Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HSC03-01 Room:105 Time:May 28 10:00-10:15

Identifying land use changes and the related problems in northern states of India

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India has been experiencing an accelerating rate of socio-economic changes in the last three decades and their interaction with the land and its changes to date and in the near future are a great concern of this rapidly growing country. However, the study of the change of the use of land and land-related problems has not been sufficient, particularly for the period including the 1980s. The present study is to identify land use changes and the related problems in some selected areas in northern India from the 1980s.

Keywords: India, land use change, socio-economic change

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Variation in the use of ecosystem services by local people in Borneo: Social and ecological factors

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Non-timber forest products (NTFPs) are important ecosystem services provided by natural forests. Utilization of NTFPs by local people is rapidly decreasing and/or changing throughout the world with economic globalization, the prevalence of a monetary economy, and decrease and degradation of forest ecosystems. Potential causes and consequences of the decrease and changes, however, have rarely examined using quantitative sociological data. In this study, we investigate the effects of social and environmental characteristics of villages and households on the utilization of NTFP by households, in Sarawak, Malaysia.

In Sarawak, primary forests were exploited by indigenous people through swidden agriculture (slash-and-burn agriculture) and collection of wild animals and plants before the modern economic transformation, which started in the 1960s. In the last few decades, however, commercial logging and the development of oil-palm plantations have changed the land cover drastically. On the other hand, many indigenous people today have migrated to urban areas, or even outside of Sarawak. Village life has also changed in various ways, and local people depend on natural forests less and less.

We conducted questionnaire survey in 22 and 69 villages in the basins of the Rajang and Bram rivers in the state of Sarawak, as part of the project of “Collapse and Restoration of Ecosystem Networks with Human Activity” (Research Institute for Humanity and Nature, Kyoto Japan). When consent was obtained, the surveyors interviewed a representative of the village (the village head, if available) and 16?20 households in each village and filled questionnaires in Malay. We analyzed the data together with land cover dataset, the proportion of the land covered by forests surrounding the villages was estimated based on the land cover map based on satellite images.

We analyzed the data using hierarchical Bayesian modeling. The modeled NTFP variables were (a) presence and absence of catches of (a) wild boars (*Sus barbatus*) and (b) sambar deer (*Rusa unicolor*) in the previous year, and frequency of (c) firewood, (d) wild-fruit, (e) wild-mushroom and wild-vegetable collections. The explanatory variables included in the model were (1) forest cover, (2) economic condition of the household and (3) village accessibility.

The results show that forest cover significantly explains the variation in the usage of most NTFPs, while other factors are also responsible for the variation. For example, economic conditions of the households affect negatively or positively depending on NTFP types.

Not only are NTFPs essential for subsistence, collection and utilization of NTFPs are often important cultural and social activities for people. This study demonstrates that multidisciplinary approach of collaboration of social and natural scientists are necessary to understand extensive repercussions of land cover changes on lives of local people.

Keywords: Ecosystem services, Borneo, Tropical Forest, NTFP, Land cover

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Land-use change and flood disaster of semimountinous region -A case of Taketa City, Japan-

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1. Preface

A huge tsunami due to the East Japan Great Earthquake that had occurred in March, 2011 cased the great deal of harm in Japan also even in the region by taking precautions against tsunami such as breakwaters. In the history, Japan has experienced not only the large earthquake, but also repeating the flood and the sediment disaster by the heavy rain from the seasonal rain front and the typhoon. The authors considered Taketa City, Oita Prefecture, where the four times of heavy rain within 30 years was experienced, the flood and the sediment disaster occurred in every case and the human suffering, the house destruction, and the farmland damage occurred. Taketa City is almost located on the central part on Kyushu Island, and it has the characteristic of a typical semimountainous area of Japan in the point that the population decreases and the aging of the population has progressed. The purpose of the present study considers the flood situation, a geographical features condition and the relation to the land use change as a case of the flood damage that occurred in the Taketa City in July, 2012.

2. Flood damage in Taketa City from the Northern Kyushu Downpour Disaster in July, 2012

The Northern Kyushu Downpour between 3rd and 14th of July, 2012 was a natural disaster that the slope failure and the river flood generate by the seasonal rain front activated on the northern part of Kyushu Island including Oita Prefecture. Taketa City received the big flood damage again by the Northern Kyushu Downpour in July, 2012. The total amount of rainfall was not large, but the rainfall of 30-40 millimeters per one hour continued from 3 to 9 o'clock on the 12th. The water level of the Inaba River and the Tamarai River rose rapidly in only about six hours because there was a large amount of precipitation that reached 250 millimeters.

There was fortunately no overflow in Inaba River though the water level rose to the very limit top of the embankment in the Inaba River where the dam had been completed in the previous year. However, the flood occurred in several places in the Tamarai River around Haidabaru Area. The water level rose from the top of the embankment to 2.5 meters in the Haidabaru Area. Driftwood by the slope failures in the upper stream of Tamarai River that hung to the bridge in the downstream in addition to the overflow by the water rising promoted the overflow.

3. The flood damage and land use change in several decades in Taketa City

Recently, the residential house, the commercial establishment, and communal facilities tend to be located in the flat plain of the river valley though it was a valuable agricultural area in a rice field and a dry field in the Taketa City since the latter half of the twentieth century. On the other hand, the land use change of afforestation on the farmland in the mountainous region is also general due to shortage of person in charge of agriculture by the population decrease and the aging of the population. It is understood that the land use and the social change connected with the factor and the background of the flood damage confirmed in Chapter 2 are progressing in Taketa City.

It is difficult to induce an existing land use such as residential house move enough to preferable use by the viewpoint of the disaster prevention in the present legal system of Japan. The flatland that is appropriate for the urban land use is very little in the hilly, mountainous area that the present study considers. The discussion of the ideal way of the land use in the river valley plain that becomes basic of the citizen's life is expected to be advanced as a base of the improvement of citizens' disaster awareness to achieve the disaster prevention and mitigation in the future in Taketa City.

Keywords: Semimountainous region, Flooded area, Urban development, Population decrease

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Land use change of Hlaingthayar township,Yangon

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This study is an attempt to highlight the land utilization development of Hlaingtharyar Township, one of the recently-built new towns in the suburbs of Yangon City and to check the drinking water quality condition for the new housing development area and industrial zones. Based on the assessment with relevant statistical methods and Geographic Information System, the resultant values are presented with diagrams and maps. The chief finding of this research work is the rapid development of the study area among the new towns of Yangon City because of its advantageous of geographic location and the presence of relatively larger industrial zones. The chief finding of this study is the rapid land use changes of the study area among the new towns of Yangon City because of its advantageous of geographic location and the presence of relatively larger industrial zones. When Hlaingtharyar Township was constituted in 1989, it had only 2,765 persons. After residential land plots were allotted, the population increased rapidly from 148,898 in 1994 to 391,765 in 2009, but slightly decreased to 374,698 due to the exclusion of people eligible for voting living outside the township. Comparatively the growth rate and the number of population of Hlaingtharyar Township are much greater than all the other newly built townships on account of locational advantage linking Yangon City and Ayeyarwady Division by the newly constructed bridges and roads. The rapid population growth implies to some extent, the improvement in the land use conditions of the study area. All the nine major types of land use including land use for primary production exist in this township. Unlike most other townships, the proportion of land use for industry is relatively high with 26.54 %due to the presence of industrial zones. Consequently 63.97 %of workers are engaged in the manufacturing sector, compared with 3.95 % in the government services sector and 10.47 percent in the trade and commerce sector. The average per capital income is Ks. 4,816 which is equivalent to a little over US $ 5. With this indicator, it is well above the level of poverty measured by the UN’s indicator of poverty. Although the township has more modern style multi-story residential buildings due to the presence of several housing projects, a greater proportion (43.63%) of houses are huts which appear slummy. Generally the pace of land used development is fairly high for a new township in the vicinity of Yangon City because of the presence of industrial zone which is the largest in Myanmar and due to its advantageous location as a gateway from Yangon City to the Ayeyarwady deltaic region. In this study, the large amount in calcium Ca2+ and sodium Na+ concentrations in the groundwater samples from the study may theoretically reflect local mineralogical changes in the sediments and in the carbon dioxide produced by biological processes in their surface layers. The high nitrate NO3- concentration in the water samples indicates that the shallow aquifer near industrial zone is already challenged by the problem of pollution. The high EC value is directly affected by tidal effect of river water from Panhlaing River.

Keywords: land use change, population growth, urbanization

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A Quantitative Assessment of Watershed Resilience: A Case Study of the Heihe River basin in Northwestern China

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The Heihe River Basin has been through significant transformation and the sustainability of its water network has been significantly altered by mankind as a result of historical agricultural activity and the more recent water infrastructure investments. While there are many studies examining the sustainability of the Heihe River Basin, most studies focus on single issue criteria and do not have a holistic system-level perspective. As sustainability is a system-level trait a system-level analysis is warranted. The objective of this study is to investigate sustainability of the Heihe River Basin through the ecological network analysis (ENA). We established a framework of the ecological network analysis that can be used to examine sustainability of a river basin. We collected detailed data from the flow network, such as precipitation, river discharge, groundwater storage change in the Heihe River Basin from 2000 to 2010. We also estimated evapotranspiration from different land uses based on the heat balance at the surface using the daily mean air temperature, relative humidity, and wind speed. Compared to previous studies (Li et al., 2009; Li and Yang, 2011), our study successfully combined hydrological model into the existing method of the ecological network analysis. The system-level metrics of the basin were measured and through these metrics the evolution of the basin was examined. Specifically through the metrics of efficiency, resilience, redundancy, cycling, and robustness, the long term effects of agricultural development and the more recent effects of water infrastructure investment in the Heihe River Basin. The proposed ENA methodology is significant in terms of ability to examine sustainability from several different key concepts such as efficiency, resilience, redundancy, cycling, and robustness. This method can be incorporated into existing decision-making support system for integrated water resources management in the river basin. We highlight the importance of combining the proposed ENA methodology into a framework of multi-criteria decision analysis, so called MCDA.

Keywords: Ecological Network Analysis, Sustainability, Resilience, Efficiency, Robustness, Water Resource Management

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Integral Approach to Historical Interaction between Human Activities and Hydrological Cycle in Dryland

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This article proposes an alternative approach in sustainability assessment. The conceptual framework was developed by modifying Ken Wilber's All Quadrants, All Levels (AQAL) approach. To look at how our framework can facilitate the practice of sustainability assessment, we apply the framework to examine interaction between humanity and environmental changes in the Heihe River basin.

Historically, nomadic grazing was practiced in the arid areas of the basin and agriculture was practiced in the water-rich oases. Since the 1940s, however, large-scale development has been carried out for irrigation agriculture. However, the large-scale irrigation agriculture dried up the river and caused groundwater level decline in the lower reaches. In the 21st century, the Chinese Government has implemented water saving policies. The policy proposed several water efficiency measures, such as restriction of river water intake, more efficient water supply, introduction of more water-efficient crops, and prohibition of the reclamation of new farmland. However, problems have since emerged, such as disparity in the efficiency of water use attributed to economic inequality among farmers, a decrease in the groundwater recharge due to irrigation, and water saved by farmers being diverted to farmland newly reclaimed by agricultural corporations. It was reported in July 2002 that water had returned to the dried-up terminal lake of the river. Water balance analysis shows an increase in river discharge released to the downstream, but this was due to greater rainfall in upstream reaches. On the other hand, in downstream reaches where livestock farming has been practiced, vegetation conservation policies have been promoted, such as fencing of riparian forests, "ecological migration," and construction of feed bases. On grazing land, biomass has increased as a result of declining grazing pressure; and has also increased in the downstream areas as a whole, but due to farmland development and plantations rather than as a result of these policies.

The history of human/ecological interactions in the oases of the Heihe River Basin indicates that water deficiency resulting from increased human activities has traditionally been solved by sourcing water from outside the living sphere of the local people. In other words, people have solved the problem by expanding their system boundaries. It would be no exaggeration to say that advancements in civil engineering and other technologies have enabled this. However, globalization has expanded the current system to the limits of the closed system we call the Earth. Historically successful methods can no longer be used, and limiting our efforts to simply pursuing efficiency would only create new problems. It therefore is crucial to find new solutions.

The proposed approach enables us to investigate the environmental problems of the Heihe River basin in a four-quadrant framework, and combine the empirics of quadrants obtained from traditional disciplinary methodologies. The four-quadrant framework adopted in this study illustrates the interlocking relationships among various perspectives of environmental issues in the Heihe River basin, namely, physical perspective, personal perspective, cultural perspective, and social perspective. In particular, the protruding development (evolution) of the lower right dimension is the fundamental cause of the environmental degradation and its related social problems in the Heihe River basin. Compared to other established approaches in literature that emphasize on the tradeoffs of various perspectives of sustainability, our findings indicate the potential contributions of four-quadrant framework to sustainability assessment through its focus on the inter-relatedness/inter-connection of different perspectives.

Keywords: AQAL, Integral Studies, Sustainability assessment, Irrigation agricultural development, Water resources management, Culture

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Administrative Discrepancies of Karnataka State Forest Department India, and its consequences at a Village level

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The administrative divisions to manage forest area in India are complex which is out of the understanding of the general public. There are overlapping administrative controls which are a good means of escapism from accountability and responsibility. There are three main divisions of forest which can be seen throughout India, such as Reserve Forest, State Forest and Social Forest. The social forest is developed out of the actual forest area and it is developed in the villages as village level forest. Whereas the Reserve forest and State forests share their boundary within the natural forest. The confusing and complex aspect of the reserve and state forest are, they also hold protected forest National Park Wild Life Sanctuaries and Tiger reserves. The real jargon is that, how all these sub divisions share their boundaries and also accountable is a matter of debate. In this context, the present paper focus on a micro level situation, where a village bounded by the Reserve forest, State forest and wild life sanctuary is a victim and is also a place of conflict in all respects, The complex administrative structure has been revealed in this paper and how to overcome these issues has been discussed.

Keywords: Forest, Administration, Management, Village, Wild Life, Karnataka

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The use of maps for disaster prevention - some lessons of the Great East Japan Tsunami Disaster

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The increase of large scale disasters is becoming a major threat to our sustainable future, as the Great East Japan Tsunami of 11th March 2011 mercilessly showed. The paper discusses how the damages can be reduced by carefully making, reading and using relevant maps based on the lessons of the Great East Japan Tsunami Disaster.

Keywords: Great East Japan Tsunami, map, disaster, Future Earth, land use