to urban forms, which has been studied by various researchers (Thapa and Murayama, 2010). These changes as well influence the urban density, which would be the increase of the growth rate in several dimensions. Transportation network systems, urban construction and urban traffic accidents are interdependent each other. Urbanization is taking place at a rapid pace in Tehran, and this expanding city is changing the urban structure. Land use is one of the most important pillars in creating urban areas, and thus, creating transportation and road patterns have a direct impact on urban traffic accidents. The combination of high population and growth of land use causes the increase of daily trips that produce urban traffic accidents in the city. Agreeing to this varying communication between land use and the road network, which is causing traffic accidents, also calls for an agreement on how the land use is associated with urban traffic accidents. An explanation of the connection between the several land uses and occurrence of urban traffic accidents in Tehran's metropolitan area indicates that land use generates different kinds of causes, which are brought about by various actions. It is necessary therefore to have an understanding structure of urban and accidents for improving safety on the roads which will be done with GIS as GIS is a comprehensive management tool for traffic

safety.

Keywords: Urban Traffic Accidents, Urban Structure, Spatial Analysis

Modeling Urban Land Use / Cover Changes Based on Machine Learning Techniques: A Case study of Shanghai, China

*Hao GONG¹, Yuji Murayama¹

1. Graduate Schools and Programs Life and Environmental Sciences, University of Tsukuba

Urban growth is one of the most important topics in urban studies. A city is considered as a complex system. It consists of numerous interactive sub-systems and is affected by various factors including governmental land policies, population growth, transportation infrastructure and market behavior. To understand the driving forces of the urban form and structural changes, the satellite-based estimation is considered as the appropriate methods to monitor these dynamic changes in a long term.

Based on previous studies, classified Landsat satellite images are used to monitor the temporal changes of land use and land cover (LULC) for the study area. Furthermore, modeling and simulation are believed to be powerful tools to explore the mechanisms of urban evolution and to support the planning in growth management. In this study, authors use the social and geographical factors to model and simulate the urban growth in Shanghai. Finally, an attempt is made to utilize two machine learning models (the deep convolutional network and multi-layer perceptron neural network) to predict the future changes in the land use / cover, and compare the performance of two models.

Keywords: LULC, Machine learning, Shanghai, Urban growth modeling

Urban Growth Modeling Using Neural Network Simulation: A Case Study of Dongguan City, China

*XINMIN ZHANG¹

1.University of Tsukuba

Dongguan is an important industrial city, located in the Pearl River Delta, South China. Recently, Dongguan city experienced a rapid urban growth with the locational advantage by transforming from traditional agricultural region to modern manufacturing metropolis. The urban transformation became usual change in China under the background of urbanization which belongs to one trend of globalization in the 21st century. This paper tries to analyze urban growth simulation based on remotely sensed data of previous years and the related physical and socio-economic factors and predict future urban growth in 2024. The study examines and compares the land use/cover (LUC) changes over time based on produced maps of 2004, 2009, and 2014. The results showed that water and forest area decreased since the past years. In contrast, the urban land increased from 2004 to 2014, and this increasing trend will continue to the future years through the urbanization process. Having understood the spatiotemporal trends of urban growth, the study simulated the urban growth of Dongguan city for 2024 using neural network simulation technique. The Kappa transition was calculated for the simulated map of 2014, and the value was approximately 0.5. Further, the figure of merit (FoM) of simulated map of 2014 map was 8.86%, which can be accepted in the simulation and used in the prediction process. Based on the consideration of water body and forest, the newly growth area is located in the west, northeast, and southeast regions of Dongguan city. The finding can help us to understand which areas are going to be considered into the future urban planning and policy by the local government.

Keywords: Neural Network Simulation, Dongguan City, Urban Growth

Evaluating Walkability through Neighborhood Environment: A Case Study in Tokyo Metropolitan Area

*Hao Hou¹

1.Division of Spatial Information Science, Graduate School of Life and Environmental Sciences, University of Tsukuba

Walkability is an index to evaluate how friendly the built environment is towards the presence of people's walking behavior. Neighborhoods with high walkability can promote local residents' daily walking behavior and the evidence has shown that regular walking behavior is benefit to personal health. As a result, evaluating walkability is a public health priority since it provides information of how to build a walkable neighborhood to promote local people's walking activity. Daily walking behavior can be separated into two categories: utilitarian walking and recreational walking. Among them, utilitarian walking is a mobile method to reach a place for further behavior and it is highly affected by the built environment and availability of different destinations. On the other hand, recreational walking refers to walking for health, pleasure and entertainment. It is highly affected by aesthetics and safety. In this study, the main purpose is to evaluate utilitarian walkability in Tokyo Metropolitan Area (TMA) and prove that good utilitarian walkability of neighborhoods promotes the daily walking behavior.

For evaluation of utilitarian walkability, five factors (residential density, road accessibility, land use diversity, bus stops density, and railway station accessibility) are selected and GIS methods are adopted for collecting and analyzing the data. For accomplishing Multi-criteria Evaluation (MCE), Analytic Hierarchy Process (AHP) analysis is employed to determine the weights of each factor. Subsequently, the final walkability map is established by raster calculation of all the factors based on assigned weights. With the utilitarian walkability map of TMA, the spatial patterns of utilitarian walkability are detected and summarized. Further, two neighborhoods with different utilitarian walkability are selected for the detailed analysis and comparison. The key points of this step are the separation of walking behavior happened within and without the neighborhood, together with the combination of social-economical attributes of residents and physical attributes of the neighborhood environment. With the findings from this study, characteristics of utilitarian walkability in TMA can be better understood. Advices on building a more walkable neighborhood can be concluded.

Keywords: neighborhood environment, people flow, Tokyo Metropolitan Area, utilitarian walking, walkability

Geospatial data gathering using cloud GIS and smartphones: its advantages and significance

*Takehiro Morimoto¹, Yuji Murayama¹

1.Faculty of Life and Environmental Sciences, University of Tsukuba

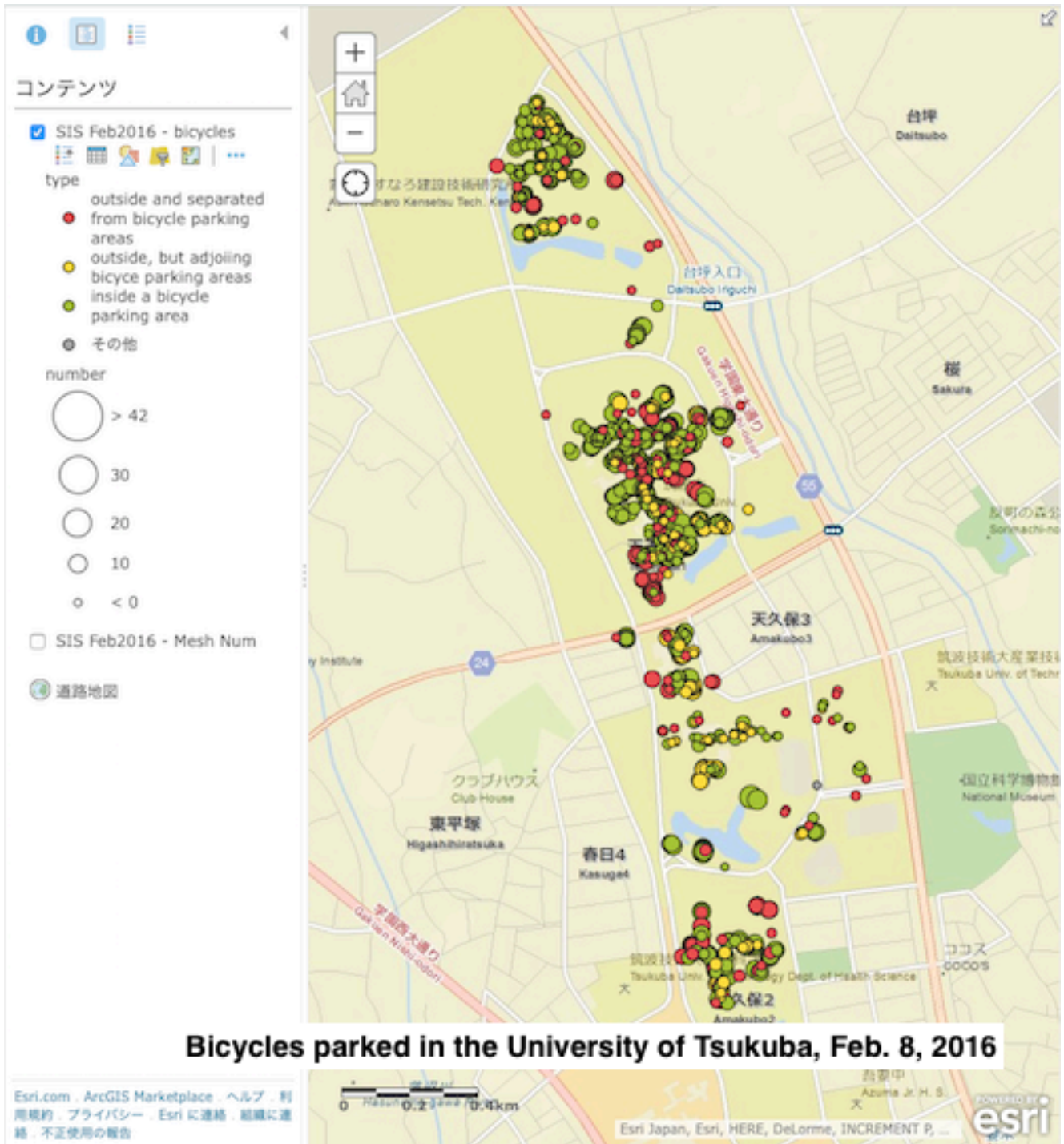
The authors examined the advantages and significance of the use of cloud GIS and smartphones to collect geospatial data in a fieldwork.

For this purpose, the authors conducted an experimental study in which the distribution of bicycles parked in a whole university campus was investigated.

The authors implemented a web-GIS map on ArcGIS Online, a cloud-GIS service by ESRI, to map the location of bicycles. Thirty students surveyed the distribution of bicycles in their assigned areas using smartphones on-line. They could record the data about bicycles onto the web-GIS map using ESRI's Collector for ArcGIS, an application for data collection, installed on their smartphones. The authors had a questionnaire on the students' experience after the investigation.

Results of this study showed that the use of cloud GIS and smartphones in a fieldwork made simple, quick and cooperative investigation possible, triggered interests in using GIS, and stimulate spatial thinking. The authors argued that advanced use of them should be developed to enhance its advantages and significance.

Keywords: cloud GIS, smartphone, fieldwork, geospatial data, geography education



Bicycles parked in the University of Tsukuba, Feb. 8, 2016

New WebGIS system for geospatial data sharing of Thailand using open source software server and web service standard

*Nutjaree CHAROENBUNWANON¹, Koji WAKITA¹

1. Graduate School of Science and Engineering, Yamaguchi University

Authors made a new challenge for sharing on the mineral and geological information of Thailand. Although some efforts existed to share either standardized data format such as GML /EarthResourceML or client applications to gain access on heterogeneous data that stored in different formats from diverse sources, the usability of the access was limited due to lack of suitable data semantic encoded. The authors proposed a new method of geospatial data sharing of Thailand that are compliant to the standard format and access protocols of Web Map Service (WMS) and Web Feature Service (WFS) to overcome these problems. Our Web-Based GIS architecture is designed based on OGC service standard such as WMS, WFS and Open Source Software server. It approaches to the geological and mineral information sharing, formulation techniques of WebGIS configuration. The new method can be applied to other fields of geosciences for implementation of web-based system because there are applicable and functioning tool for server software. It has an advantage on cost efficiency in either the development or system maintenance as well.

Keywords: OGC web service, Web Feature Service, GeoServer, Thailand, mineral resources

Providing open-access online materials for GIS exercises

*Takashi Oguchi¹, Hiroyuki Yamauchi¹, Yuji Murayama², Koichi Kubota³, Yukio Sadahiro¹, Keiichi Okunuki⁴

1.Center for Spatial Information Science, The University of Tokyo, 2.Graduate School of Life and Environmental Sciences, Univerisy of Tsukuba, 3.Faculty of Science and Engineering, Chuo University, 4.Graduate School of Environmental Studies, Nagoya University

Since around 2000, GIS researchers in Japan have collaborated to provide materials for GIS lecture classes usable in university education. The outcome includes a GIS core curriculum, a GIS "body of knowledge" explaining the details of the curriculum, a series of PowerPoint presentations, and a GIS textbook. However, they have not yet provided materials for GIS exercises using GIS software. Therefore, we launched a new project to provide such materials which will be available online and accessible by anybody. This paper introduces the project and materials provided so far.

Keywords: GIS, Materials for exercises, Open access