Park system concept for environmental sustainability in urban spatial development

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Abstract. Urban Park System is an integrated concept between nature system and urban life. The problems caused by urban population activity resulted in the need to increase the balance between two systems. Establishment of urban park system is a response to the need for resilience of urban space structures. As an ideal requirement it needs to be built integration between the ecocological, social, economic, aesthetic aspects of urban landscape architecture. The methodology was developed based on an approach to issues affecting the conditions due to urban issues and its relation to the development efforts of urban park system; Observation of Jakarta problem was obtained based on published studies and data, literature, characteristic and potential analyzes, local physical, from limited field observations. Both are simple methods aimed to describe the nature of a condition as well as form characteristics of problems in controlling the development of region, to examine the causes and symptoms. This method try to assess an object study compared between the conditions before and after. The benefits of urban park system development will not only improve the urban environment, but the value of urban pride, identity and control urban growth in line with efforts to improve the balance between conservation and development. Integrated urban park system will enhance the multifunctional role, connectivity, habitability, durability, identity and investment.

Keywords: conservation and development, urban park system, urban environment

1. Introduction
Increased urban land use change in Jakarta of green areas into developed regions resulted in problems for the environmental balance of the city. The excessive carrying capacity is the main problem for Jakarta. Overlapping issues; including overcrowding, litter, water pollution, air, soil, flooding has established a network problem, signaled to the municipality to act in resolving systemically; through the urban park system. In modern landscape architecture, the park system is collaborating with the idea of planning greenways, which run through urban and rural areas. These systems can serve the landscape through ecological, recreational, social, cultural, and healthful measures, and are designed with intentions of sustainability. Carrying capacity is the maximum number of individuals that can be supported or served by the resources within an ecosystem. Or, the ability of the environment (ecosystem) to support the lives of all creatures that are in it on an ongoing basis. Urban Park System is an important part of the environmental support systems. As the main support of urban park system in urban areas, it is necessary to develop green infrastructure. Social dimensions of carrying capacity include lifestyle aspirations, epidemiological factors, and patterns of socially controlled resource distribution, the disparity between private and social costs, the difficulty in formulating rational policy in the face of uncertainty, and various other features of human sociopolitical and economic
organization [7]. Urban parks and open space improve the physical and psychological health, strengthening communities, and make cities and neighborhoods more attractive places to live and work.

2. Research Method
Jakarta as the capital of the state and metropolitan cities have a complex problem. As a citizen liaison application that allows citizens to actively report the surrounding conditions to the government or related parties, it has released the first quarter data of 2017 regarding reports of incoming citizens through its application. Data problems most frequently reported in the first three months of 2017: the need for clean water, waste, parking, and rent on the street, misuse of public facilities, damaged roads, street vendors, traffic congestion, street lighting and flood [6].

Observations of Jakarta city cases were obtained based on published studies and data, literature, characteristic and potential analyzes, local physical, social, economic and cultural approaches from limited field observations. Problem description is the result of observation; Both are simple methods aimed at describing the nature of a condition while forming the characteristics of the problem, to examine the causes and symptoms. With this method try to judge a comparison between the condition of the object before and after.

3. Results and Discussion
Today, most people live in urban regions, and many try to move from rural to urban areas for jobs, education, and cultural experiences. Urbanization is the consequence of this phenomenon. High population density and built context are growing in urban regions, leaving only small green spaces next to tall buildings. This urbanization has enormous impacts on biodiversity and ecosystems in cities. Urban areas cover a small portion of land, but people in urban areas have powerful effects on the earth by using natural resources in a most profound manner [9]. Growing urban populations cause many environmental problems around the world (Figure 1) [16]. Urban population and protected areas are overlapping in the map, and these results suggest four category classification schemes which can help us understand the extent of contemporary urbanization in the global scale.

Figure 1. The growth of urban and rural populations around the world, 1950-2050 [16].

3.1. Jakarta’s Spatial Problem
The rapid development of Jakarta has reduced the green area. In 1970, the green area is still 70% of the city’s width, and is currently only about 10%. Within 40 years there has been a decrease in green space almost 60 percent. Based on the prevailing standards, the green space is at least 30 percent of the total area built up. The transfer of agricultural land into an area built outside Jakarta has an impact on the environmental conditions in Jakarta, especially flooding [11]. In 1992, the area awakened in the upstream is still 100 thousand ha, currently has become 225 thousand ha. Thus, the existence of the Jabodetabekjur Spatial Plan as a means of controlling the utilization of space becomes vital. Based on the scenario RPJMN 2015-2019, spatial arrangement has entered the stage of space utilization and control of space utilization. The unfinished spatial plan has impact on the weakness of spatial use control, especially in coastal areas. Meanwhile, it is fully realized that many of the problems that occurred in Jakarta started from the not optimal implementation of spatial planning. There are still
many spatial violations that result in increased traffic generation, congestion, flooding and environmental pollution.

**Jakarta’s Environmental Problems**

Environmental problems in Jakarta, especially garbage, flooding, congestion and the need for clean water is a group of classical and most fundamental problem. The number of residents in Jakarta, plus the newcomers, and commuters who live in suburbs but work in Jakarta causing waste production. Data Production of waste in Jakarta continues to rise and is now estimated at 6,000 tons per day. While the cooperation contract of DKI Jakarta Provincial Government with PT Godang Tua Jaya as the manager of Bantar Gebang Integrated Waste Disposal Site, which is 3,000 tons per day which means 3000 tons of un-transported garbage, spread in the Jakarta area, plus the lack of public awareness waste problem becomes serious [5]. Air pollution is generally considered as a major concern in urban areas, and as being among the major risk factors contributing to the global burden of disease, with for example high levels of particulate matter (PM) air pollution being associated with excess mortality and morbidity in the urban population [3].

Jakarta lies between river basins such as the Ciliwung River, Pesanggrahan River, Krukut River and Sunter River, where this area lacks good river management, waste is dumped in rivers, and illegal housing on the banks of the river also triggers flooding. Water absorption area continues to decrease due to the construction of buildings and settlements so that water from rain can not seep very well down to the ground. Jakarta's location is lower than sea level and water from Bogor is a factor that worsens flooding.

![Figure 2. Pieces North-South Jakarta (Source: Pem Prov DKI Jakarta) [13].](image)

Slum areas in Jakarta are 174 neighborhoods in five administrative municipalities, resulting from poverty. Illegal migrants with low socioeconomic conditions typically lead to the growth of illegal settlements and declining housing conditions that they occupy into slums. Congestion and air pollution problems supported by commuters from satellite towns around the capital that works in Jakarta, plus the growth of the highway in Jakarta a 0.01% per annum from 6.9 million meters wide road equivalent to 6900 kilometers. While the growth of vehicles in Jakarta per day up to 6000. Statistic Institution [2] makes congestion into serious problems in this megapolitan city, resulting in air pollution due to motor vehicle fumes, plus the extent of inadequate green areas make pollution cannot be absorbed by plants. Inadequate public transport facilities make people more likely to use private vehicles. A systematic review of the cooling effects of urban greening, including specifically the category of urban parks. This review also included a meta-analysis to statistically synthesise data on the temperature differences between urban parks and non-green urban areas to quantify the average cooling effect of a park across studies. In the context of climate change, the sequestration of carbon by urban trees and other vegetation plays an important role. Five of the articles included COx removal by urban parks, agreeing that parks act as ‘carbon sinks’ [8], [11], [10], [17], [5].

The Provincial Government of DKI Jakarta has not been able to adequately fulfill clean water needs for its citizens. So much ground water suction for clean water. The presence of large-scale groundwater is also done with the needs of high-rise buildings in offices and commercial areas. This resulted in significant reductions in groundwater levels and land subsidence.
Figure 3. Map of flood area and flood hazard area in Jakarta [13].

Treat people living habits and their physical environment at odds with natural physiographic characteristics of the landscape. From the house, the manufacturing industry, offices, markets and shops, workshops, recreation centers and others, they left garbage in the drainage, causing flooding in the anal and drainage channels silted and filled with sand, plastic cans and bottles, sachets of pure water, plastic bags and others [1]; Urban green space promotes physical activity and public health; Many US minority communities lack green space access, an environmental injustice; US and Chinese cities have developed innovative ways to create new green space; Urban greening can, however, create paradoxical effects such as gentrification; Urban green space projects need more integrative sustainability policies to protect communities [14].

Ecosystem-services-based approaches can help regulate the urban water cycle by reducing the amount of stormwater runoff and to improve water quality by removing pollutants from runoff. Bioswales, rain gardens, green roofs and other green infrastructure components can help reduce runoff e.g., due increased infiltration rates for non-paved surfaces. Increased infiltration would promote groundwater recharge and evapotranspiration from vegetated surfaces, and thus help to improve climatic conditions in the city [15], [4]. Urban landscapes with 50–90% impervious cover can lose 40–83% of rainfall to surface runoff [4]. Solving problems of the city should be developed within the concept of management at national, regional and local planning on short, medium and long term. Basically problem solving can be anticipated through; awareness raising for stakeholders; intensive increase community involvement; Enhancing partnerships with the private sector, universities, communities and NGOs; Implementation of regulations and law enforcement related to space utilization and management.

For the sustainability of urban resilience, it is necessary to implement the management of all urban areas mainly in watershed areas as the control of the water system. (i) Water catchment areas management, restoring lakes/situ functions around Jakarta that support Jakarta's water system. (ii) Water Resources Management. Development of Water Resources, Drought Prediction, Drought Relief, Water Use Permit, Water Allocation, Water Distribution. (iii) Flood Control. Flood Monitoring and Prediction, Flood Control and Prevention, Flood Mitigation, Flood Damage Improvement. (iv) River Environment Management. Land Use Planning of River Border Area, Control of River Border Use, Water Biota Preservation, Tourism Development, Sports, and Transformation of Water. (v) Community Empowerment.

Examples of Watershed Management and Development: (i) East Canal Floods and West Canal Floods were built with the aim of channeling rainwater and water from upstream to the sea, so water does not flood Jakarta; (ii) The river dredging program in Jakarta is conducted systematically and planned from 2008, the government has dredged 6 critical river rivers; 2009 with dredging 66 river segments; 2010 with 6 segments of river dredging in five areas of Jakarta.
The large scale river normalization program in Angke started in 2003. The 5 meter wide river width is widened by 40 meters. Angke residents who have lived in huts on the banks of Kali Angke illegally moved into flats in Muara Angke and Cengkareng.

Urban green space, such as parks, forests, green roofs, streams, and community gardens, provides critical ecosystem services. Green space also promotes physical activity, psychological well-being, and the general public health of urban residents [14]. A direct relationship between biodiversity to human well-being, is the establishment of ecosystem function which is a positive impact for the city park air quality improvement and carbon sequestration; related to water management: the park's contribution can cope with the effects of flooding. And contributing to the climate is cooling urban areas. As the development of the Jakarta Urban Park System and resolving disputes cities need to be built in the Green Infrastructure planning application-based urban design ecology would be a wise solution strategies; a network planning and management strategies for the sustainability of ecological processes, landscape and green open spaces of the city that will protect the values and functions of natural ecosystems and to improve the benefits for human life. The city of the future can be realized if Jakarta accommodates the realization of urban park system for the target of achievement of RTH by 30% in the City Spatial Planning (RTRW) in line with the effort to build a sustainable city as mandated by Law no. 26 Year 2007 on Spatial Planning. Building the city's resilience to climate change is a top priority for the city. In addition to mitigation, cities must now build an integrated concept in the form of Urban Park System in the adaptation and handling of conservation of environmental systems.

4. Conclusion
Jakarta Urban Park System must: (i) Being a major consideration in planning, development and maintenance of Jakarta eco-city. (ii) Designated as a network that varies, is widespread, strategically planned and interconnected. (iii) Become an element in land assessment and decision on the determination of housing density and urban structures. (iv) Accessible to local communities and provide alternative means of transportation. (v) Designed to reflect and accentuate local character, including landscape and local habitat. (vi) Required surface water flow data, such as rivers, reservoirs,
situations, and waterlogged areas during rain to develop a flood control RTH pattern by determining areas that should not be built for conservation and preservation functions so that hydrological processes can still take place to support the Green Infrastructure Intensification strategy. (vii) Multifunctional: Integration and interaction of different functions on the same footprint and across the infrastructure network as a whole. (viii) Implemented through planning and management coordination through local authorities and constraints across sectors. (ix) Able to achieve physical and functional relationships between sites at each level; City or sub-region. (x) Implemented intact through the main strategies of green infrastructure intensification and spatial strategy planning systems from regional spatial strategies to local development framework that are formally adopted through provisions and planning documents established with the support of ongoing allocation of maintenance and adaptation funding. (xi) Support the legal aspect of political will in the form of a national policy set forth in a higher regulation or law.

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