Urban Green Space Planning and Management for Biocultural Diversity in Jakarta, Indonesia

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Abstract

More than half of the world's population lives in urban areas, and there is increasing recognition of the importance of urban green spaces in relation to human well-being as cities grow larger. Jakarta, the capital of Indonesia, faces various problems due to rapid urbanization as it is bringing along increasing levels of air pollution and harming the quality of life of residents. The Indonesian government plans to reduce the problems by gradually increasing the area of urban green space through urban landscape planning and management. Like many other urban areas located in tropical regions, Jakarta exhibits a relatively high biodiversity due to its traditional land use patterns. This feature should be utilized in the planning and management of its urban green spaces. In addition, both ecological and cultural aspects of urban and sub-urban areas require attention and should inform the decision-making. Urban green spaces need planning that fits the local characteristics of urban landscapes, both ecologically and culturally. In other words, attention for biocultural diversity will result in more effective landscape planning and management systems.

Keywords

Biocultural Diversity · Landscape Planning · Land Use Pattern · Urban Environment · Urban Green Space · Traditional Land Use · Well-being

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S. A. Abdullah et al. (eds.), *Conserving Biocultural Landscapes in Malaysia and Indonesia for Sustainable Development*,
https://doi.org/10.1007/978-981-16-7243-9_13

13.1 Introduction

In general, cities exist because of mainly economic and social reasons and urbanization makes many of them grow larger and larger over time. Modern cities have become the centers of politics, economy, and society, and over 50 percent of the world's population now lives in urban areas (WHO-Europe 2017). In the past, upon the emergence of the first cities, the conditions for food cultivation were key in determining which locations were best suited because the community needed to be sustained. For example, early stage cities such as in Egypt and China were located near rivers as these ensured water resources and fertile land (Kaplan and Holloway 2014).

Modern cities are spaces with social and cultural components connected to an economy that are accustomed to a high population density. However, in terms of their operation as a system or ecology (Forman 2014), they are also confronted with various problems such as poor air quality, traffic congestions, issues related to waste management, and substandard housing. Although such problems occur in cities all around the world, typically they are more severe in developing countries. For example, Jakarta, the capital of Indonesia, is facing serious problems such as increasing population density, flooding, and air pollution (Arifin and Nakagoshi 2011; Kusuma et al. 2019; Setiowati et al. 2018), which are problems that directly affect its residents (Kusuma et al. 2019, Setiowati et al. 2018). Increasing demands for improved health, well-being, and quality of life are feeding the desire to improve the sustainability of urban environments. In this, the planning and management of urban green space (UGS) is widely recognized as being of key importance (Van Bueren et al. 2014; Austin 2014; WHO-Europe 2017). Also in the case of Jakarta, UGS has been emphasized to improve residents' well-being and quality of life (Setiowati et al. 2018).

Recently, the planning and management of UGS has been discussed, not only in the sense of simply creating more UGS, but also in respect to increasing biocultural diversity. It is widely agreed upon that UGS contributes to better air quality and more esthetically pleasing spaces. In tropical and subtropical regions, it is fairly common to find high biodiversity in UGS (Mabuhay and Isagi 2005). In addition, these regions are also well known for their cultural diversity. In particular, studies have shown that tropical regions in Asia exhibit both linguistic diversity and biodiversity (Maffi 2005; Maffi and Woodley 2010). The combined concept of biocultural diversity was brought to the attention of policymakers around the world when it was discussed at the 1992 Convention on Biological Diversity. In the United Nations Environment Programme, published in 1999, biodiversity is stated as being related to the culture and spiritual situation of humans. In other words, biodiversity and cultural diversity are tightly linked to each other. This is recognized as a very important factor in discussing sustainable landscapes, both urban and non-urban.

This chapter focuses on investigating the current state of the urban environment in Jakarta and discusses strategies for UGS planning aimed at improving the urban landscape and the quality of life of residents. Moreover, it discusses how biocultural

diversity forms an appropriate guideline in creating UGS that makes the urban landscape more sustainable and improves the quality of life.

13.2 Status of Jakarta

In Southeast Asia, Jakarta is one of the urban regions that has seen a rapid increase in population (Fig. 13.1). In 1950, the population stood at approximately 1.5 million and, in the following decade, it grew at an annual rate of over 6%. During the 1960s, 1970s, and 1980s, the population more than doubled with an annual growth rate of 3–4%, bringing the population in 1990 to a total of 8.2 million. After a near standstill in the 1990s due to suburbanization and the 1997 Asian financial crisis (Rukmana et al. 2019), the population continued to grow again at a moderate but steady pace. In the 2000s and 2010s, the annual population growth rate was around 1%, bringing the population of Jakarta to a total of around 10.8 million in 2020.

With its population increasing, Jakarta's land use patterns are undergoing many changes as various urban functions are created or expanded, such as functions to support daily needs. According to Maheng et al. (2021), built-up areas in Jakarta increased by 44.3% from 1995 to 2014, while decreases occurred in land used for cropland (32.27%), grassland (36.11%), and forest (58.05%). According to Setiowati et al. (2018), the area used as UGS in Jakarta decreased by 23% from 1983 to 2013.

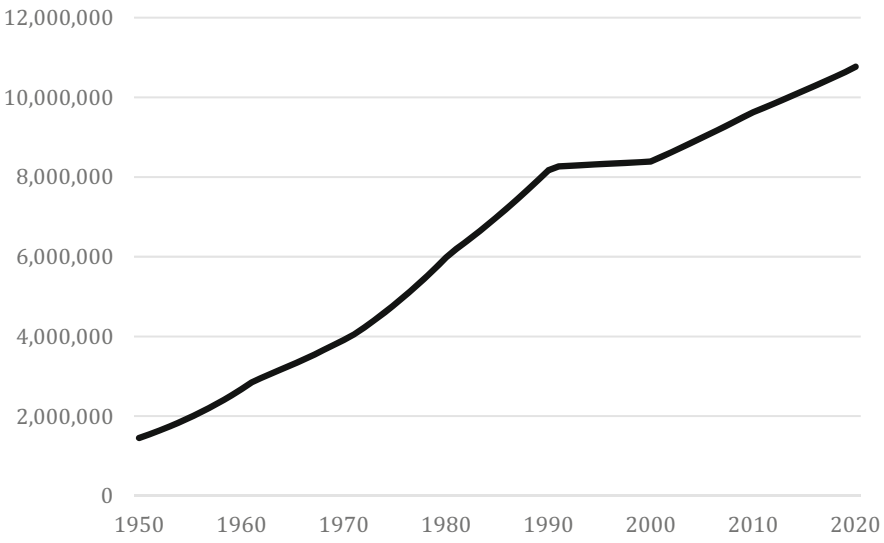

Fig. 13.1 Human population history of Jakarta (data: United Nations-World Population Prospects, https://population.un.org/wpp/)

Table 13.1 Air Quality Index (AQI) levels, related concentrations of fine particulate matter ($PM_{2.5}$), and their health implications (data: EPA (2018))

Air Quality Index (AQI) Values	$PM_{2.5}$ (μg/m^3)	Levels of Health Concern	Health Implications
0–50	0.0–12.0	Good	Air quality is considered satisfactory, and air pollution poses little or no risk
51–100	12.1–35.4	Moderate	Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion
101–150	35.5–55.4	Unhealthy for sensitive groups	The following groups should reduce prolonged or heavy outdoor exertion: • People with lung disease, such as asthma • Children and older adults • People who are active outdoors
151–200	55.5–150.4	Unhealthy	The following groups should avoid prolonged or heavy outdoor exertion: • People with lung disease, such as asthma • Children and older adults • People who are active outdoors Everyone else should limit prolonged outdoor exertion
201–300	150.5–250.4	Very unhealthy	The following groups should avoid all outdoor exertion: • People with lung disease, such as asthma • Children and older adults • People who are active outdoors Everyone else should limit outdoor exertion
301–500	250.5 and over	Hazardous	Health alert: Everyone may experience more serious health effects

The urban changes are also partly due to the fact that the role of Jakarta as capital city has further strengthened. This role creates demand for various economic and political functions and an additional increase in population, which in turn all cause land use changes. Especially, population growth has led to an increase in built-up areas for land uses such as housing, commercial activities, and transportation infrastructure in response to basic needs. With the area being urbanized increasing, automatically the proportion of built-up area increases and the proportion of area used for other land use types diminishes.

The decrease in UGS in Jakarta has had a bad effect on the quality of the urban environment, along with the increasing number of vehicles and industrial facilities. The deterioration of the urban environment in Jakarta has begun to affect the quality of life of its residents (Setiowati et al. 2018). A major problem is the increase in air pollution, such as increasing concentrations of particulate matter (PM). The World Health Organization (WHO) has classified air pollution as the biggest environmental risk to human health, linking it to both mortality and morbidity (WHO-Europe 2017). Table 13.1 shows the health concern raised by different levels of air quality, as defined by the United States Environmental Protection Agency (EPA).

Table 13.2 Average air quality level in Jakarta by Month (Data: 2019 World Air Quality Report, https://www.greenpeace.org/static/planet4-thailand-stateless/2020/02/91ab34b8-2019-world-air-report.pdf)

Month	Monthly average ($\mu g/m^3$)	WHO Standard Risk
January	24.2	Moderate
February	34.5	Moderate
March	31.2	Moderate
April	46.2	Unhealthy for sensitive groups
May	58.3	Unhealthy
June	67.2	Unhealthy
July	63.4	Unhealthy
August	53.5	Unhealthy for sensitive groups
September	57.1	Unhealthy
October	60.4	Unhealthy
November	53.3	Unhealthy for sensitive groups
December	43.2	Unhealthy for sensitive groups

Table 13.1 shows the different levels of air quality in terms of concentrations of fine particulate matter (i.e., particles with a diameter less than 2.5 micrometers) and what it means for residents to be exposed to these levels. Fine particles have a strong adverse effect on human health as they can reach deep into the lungs when inhaled (Setiowati et al. 2018; WHO-Europe 2017). Climatic and seasonal conditions also play a role in air pollution. In Jakarta, the air quality has shown to be more favorable when there is a climatic trend of increasing rainfall (Kusumaningtyas et al. 2018) and towards the end of the rainy season in the months of January to March (Table 13.2).

13.3 The Importance and Value of UGS

UGS influences the urban landscape in various ways. It improves the quality of human life by helping cities to adapt to climate change (Douglas 2011) and creating a visually more pleasing urban environment (Bertram and Rehdanz 2015; Tzoulas et al. 2007). Moreover, UGS contributes to the quality of life in terms of counteracting bad urban environmental conditions such as air pollution, urban heat islands, and noise. Increasing contact with nature also brings benefit to people in a psychological sense (Bertram and Rehdanz 2015; Vierikko et al. 2016).

Investments in UGS tend to increase when economic development advances and society stabilizes (Shuvo et al. 2020). In other words, urban areas that are more economically developed and more socially stable experience an increased demand for nature. In case of cities in developing countries, like Jakarta, UGS is typically insufficient in both quantity and quality (Kim 2012; Manan 2016; Setiowati et al. 2018; Ramdhoni et al. 2016). Recently, the Indonesian government has recognized the decrease in UGS due to development and set up a plan to increase the area of UGS step by step (Setiowati et al. 2018). By defining it a priority to increase the

proportion of UGS in Jakarta, the government acknowledges the importance of UGS in the urban landscape. However, the quality of UGS is equally important, as it has the potential to affect human health and well-being directly (e.g., Carrus et al. 2015; Fuller et al. 2007; Manan 2015; Zhang et al. 2017). The success of implementation also depends on how urban areas are planned as a whole and to what extent UGS is made an integral part of it (WHO-Europe 2017; Knobel et al. 2021; Lian and Sodhi 2004). Moreover, the level of consistency that is put into the maintenance of UGS will determine whether its potential is fully utilized in the longer term (Ottitsch and Krott 2005).

The UGS management of Jakarta is handled by the government's Park Services, Forest Services, and Agricultural Services. The major problems of UGS in Jakarta are considered to be the reduction of UGS due to development, the lack of proper management, and the lack of awareness among local residents regarding the benefits of UGS (Manan 2016). UGS should be planned in consideration of its structure and function along with the expanding urban landscape. In the strictest sense of the word, UGSs in urban landscapes are not natural landscape elements, as they are made or shaped by humans and not nature. They are landscape elements created with a purpose, and this should be taken into account when planning UGS (Elands and Van Koppen 2012). By using landscape indices to evaluate the spatial patterns, it is possible to predict and assess the landscape function of different UGS scenarios and use this as a basis for decision-making in UGS planning (Turner et al. 2001). From an ecological perspective, it is recommended to create areas of UGS that are large and connected instead of small and isolated, while curved and irregular boundaries are preferred over straight and sharp-angled ones because they perform better in terms of species richness (Forman 1995; Turner et al. 2001; McGarigal and Marks 1995). These aspects are fundamental to establish a spatial pattern of UGS that is more natural and less fragmented and therefore more sustainable and easier to maintain and manage.

In addition to improving the quantity and quality of UGS through planning and implementation, it is also important to consider and define management strategies in advance as well as to set up campaigns to raise awareness of the necessity and value of UGS among residents in the community. The quality of UGS could not be adequately maintained without such efforts. Furthermore, to ensure the sustainability of UGS it is essential to take into account local characteristics, such as the influence of climate and also cultures in terms of how local residents tend to use and perceive nature (Agnoletti and Rotherham 2015; Elands et al. 2015; Stålhammar and Brink 2020). In general, when UGS is accessible, usable, and attractive to local residents, it can provide opportunities for better physical and mental health (e.g., De Vries et al. 2013, James et al. 2015, Maas et al. 2006, Nutsford et al. 2013, Van den Berg et al. 2015).

13.4 Sustainable UGS

For a large number of people who live in cities nowadays, interactions with the natural world are limited to the UGS they have available around them (Dallimer et al. 2014). Especially in developing countries, this is in great contrast with people who live in non-urban areas, such as rural or woodland areas, where people live closely with nature as their livelihood largely depends on it. The reality is that for people who have spent most or all of their lives in urban areas, it is very difficult to know how to live with nature. According to Elands et al. (2015), the concept of biocultural diversity in cities is that in cities, where high urbanization and artificial landscape dominate, biocultural diversity has a creative concept rather than a conservation meaning. Therefore, it seems desirable to consider biocultural diversity in urban areas in a creative sense rather than in the context of conservation of existing organisms and cultures.

Biocultural diversity does not mean that biodiversity promotes or reduces cultural diversity. As in the case of rural landscapes, proper human disturbances (in other words, cultural approaches) affect the urban environment and progress in the direction of increasing species diversity. In other words, biocultural diversity is not a one-way relationship in which nature affects humans as described in ecosystem services (Kim 2019). Instead, it can positively exert influence in both directions, depending on the degree of human disturbances (Stålhammar and Brink 2020). When discussing the concept of the relationship between nature and humans, the viewpoint of biocultural diversity is most appropriately seen in terms of the interactions between nature and humans. In particular, biocultural diversity can strengthen UGS infrastructure planning and landscape management (Vierikko et al. 2016). This potential is due to the fact that it offers a way to match the supply of UGS, both quantitatively and qualitatively, to the specific needs and desires of local residents, which in turn can make sure the UGS is appreciated, well-utilized, and cared-for (WHO-Europe 2017). However, despite the fact that biocultural diversity is a very useful strategy for sustainable development and management of UGS, there have been no political attempts to apply it yet (Elands et al. 2015; Agnoletti and Rotherham 2015).

Traditional rural landscapes are known to have relatively high biocultural diversity due to the existence of proper interactions between nature and humans (Kim and Hong 2016; Elands et al. 2015). Land use and management in these rural landscapes is based on biocultural diversity and is also a resource for biocultural diversity.

Biocultural diversity in urban landscapes should be considered in accordance with the complex and diverse environment formed by the city (Stålhammar and Brink 2020). In other words, especially in urban areas with relatively high biocultural diversity, the planning of UGS needs to be integrated into the city's overall planning, linking it to all other facets at play in the city, including its cultural background. A city like Jakarta, which is known for its rich biocultural diversity, may consider developing a UGS infrastructure with reference to its traditional sub-urban land use pattern and habitat. Through planning efforts that account for the cultural identity of the city and its surrounding areas, UGS can serve as an

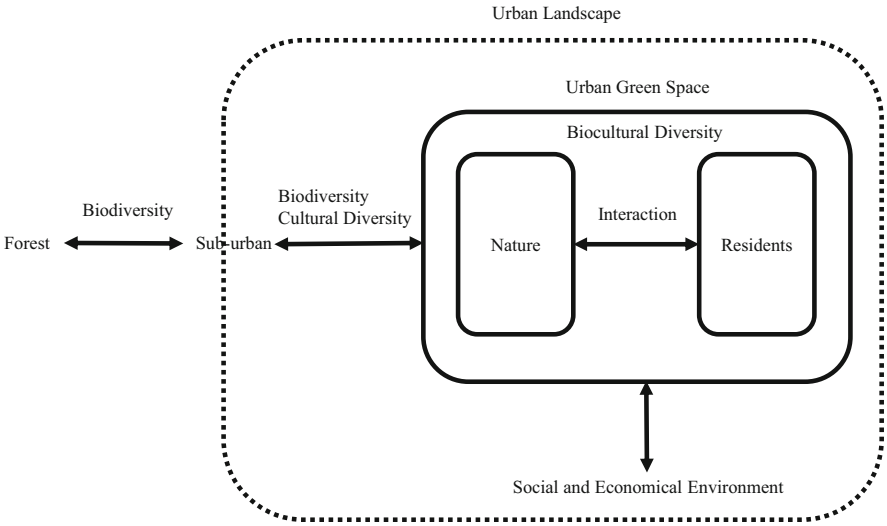

Fig. 13.2 Schematic diagram of sustainable landscape planning and management through biocultural diversity of UGS

instrument to positively affect both the lives of local residents and the sustainability of the whole city (see Fig. 13.2).

13.5 Conclusion

It is important to increase the area of UGS in cities such as Jakarta where the absolute amount of green space is insufficient and proportionally decreasing under the pressure of urbanization. With respect to UGS planning, consideration of the scales of habitats and the connections between different green spaces will be needed. Moreover, using the concept of biocultural diversity in UGS planning will do justice to both nature and humans, and as such it can be a driver of sustainability. Creating UGS based on biocultural diversity can lead to more effective management and more engaged local residents.

UGS can be a means to improve biocultural diversity through landscape planning in which traditional land use patterns of the surrounding area are used as a reference. Traditional land use can enhance natural value and modern management techniques in landscape (UNESCO 2019). As such, it will be possible to develop sustainable UGS by creating a structure that establishes a virtuous cycle in which the UGS promotes the health, well-being, and quality of life of residents, and in which reciprocally the residents are encouraged to make sustainable use of the UGS as it fits their cultural needs and desires.

Acknowledgments This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2020S1A6A3A01109908).

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