Ecological function of green open space as water infiltration: study in kalijodo green open space, north jakarta

D P P Mbarep¹, H Herdiansyah¹*

School of Environmental Science, University of Indonesia, Jakarta, Indonesia

*herdis@ui.ac.id

Abstract. Kalijodo Green Open Space is a green open space set by the DKI Jakarta Provincial Government in 2017. Related to the ecological function of green open space as water infiltration, a literature study was conducted to analyze the condition of Kalijodo green open space based on supporting data sources using descriptive analysis techniques. The results of the analysis show that the Kalijodo green open space has not been able to carry out ecological functions as well as water absorption. Based on the imagery in Google Earth, it is seen that Kalijodo's green open space is very minimal vegetation and looks barren. This condition has implications for hardening the soil, so that water is difficult to seep into the soil. In the last 5 years, the average rainfall intensity from October 2013 to March 2014 was 134.97 mmph and was a very high level of rainfall intensity. Green open space is included in flood-prone areas. With the condition of the Kalijodo green open space and the high intensity of rainfall, the ecological function of green open space as water infiltration has not been maximized.

1. Introduction

Green Open Space is an important element in urban areas because it forms an environment that is comfortable and healthy. The availability of green open space in Jakarta is 9.98% and has not met the ideal requirements of 30% [1]. Kalijodo is an area around the scouting road II, Pejagalan Village, Penjaringan District, along with the eastern bank of the flood canal that used to be a place of nightlife and prostitution. Then in 2017, the DKI Jakarta Provincial Government sets the Kalijodo area as Green Open Space and Integrated Child-Friendly Public Space. The one of the ecological functions of green open space is as water infiltration [2]. Green Open Space (GOS) can help absorb water so that the supply of water in the soil increases and saves the cost of building Stormwater Drainage which must be provided by big cities to overcome flooding [3]. Regarding the ecological function of green open space as an absorbent of rainwater, the condition of Kalijodo Green Open Space received little attention. This can be seen from the poorly maintained vegetation resulting in soil surface hardening. Some factors that influence the rate of infiltration of water into the soil, namely depth detention on the surface (surface detention) and saturated layer thickness, soil moisture, compression by rainwater, vegetation (cover crops), topography, and intensity of rain [4]. As a result of the lack of vegetation available, soil surface permeability decreases, thereby reducing water infiltration and increasing surface water flow which can lead to flooding [5].

These problems can disturb people’s comfort because it can cause flooding. With the occurrence of floods, it can disrupt the economic activities of the community and the damage caused by floods can damage the physical condition of the Kalijodo Green Open Space so that its aesthetic value decreases. Therefore, this literature study was carried out to analyze the ecological function of the Kalijodo green open space as rainwater infiltration and to be an evaluation material for the improvement of the condition of the sustainable Kalijodo Green Space.
2. Methodology

2.1. Place
The study was conducted on the Kalijodo Green Open Space located on the scouting road II, Pejagalan Village, Penjaringan District, North Jakarta Administrative City. Kalijodo Green Open Space was chosen as the location of the literature study because it was only determined by the DKI Jakarta Provincial Government and is located east of Banjir Kanal, so it is necessary to conduct a study and analysis to find out the current conditions.

2.2. Source of data
The data sources used came from various agencies such as the Badan Penanggulangan Bencana Daerah (BPBD) of DKI Jakarta province which had data in the form of data on flood-prone areas, Badan Pusat Statistik (BPS) which had data on the intensity of rainfall in the last 5 years in DKI Jakarta Province from the year 2013 to 2014. Then a literature review of several previous research journals and books relating to the ecological function of green open space as rainwater infiltration.

2.3. Data analysis technique
The data analysis technique used is descriptive analysis, which analyzes and concludes the current condition of Kalijodo green open space based on the data sources obtained.

3. Result and Discussion

3.1. The Condition
Based on observations made through google earth, the Kalijodo green open space looks barren and has minimal vegetation. The new Kalijodo green open space was inaugurated in 2017 and of course it is still in the process of developing towards ideal conditions, in accordance with its functions, however, the development of green open space at this time does not seem to be going well. The condition of vegetation in the Kalijodo green open space has not been well organized and tends to be a lot of grasses that cover damaged soil. Grass in green open space Many times are withered, so they look very dry due to poorly maintained conditions. The condition of the unkempt green open space can be seen in Figure 1.

![Figure 1. Area of Kalijodo Green Open Space](image-url)
The one of the factors influencing the rate of infiltration of water into the soil is the presence of plants (cover crops) [4]. The number of plants that cover the surface of the soil, such as grass or forests, can increase the infiltration capacity of the land. Trees as important elements in urban green open space have ecological functions in improving environmental quality, among others in storing and trapping carbon, reducing the rate of runoff water, absorbing solar radiation and reducing energy use in urban environments [6].

3.2. The Location
The location of Kalijodo green open space is located in Pejagalan Village, Penjaringan District, North Jakarta Administrative The administrative city of North Jakarta is a flood-prone area [7]. Areas prone to flooding in North Jakarta are scattered throughout sub-districts and villages. One of the flood-prone areas is Penjaringan District, Pejagalan Village. Data on flood-prone areas, especially in Penjaringan District, North Jakarta can be seen in table 1.

Table 1. List of Flood-Prone Areas in Penjaringan District, North Jakarta.

| No | Districts  | Village     |
|----|------------|-------------|
| 1  | Penjaringan| Kamal Muara |
|    |            | Kapuk Muara |
|    |            | Pejagalan   |
|    |            | Penjaringan |
|    |            | Pluit       |

(Source: Badan Penanggulangan Bencana Daerah DKI Jakarta, 2018)

Flood-prone areas in DKI Jakarta Province, generally are areas with drainage conditions and high population densities. Therefore, one of the drainage systems that can be used is a natural drainage system. The natural drainage system is by providing water absorption space with green land where there are various variations of plants. Plants (grasses and trees) have the benefit of increasing soil permeability so that the soil can absorb surface water optimally, according to the standard infiltration rate which is good. Water infiltration spaces such as forests / urban parks and green open spaces are needed in large cities with high density. In addition to one of the functions, namely as an absorbent of rainwater, another function of the forest/city park and green open space is that it can be used as a means of socialization and means for economic development.

3.3. The Intensity of Rainfall
Based on the rainfall data of the last 5 years in DKI Jakarta Province and the calculation of the intensity of the rain carried out, especially during the rainy season between October 2013 and March 2014, it was noted that the average rainfall intensity reached 134.97 mmph [8]. This average rainfall intensity is at the level of rainstorms [9]. According to Badan Meteorologi Klimatologi Geofisika (BMKG), the intensity of rainfall is at a very dense level. The intensity of rainfall at this level can result in floods in the DKI Jakarta area. The graph of rainfall intensity can be seen in Figure 2.
The intensity of rainfall can affect the rate of infiltration. The large volume of surface water that continues to inundate the surface of the land, without the presence of media or locations that can accommodate and absorb into the soil can cause floods. The hardened soil conditions cannot be used to carry out the infiltration process properly so that the surface water flow continues to increase and can move towards the lower area. Soil hardening occurs due to lack of cover plants. Plants play a role in increasing soil permeability so that the soil pores become wider and can absorb surface water flow. Therefore, the flow of surface water that flows continuously with large volumes is destructive so that it can hamper all economic activities carried out and disrupt the social activities of the community.

4. Conclusion
The results of the analysis of Kalijodo green open space are based on the data sources obtained, concluding that:

1. The condition of Kalijodo green open space has the potential to produce a low infiltration rate due to a lack of vegetation (grass and trees) as a land cover so that the soil experiences hardening and difficult water seeps into the soil.
2. Apart from the lack of plants that make the soil hardened, the intensity of very high rainfall can increase runoff/surface water flow that cannot be absorbed by the soil, causing flooding.
3. The condition of green open space which has a decrease in ecological functions, can have a negative impact on other functions such as social functions where people who are unable to carry out activities such as sports and others properly, and bad economic impacts will occur.

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