

MONITORING FOREST AREA CHANGE USING QUICKBIRD

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ABSTRACT

A study was conducted to compare the urban forest management in three urban forests in Samarinda City. The application of GIS (Geographic Information System) is one of the alternatives to conduct a variety of processes such as: providing geographical information system, identifying the areas of urban forests in Samarinda, helping to plan the process of map digitalization and performing overlay process. The main method used for the data analysis process on the map was the overlay process data analysis technique. The research findings showed that: 1) the appointment of urban forests as the initial step of urban forest development needed more implementation from the government; 2) the urban forest determination needed more socialization to the owner of the urban forest and the public in 1992 and 2019; 3) the urban forests needed more management. There were some similarities and differences in the management of urban forests in the three study locations. The similarities among the three locations were that the three locations had already met the minimum standards of one urban forest location even though there was still one location outside of these three locations which did not meet the minimum standard. The differences were in managing the urban forests. These differences indicated that the urban forest policy was not fully implemented in Samarinda City.

Keywords: comparison, geographic information system, management, policy implementation, urban forests

INTRODUCTION

The increasingly rapid growth of population and development nowadays causes a lot of changes in the appearance of Samarinda City (Angel *et al.* 2019; Caddeo *et al.* 2019; Cao *et al.* 2019). The rapid development has turned most of the green spaces in Samarinda City into shopping centers, stores, housing areas, mining areas and other places for anthropogenic activities (Tunas & Maadji 2018). These changes caused extreme environmental degradations and destructions (Carrer *et al.* 2018; Daoed *et al.* 1997; Deng *et al.* 2020). The city's development emphasizes on the aspect of economic growth (Diodato & Bellocchi 2020; Fernández-guisuraga *et al.* 2019; Guo *et al.* 2020), leading to several environmental problems (Hafeez & Khan 2012; Hong *et al.* 2017; De Jager *et al.* 2019), including water crisis, floods and

pollution resulting from the traffic and the decreasing number of green spaces in Samarinda City (Daoed *et al.* 1997).

Certainly, the current conditions of Samarinda City are no longer compatible with the city's slogan a "TEPIAN" city, which is the abbreviation of 'Tedub' (Shady), 'Rapi' (Tidy), 'Aman' (Safe), and 'Nyaman' (Comfortable). Environmental degradation, of course, should be ceased to continue (Lagacherie *et al.* 2020; Lister & Leites 2018; Liu *et al.* 2017). One of the solutions to overcome the environmental degradation is by applying environmentally sound developments through urban forest development (Liu *et al.* 2019; Morales & Perry 2017; Nguyen *et al.* 2019). The Decree of Samarinda Mayor Number 178/HK-KS/2017 showed that the size of the existing urban forests is 690.237 ha of the size of Samarinda City which is 718 km². Clearly, the size of the urban forests is still far from sufficient to meet the minimum 10% of the urban area based on

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the regulation stated in Article 8 of the Government Regulation Number 63 Year 2002 on Urban Forests (Windusari *et al.* 2017).

In order to meet the 10% minimum percentage, the Samarinda City should have 7,180 ha of urban forests. One of urban forest locations in Samarinda City owned by PT. Gani Mulya is only 0.097 ha and this is not in line with the Article 8 of the Government Regulation Number 63 Year 2002 on Urban Forests which stated that the size of urban forest in one compact stretch is at least 0.25 ha. Unfortunately, this regulation also mentioned about the adjustment of the urban forest size with the local condition of each region (Abdullahi *et al.* 2017), which seems to give a room for the local government to ignore the existence of urban forests. Most city planner is still unaware of the significance of urban forests (Nuddin *et al.* 2019; Podlaski 2019; Reza *et al.* 2020). If the regulation stated in the Government Regulation Number 63 Year 2002 on Urban Forests is properly followed, then all of the existing environmental problems faced by the Government of Samarinda City may be minimized (Hong *et al.* 2017).

Urban forest as an open green space or *Ruang Terbuka Hijau* (RTH) should actually get attention from the government in order to make Samarinda City an environmentally-sound city (Tunas & Maadji 2018; Viccaro *et al.* 2019; Wiggins *et al.* 2019). The population of Samarinda deserves to have a comfortable, healthy and aesthetic environment (Windusari *et al.* 2017; Zhao *et al.* 2020). The city needs to be protected from a variety of negative environmental impacts (Tunas & Maadji 2018; Viccaro *et al.* 2019; Wiggins *et al.* 2019). Among techniques to achieve a better quality of environment is by increasing the quality and quantity of city greeneries suitable with the city's urban forests (Hafeez & Khan 2012). Urban forest as an element of RTH is expected to overcome environmental problems in the urban areas by absorbing pollutions caused by the anthropogenic activities (Silveira *et al.* 2019; Sinha *et al.* 2019; Soma & Kubota 2018). The development of urban forest in big cities in Indonesia indicates the policy makers' awareness on environmental issues (Sameen *et al.* 2019; Schwede *et al.* 2018; Shang *et al.* 2020). The issues of urban forest need a special attention

from the government considering the rapid development in Samarinda City which causes adverse impact on the environment and the decreasing number of green spaces (Nuddin *et al.* 2019; Podlaski 2019; Reza *et al.* 2020).

Following the changing of times and the rapid development of technology, there are many methods to retrieve information on location in the form of map, one of which is using GIS (Geographic Information System) (Liu *et al.* 2019; Morales & Perry 2017; Nguyen *et al.* 2019). By using GIS we can capture a map of a location which provides detailed information (Lagacherie *et al.* 2020; Lister & Leites 2018; Liu *et al.* 2017). With the existence of geographic information system, it is expected that people will know more about the urban forests available surrounding the Samarinda City. This study aimed to obtain comprehensive understanding on urban forests as the basis of policy making in developing urban forests in Samarinda City (Hafeez & Khan 2012; Hong 2017; De Jager *et al.* 2019).

The interview conducted in this study focused on the urban forest areas of Samarinda City, guard posts, and standardization of forest preservation (Balachandran 2017). This research applied literature study by collecting and studying issues related to the Geographic Information System of forestry data (relevant institutions) (Sulistyo *et al.* 2017).

Basic Theoretical Framework

Public policy is a specific goal or a series of specific principles or actions taken by the government in a certain period of time with regard to one subject or as a response toward a crisis condition (Wahab 2008). In addition, Rose (1990) defined public policy as a series of less or more related activities and their consequences to the people concerned rather than a separate decision. Furthermore, Van Meter and Van Horn (1975) defined policy implementation as an action taken by individuals or officials or groups of governmental or private organizations directed to achieve goals which have been stated in the policy decision. From this definition it can be identified that policy implementation covers three aspects, namely: 1) goals and targets of policy; 2) activities or policy goals and objectives; 3) outcome of the activities (Agustino 2006). Public policy has goals,

objectives and is behavior-oriented. Public policy refers to what the government really acts on, not merely a statement or desired target of action. Public policy is a directed target, meaning that the action is followed by an actor or a number of actors working together to solve problems.

Implementation study is an analysis on the policy implementation process. In its practice, policy implementation is a considerably complex process; even it usually has political contents because of intervention of various interests. When an issue which addresses common interests is considered necessary to be regulated, then the formulation of the issue becomes a public policy which needs to be implemented, prepared and approved by all the authorized officials. When the public policy has been stated as a public policy, then it turns into a law which needs to be carefully observed.

Policy in Urban Forest Management

Urban development is usually reflected by the physical development of a city which is considerably determined by the existing facilities and infrastructure. The past and current urban development tends to minimize the open green spaces and to eliminate the face of nature. The condition of urban environment develops economically, but degrades ecologically. Indeed, the ecological balance of urban environment has the same significance as the development of economic value in urban areas. This condition creates unharmonious relationship between urban community and its environment. Being aware of the inharmony and considering the negative environmental impacts, there should be an effort to improve the environment through urban forest management. Urban forest is one of the open green spaces. Its existence functions as hydrological system, creating micro climate, maintaining oxygen (O₂) and carbon dioxide (CO₂) balance, reducing pollutant and absorbing noise. In addition, urban forests also function to add the aesthetic values and the beauty of the city, thus giving positive impacts on the quality of environment and the life of the community (Sibarani 2003). There are some municipal government policies which regulated the appointments of some urban forest locations. Samarinda City has an urban forest policy which

is stated in the Samarinda Mayor's Decree Number 178/HK-KS/2019.

The detailed regulation which addresses urban forests in the form of Local Regulation has not been made until now in Samarinda City. However, the regulation governing the management of urban forests can be seen in the higher-order regulation, namely the Government Regulation Number 63 Year 2002 on Urban Forests. In addition, there is also the Minister of Forestry Regulation Number P.71/Menhut-II/2009 on the Guidelines for Urban Forest Management. Article 4 of the Government Regulation Number 63 Year 2002 on Urban Forests stated that urban forest management covers: 1) appointment; 2) construction; 3) determination; and 4) management. However, this research only covered urban forest management which focused on the appointment of urban forests which included the sizes and the locations of the urban forests in Samarinda. The highlight of this study were: 1) The determination of urban forests and 2) Urban forest management which includes maintenance, protection and security, utilization, monitoring and evaluation.

The policy implementation policy of urban forests were analyzed in 3 locations based on their gradient distances from downtown, namely in the area of City Hall, Lempake Village and Samarinda Botanical Garden of Mulawarman University.

MATERIALS AND METHODS

Data Retrieval

This study used primary data collected from field observations and systematic recording using GPS Garmin 60. Secondary data were collected from various kinds of relevant literatures and social phenomena, namely administrative maps of Samarinda City, vegetation, plantations, and contours.

Data Processing

Administrative maps, vegetation, plantations and contours were superimposed over the Samarinda urban forest map (BPKH Region IV) (first process). Field checking was conducted to

obtain the most up-to-date information on the urban forest (second process). Subsequently, the results of the two processes were combined. The image correction was carried out using Quick Bird software to reduce geometric, radiometric and atmospheric problems (Fig. 1). The image analyses were subsequently carried out, by first making criteria and scoring assessments in tabular form as part of the data preparation process. Visual interpretation of up-to-date urban forest maps was used to get raster data in the form of land-use conversion. Figure 2 presents the flowchart of Samarinda urban forest map preparation. The Samarinda's urban forest vegetation was determined based on the results of image analyses.

RESULTS AND DISCUSSION

The determination of one particular area as an urban forest can be in the form of designation within the urban area and it can be a piece of land owned by the government or owned privately with a land ownership right. The designated urban forest location is a part of

the open green space of the city. The importance of urban forest functions is regulated in the Government Regulation Number 63 Year 2002 on Urban Forests in Articles 7, 8 and 9. The designation is based on the programs of the Government of Samarinda City through *Bapedalda* (Local Board of Environmental Impact Management). In 2001 - 2019 the Government of Samarinda City through *Bapedalda* had planned, prepared and implemented urban forests which was funded by DAKDR budget (Special Fund Allocation - Fund for Forestation). In 2003 the city government and Samarinda Local House of Representative enacted the Local Regulation Number 28 Year 2003 on Protected Area in Samarinda City. Even though there is no obvious regulation concerning urban forests, the Government of Samarinda City keeps continuing the development of urban forests based on the Local Regulation Number 28 Year 2003. Through *Bapedalda*, the Samarinda City planned, prepared, and implemented urban forests using DAK-DR budget (Special Fund Allocation – Fund for Forestation).



Figure 1 Quickbird satellite image of Samarinda City

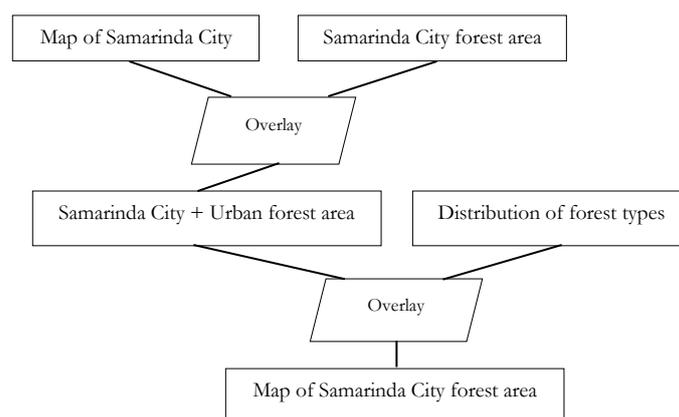


Figure 2 Flowchart of Samarinda urban forest map preparation

After planning, preparing and implementing Urban Forest in Samarinda, *Bapedalda* provided a recommendation to the Government of Samarinda City to issue a Mayor Decree concerning the location of urban forests in Samarinda City. Then, the Decree of Samarinda Mayor Number 178/HK-KS/2005 on the Determination of Urban Forest Locations in Samarinda City was issued. There were 25 locations which were appointed as urban forests in the urban area of Samarinda. The Decree of Samarinda Mayor Number 178/HK-KS/2005 showed that the area of urban forests was 690.237 ha with the percentage of 0.96% from the total urban area. Samarinda City has the area of 718.00 km², so that to meet the minimum 10% of the urban area size, Samarinda should have urban forests with the size of 7,180 ha. This means that Samarinda still requires

6,489.763 ha or 9.04% to fulfill the required minimum 10% of the total urban area. In addition, the decree also mentioned one of the urban forests, namely PT Gani Mulya with the extent of 0.097 ha.

The size of urban forest owned by PT Gani Mulya does not meet the standard based on the criteria stated in Article 8 section (2) that the size of urban area in one compact stretch should be at least 0.25 ha. Furthermore, the distribution of urban forest in each subdistrict in Samarinda is not equal because there are still 2 subdistricts from the total of 10 subdistricts which do not have an urban forest in their district areas, such as Palaran and Sungai Pinang Subdistricts. Each subdistrict also still has a significant shortage from the required minimum total area. The criteria of urban forest in each subdistrict is presented in Table 1.

Table 1 Criteria of urban forest area for each subdistrict

No	Subdistrict	Urban forest area (ha)	Area (km ²)	Minimal forest area (ha)	Shortage (ha)	Percentage by the zone (%)
1.	Palaran	-	221.29	2,212.9	-2,212.9	0
2.	Samarinda Ilir	6	17.18	171.8	-165.8	0.35
3.	Samarinda Kota	11.56	11.12	111.2	-99.64	1.04
4.	Sambutan	187	100.95	1,009.5	-822.5	1.85
5.	Samarinda Seberang	1.5	12.49	124.9	-123.4	0.12
6.	Loa Janan Ilir	8.697	26.13	261.3	-252.603	0.33
7.	Sungai Kunjang	69.75	43.04	430.4	-360.65	1.62
8.	Samarinda Ulu	8.98	22.12	221.2	-212.22	0.41
9.	Samarinda Utara	306.75	229.52	2,295.2	-1,988.45	1.37
10	Sungai Pinang	-	34.16	341.6	-341.6	0
Samarinda City		690.237	718.00	7,180	-6,489.763	0.96

Source: Processing Data from the Mayor's Decree Number 178/HK-KS/2017 on the Determination of Some Urban Forest Locations in Samarinda City.

City Hall Urban Forest

The City Hall Urban Forest was appointed as an urban forest in 1992 through the Mayor's Decree Number No. 224 Year 1992, followed by the Mayor's Decree Number 178/HK-KS/2019. The City Hall environment was appointed as an urban forest after meeting the requirements, and in this case, the city hall urban forest has an area of 7.64 ha. The area is more than enough to fulfill the minimum requirement of one location to be selected as an urban forest, namely 0.25 ha. The City Hall Urban Forest is located on the state-owned land whose land status and ownership right belongs to the Government of Samarinda City. Land ownership is proven with a land certificate Number: P-24, Number: 305/1981 which was issued by Agrarian Office of Samarinda City on 29 June 1981.

Lempake Urban Forest

The appointment of Lempake Urban Forest was based on the land status owned by the Municipal Government since the status of the village was changed into *Kelurahan*. This location was appointed by *Bapedalda* in 2004 by involving the local community. Lempake Urban Forest has an area of 3.5 ha and this size has met the requirement of a minimum size of 0.25 ha for one location of urban forest.

The Determination of Urban Forests

Policy in the determination of urban forest has been issued twice by the Government of Samarinda City. The first one was the Mayor's Decree Number 224 Year 1992 and the second one was the Mayor's Decree Number 178/HK-KS/2019. The determination of urban forest in 1992 was issued by the Cleaning and Landscaping Agency and the determination of urban forest in 2017 was issued by the *Bapedalda* which is now recognized as BLH (Environmental Agency). The urban forests which were stated in the Mayor's Decree Number 178/HK-KS/2019 in Samarinda City were determined after the *Bapedalda* accomplished the procedure of planning, preparation, and implementation of Urban Forest. The documented procedures was then proposed to the Government of Samarinda City in order to issue a letter of determination for the locations of urban forests in the region of

Samarinda City. From 1992 to 2005 there was an increase in urban forests both in their sizes and their total number. In 1992 Samarinda had only 12 locations of urban forests with an extent of 218.177 ha, while in 2019 the number of urban forests increased up to 25 locations with an area of 690.237 ha. This indicates that Samarinda has an additional 13 urban forests and an additional area of 472.06 ha. Unfortunately, the determination policy for urban forests has not been reviewed at least once in two years following the rule stated in point three of the Mayor's Decree Number 178/HK-KS/2019.

City Hall Urban Forest

The area of City Hall was first designated as an urban forest on 17 December 1992 through the Mayor's Decree Number 224 Year 1992 with an area of 6.9 ha. This determination was then renewed by the Mayor's Decree Number 178/HK-KS/2019. In the Decree Number 178/HK-KS/2019 the area of City Hall had an additional area which was allocated for urban forest, from an area of 6.9 ha to 7.64 ha. The determination of the City Hall area as an urban forest was well-socialized to the public because of its strategic location in the middle of Samarinda City.

Lempake Urban Forest

The determination of Kas Lempake as an urban forest was not known by the public or the village government. Even though the location status is on the state-owned land, the determination of the urban forest should have been informed to the public, especially to the community where the urban forests are located. The fact that the public do not know the existence of the urban forest is caused by some factors. First, the appointment of Kas Lempake as an urban forest only involved some people following the rapid growth of population. Second, the determination of urban forest had lasted for a long time without any socialization from the former government. Third, there have been a lot of replacements of *Lurah* and personnel in the Lempake Village since the urban forest determination. Last, there is no activity initiated by the government in relation to the management of Kas Lempake.

Urban Forest Management

Urban forests are not managed uniformly because the managements are only conducted in several locations which are only owned by the government such as the area of City Hall, Segiri Softball Field, Garden Tombs of Heroes, and Samarinda City Library, which are easily accessed by the government because these locations are in the downtown area. One of the efforts made by the government in urban forest management is by re-registering the existing urban forests. The result of re-registration can be seen Table 2.

The City still needs 9.12%. The local office of Agriculture, Plantations and Forestry of the Samarinda City (DistanBunHut) also makes a plan for locations which are going to be appointed into urban forests. After doing re-registration on the size of urban forest stated in

the Mayor's Decree Number 178/HK-KS/2019, the area of urban forest was decreased by 57,167 ha from the original 633.07 ha. Therefore, the percentage of urban forest nowadays is only 0.88% from the previous percentage of 0.96%, namely 71,800 ha. The minimum requirement for an urban forest is 10% of the total urban area. This means that Samarinda still needs urban forests. The planned locations include the Center for Dipterocarp, Land of Municipal Government in Makroman, Polytechnic of Agriculture Campus (Poliagro Samarinda), and Kaltim Cultural Park. The Government Regulation Number 63 Year 2002 and the Regulation of the Minister of Forestry Number P.71/Menhut-II/2009 which is supported by the Mayor's Decree Number 178/HK-KS/2019 is sufficient to be the basis for urban forest management.

Table 2 Re-registration of urban forests in Samarinda City

No.	City forest location	Large	
		SK 2019 (ha)	Re-registration data (ha)
1.	SMU 10 MELATI	5	5
2.	KRUS	300	300
3.	Tanah Pemkot	5	5
4.	Hutan Kota Belakang Rumah Jabatan Walikota	1.75	1.8
5.	Asih Manuntung	0.25	0.25
6.	Pesantren Hidayatullah	1	0.38
7.	Tanah Pemkot di Makroman	167	167
8.	Tanah Pertanian Terpadu	20	20
9.	Kas Desa Lempake	3.5	3.5
10.	Fakultas Pertanian Unmul	6.5	3.84
11.	Pesantren Nabil Husein	9.75	9.75
12.	Pesantren Syachona Cholil	0.25	0.25
13.	Rumah Potong Hewan	2	5
14.	Hotel Mesra	2.3	0.7
15.	Jalan Pembangunan Voorfo	0.48	2.6
16.	Lingkungan Balai Kota	7.64	3.26
17.	Lingkungan Lapangan Softball GOR Segiri	0.5	0.25
18.	Perpustakaan Kota Samarinda	0.6	0.5
19.	Ujung Timur Jembatan Mahakam	1.5	2
20.	PT. HARTATY	60	-
21.	PT. Gani Mulya	0.097	2.75
22.	PT. Sumber Mas	85	85
23.	PT. Sumalindo	3.6	-
24.	Taman Makam Pahlawan	0.52	1.04
25.	PT. KIANI (Teluk Cinta di Selili)	6	13.2
Total		690.237	633.07

Source: Agriculture, Farming and Forestry Service Office of Samarinda City (2019).

City Hall Urban Forest

The urban forests which are located on the state-owned lands are managed by three government institutions at the same time, i.e., the Agriculture, Farming and Forestry Service, the Cleaning and Landscaping Agency, and the City Planning Service. The forms of management include providing seedlings and plants. The construction of shopping center next to the urban forest location is believed not to use the land of the urban forest because it is still within the border of the land owned by the owner of the building. The City Hall Urban Forest is one of the urban forest locations having decreasing in area size because of the building construction and parking lots which take the green space in this location.

Lempake Urban Forest

The government policy on the management of urban forests which are located in the land owned by Kas Lempake has not been implemented. This is not in line with the Regulation of Minister of Forestry Number P.71/Menhut-II/2009 in Article 132 through Article 143, which technically governs the urban forest management. Kas Lempake Village is under the responsibility of the government, but until now this urban forest location has never been managed properly. The fact that this urban forest is not managed by the community is caused by the status of the location that is owned by the Government. The Municipal Government has never formed a coordination with the local village to involve the community in the management of urban forests.

CONCLUSION

There are some similarities and differences in managing urban forests in Samarinda City. Their similarities can be found in the three research locations in which they have met the required minimum standard of one location, i.e., 0.25 ha. In addition, the urban forests also provide the same benefits to the surrounding environment. The City Hall Urban Forest was established as an urban forest in 1992 and it was extended in 2017, while Lempake Urban Forest and the Urban Forest of Universitas Mulawarman Botanical

Garden were just established in 2017 through the Mayor's Decree Number 178/HK-KS/2019. Those urban forests have differences in the status of land ownership. The City Hall Urban Forest and Lempake Urban Forest are located on the state-owned lands, while the Urban Forest of Universitas Mulawarman Botanical Garden is located on the land with a land ownership right.

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