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Editorial

Urban Land Systems: An Ecosystems Perspective

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1. Introduction

We live in an urbanizing world. Since 2008, more than half of humanity lives in cities, both large and small, and old and new. We also live in a world that is becoming even more urbanized, it is expected that by 2050, 66 per cent of the world's population will live in cities [1]. The process of urbanization, accompanied by the rapid expansion of cities and the sprawling growth of metropolitan regions over the world, is one of the most important transformations of a natural landscape.

In the context of land systems science, contemporary urbanisation is a set of land-use change processes and the various contemporary cityscapes are the resulting land systems. Population growth increases urban footprints with consequences on biodiversity and climate. Much of the explosive urban growth has been unplanned and conflicting land-use demands often arise as land is a limited resource. Increased requirements for living space and intensive landscape utilization constitute two of the principal reasons for the environmental change, with significant impacts on quality of life and ecosystems.

This special issue of LAND explores urban land dynamics with particular regard to ecosystem structure, and discusses consequent environmental changes and their impacts. The studies cover a wide range of countries and contexts, and draw on a number of disciplinary methods and interdisciplinary approaches from the social and natural sciences. The papers have been authored by 41 researchers from 29 institutions in countries worldwide: from Australia, Bangladesh, China, India, Iraq, Italy, Japan, Nigeria, Philippines, Saudi Arabia, Slovakia, Spain, Thailand, the United Kingdom, and the USA.

2. Dynamics of Urban Land Systems

Earth observation data can contribute considerably in monitoring complex urban land cover patterns for various applications in different environments. Several papers focus on the detection of urban growth based on spaceborne remote sensing data at multiple scales, spatial and temporal resolutions, and the evaluation of environmental impacts through well-established concepts of landscape metrics.

MacLachlan et al. [2] evaluate multi-temporal urban expansion for Perth, Western Australia, derived from Landsat imagery and the related decrease of natural resources. Their results indicate that the spatial extent of the Perth Metropolitan Region has increased considerably in the period of 1990–2015. Irreversible and unsustainable agricultural landscape changes related to urban growth in peri-urban areas of Adelaide city are assessed by Wadduwage et al. [3]. Fragmentation of agro-ecosystems due to urban expansion is analyzed using several landscape metrics indicators: percentage of land, mean parcel size, patch density, and modified Simpson´s Diversity.

Rapidly growing cities in the global south, particularly in Asia and Africa, represent the dominant urban footprint of the present and future. A great deal of attention is currently being focused on these cities, about which we know relatively little in comparison to northern cities. In this special issue, Zhang et al. [4] use Landsat imagery to detect the changes in urban land use in the Yellow River Delta to document systematic changes in natural wetlands in 1976, 1984, 1995, 2006 and 2014. Their cartographic outputs document systematic wetland degradation, wetland conversion to salt pans and aquafarms, and significant urbanization.

Similarly, Landsat data are used by Rimal et al. [5] to analyze the spatiotemporal patterns of urbanization and LULC changes in Kathmandu Valley, Nepal. Results show that the urban coverage of Kathmandu Valley has increased tremendously from 20.19 km^2 in 1976 to 139.57 km^2 in 2015, at the cost of cultivated lands and forests. This study also reports the impacts of the recent disastrous earthquake in the valley on the urban areas and discusses the high risks associated with different geological formations.

The third example illustrating rapidly developing countries in Asia is a land use/land cover change assessment of the Laguna de Bay area in the Philippines. Iizuka et al. [6] present a visual interpretation of the future changes in LULC classes of built-up, crop-grass, trees, and water up to the year 2030. The probability of changes occurring in different years in the future is calculated using three different scenarios: business-as-usual, compact development, and high sprawl. In total, a large proportion of the study area is modeled to be converted to urban built-up land cover classes by 2030, varying in extent depending on the development scenario.

3. Perception of Urban Green Spaces (UGS) and Ecosystem Services

Urban vegetation is essential for urban ecosystems and ecosystem services and can be determined by well-established methods in remote sensing. In the light of past and future urbanization trends, accurate information on the state, accessibility, distribution, and supply of UGS plays an increasingly important role in sustainable urban development, human well-being, and also for conservation of ecosystem functionality.

Kopecká et al. [7] demonstrate the potential for UGS extraction from newly available Sentinel-2A satellite imagery, provided within the frame of the European Copernicus program. UGS classes are described by the proportion of tree canopy and their ecosystem services. A comparative analysis of three cities in Slovakia indicates the relatively high importance of urban greenery in family housing areas, represented mainly by privately owned gardens.

Cultivated parks and urban gardens play an important role as providers of aesthetic and psychological benefits that enrich human life, reduce stress, and increase physical and mental health. Paul and Nagendra [8] present the results of a survey of UGS perception by park visitors in the megalopolis of Delhi that aimed to understand the importance of parks for them. For example, large parks tend to attract more visitors from further distances, despite their having small neighborhood parks in the vicinity of their homes.

On the other hand, Rupprecht [9] points attention to residents' perceptions of informal UGS—vacant lots, street verges, brownfields, power line corridors, and waterside spaces—in four shrinking cities in Japan. He proposes eight major planning principles derived from the findings as a potential basis for managing non-traditional green spaces to urban planners.

4. Urban Landscape Structure and Urban Heat Island (UHI) Effect

Urban areas influence the local microclimate in several ways, e.g., by air pollution, altered wind speeds and directions, heat stress, or changes in surface ozone concentrations. UHI describes the phenomenon that atmospheric and surface temperatures are higher in urban areas than in surrounding rural areas. Among the long-term consequences on microclimate, the UHI effect has received wide attention from geographers, urban planners, and climatologists over recent years. Rasul et al. [10] review the current research on this topic, methods, data, and techniques used in UHI detection.

They conclude with recommendations for conducting further research on surface urban cool islands that especially occur in arid and semi-arid climates.

Rahman et al. [11] investigate the increase of land surface temperature in Dammam city, the capital of Saudi Arabia's Eastern Province, due to urban expansion in the period 1990–2014. Based on land use/land cover changes and predictive modeling, this study projects a dramatic increase of land surface temperatures for the year 2026.

5. Conclusions

Global and local urbanization is creating very significant challenges for sustainability and human well-being. This special issue highlights some important aspects related to urban sprawl dynamics and urban ecosystem management. Observations and studies presented in 10 papers show that urbanization affects essential ecological, economic, and social landscape functions, whose importance are often undervalued in cities across the globe.

The special issue arises from a session convened by the editors at the GLP Third Open Science Meeting in Beijing, October 2016. We believe that the results presented in these studies will provide useful information for decision and policymakers involved in urban and spatial planning at local, regional, and national levels and can help better plan and design UGS, responding to the needs and preferences of urban communities.

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