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REVIEW ARTICLE

Green Open Space Priority Modelling Using GIS Analysis In West Jakarta

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Abstract. Green open space is one of the most important land uses, especially in densely populated urban areas. Public Green Open Land in each area regulated in Law No. 1 of 2007 is at least 20%. Based on data from the Department of Creative Works, Land and Spatial Planning as well as the Environment Agency of DKI Jakarta, West Jakarta's Green open space asset area is 277.45 Ha of the total area of West Jakarta, which is 12543 Ha. There is a need for a study to determine the potential land for green open space in West Jakarta to catch up on the fulfillment of public green open space based on spatial and regional analysis. One of the GIS-based methods that can be used to determine potential green open space is the decision tree method. This method uses AHP analysis in its formulation based on experts in the relevant agencies. In total there are 8 parameters that influence in determining potential green open space in West Jakarta, namely flood risk, air quality, population, distance to roads, distance to water sources, building density and distance to green open space assets. The modeling results are divided into five classes ranging from very priority to not priority. The total area of land that is much prioritized to be used as green open space is 95.57 hectares spread out. The modeling results show that there are still potential lands to be used as green open spaces in West Jakarta.

1. Introduction

West Jakarta as part of the capital city of Indonesia is a metropolitan area. Based on SNI 03-1733-2004, West Jakarta is classified as an area with a high population density of 2,569,462 inhabitants. The large number of residents is directly proportional to the population's need for housing and inversely proportional to the availability of Green Open Space. Currently, the existence of West Jakarta green open space is increasingly pressing due to the current condition of the existing land use which has been converted into built-up land. Based on data from Jakarta Satu, percentage of the existing public green open space owned by West Jakarta is 8.8% of the total Green open space DKI Jakarta which is still very far from reaching the 20% standard stated in Law no. 1 of 2007. Based on the Ministry of Environment and Forestry, the Land Cover Quality Index (IKHL) in DKI Jakarta has decreased in the 2015-2020 period with 24.86 points, which is one of the contributing factors to the recurrence of the flood disaster in DKI Jakarta. West Jakarta, which is part of the State Capital, has several obstacles related to the procurement of green open land, such as high land prices, limited land and the issue of evictions that are very likely to occur. For the procurement of green open space in DKI Jakarta, currently managed by the forestry service with consideration of land status and subjectivity, it is necessary to have a clear analytical study as input in determining the priority of green open space.

According to research by Nawangsari and Mussadun (2018), the extent of green open space has a close relationship with air quality conditions in an area. The larger the area of green open space owned by an area, the better the air quality because gas pollution emissions can be absorbed by the vegetation in the green open space. Based on IQAir, 2020, Jakarta has a concentration of air pollutant PM2.5 which is categorized as unhealthy. The role of green open space in addition to improving environmental quality is also an effort in disaster mitigation. According to Nuryuningsih et al., (2021) green open space has an effective function as a gathering point for disasters in the environment. Studies related to the suitability of green open space locations have been carried out, both using qualitative and quantitative approaches (Abebe and Megento, 2017; Aryaguna et al., 2022; Babalola, 2018; Dewi, 2018; Widyawati et al., 2020). The purpose of this study is to determine the location of priority green open space by using spatial modeling “decision tree and the participation of experts from relevant agencies in DKI Jakarta using AHP (analytical Hierarchy Process) as a consideration in determining the rules in the decision tree. The novelty of this research is the determination of spatially based priority green open space locations based on aspects of ease and need in procurement by mapping land parcels.

2. The Methods

Research Sites

The research location is in the State Capital, especially in the City of West Jakarta. West Jakarta Administrative City is one of 6 regencies/cities in the DKI Jakarta Province as shown on Figure 1. Geographically, West Jakarta is located between 5O19’12’’ - 6O23’54’’ South latitude and 106O22’42’’ - 106O58’18’’ East longitude.

West Jakarta has an area of 125.43 km2, which is divided into 8 sub-districts, 56 urban villages and 586 RW. West

Jakarta was chosen as the location for the research study because it has the least green open space area compared to other cities in DKI Jakarta Province. Based on Figure 2, West Jakarta has 8.8% green open space so that there needs to be a priority study to increase green open space in West Jakarta.

Data Collection Technique

The data collected in the form of secondary data from literature and government agencies in DKI Jakarta Province, related to regulations and policies as well as physical and non-physical conditions of the DKI Jakarta green open space planning area. To validate and complement the secondary data, field survey activities were also carried out.

Flood/Inundation Disaster Analysis

The analysis used to determine the priority location of the Land Acquisition Plan for West Jakarta Green Open Space comes from data on inundation events in 2015 – 2020 from the DKI Regional Disaster Management Agency (BPBD). The data obtained are plotted spatially into the administrative boundaries of the RT/RW coverage so that it is known which RT/RW are often affected by inundation and classified as table 1

Population Density

Population density in an area reflects the magnitude of the burden or pressure that must be supported by the environment. This is related to meeting the needs of city facilities and infrastructure as well as waste disposal that can cause pollution. On the other hand, population density which classification refer to table 2 is also a parameter of the need for green open space so that the ecological, economic and social benefits of green open space can be directly felt by residents. Therefore, the denser the population in an area, the wider the standard of green open space that must be met.

Building Density

Building density needs to be considered in the development of green open space because it is related to the size of non-built land that can be used as absorption land in an area. Building density is also related to KDB so that the KDB value can be a parameter in the suitability of land for green open space development (Table 3). Thus, the higher the KDB value, the higher the building density, and otherwise. KDB is obtained through an overlay analysis between the building roof parcels and the area of RT/RW. Building roof parcels got from RDTR data and for RT/RW area got from DCKTRP agency DKI Jakarta.

Air Quality Index

West Jakarta AQI data is collected from the breath application by taking air quality samples at 08.00 a.m. on 23 April 2021. The AQI collection at that hour is intended to determine the optimal pollution that occurs in West Jakarta during rush hour vehicles mobilizing from and to West Jakarta. Based on the AQI data, this study modified the previous 6 classes into 3 classes as shown in table 4.

Access Proximity Road

Roads are the main accessibility that connects one location to another so that mobility activities occur. According to (Tahmasebi et al., 2014) and (Chandio et al., 2011) recommends that a green open space location is preferred/interested if it is affordable from the road to be accessed by transportation, as shown in table 5. For the road class that is used only up to the local road class where 4-wheeled vehicle access is possible to facilitate the transportation of construction materials and public transport access to be accessible to residents outside the area.

Access to River Water Sources

According to (Abebe and Megento, 2017), the closer a land is to the river, the more suitable it is to maintain environmental health in the area (Pareta, 2013). (Manlun, 2003) and (Piran et al., 2013) also concluded that a land closest to water resources such as rivers, lakes, and reservoirs is very suitable for the development of green space, as shown in table 6. In addition, proximity to water sources is a parameter to determine river boundaries which are regulated in the PUPR Ministerial Regulation No. 28 of 2015. This river border area is an area that is required to make green open space to restore its function as a river embankment in preventing river water levels from rising which causes flood in West Jakarta.

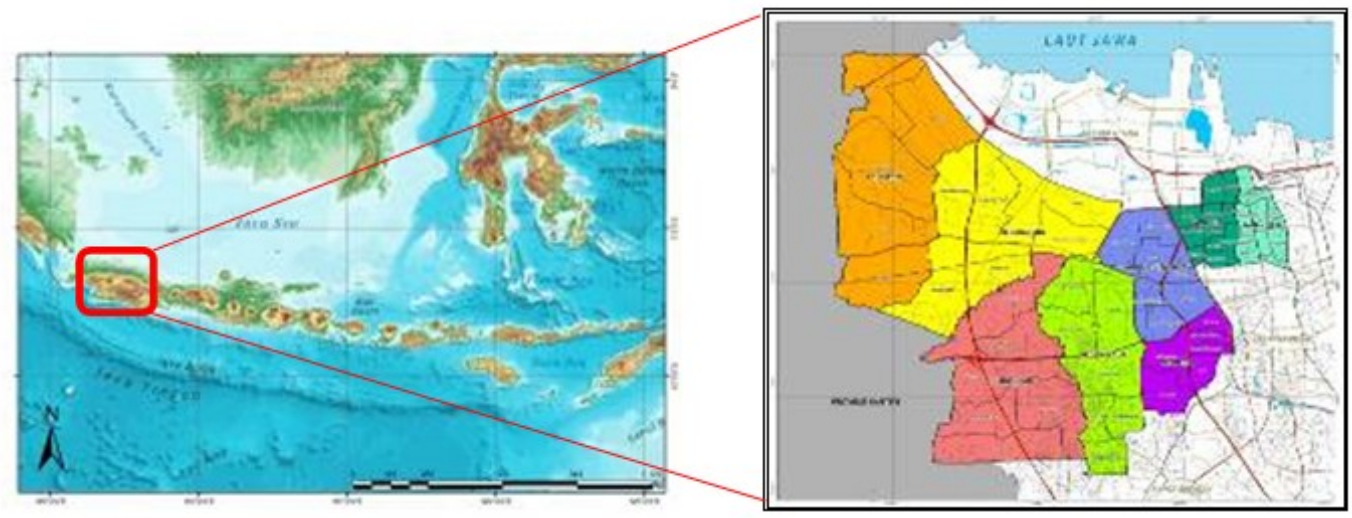

Figure 1. The Location of The Research Area.

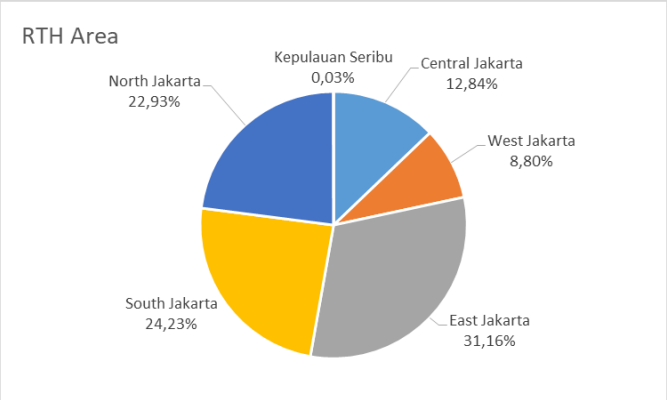

Figure 2. Green Open Space Area Each City.
Source: Jakartasatu.jakarta.go.id

Table 1. Inundation Intensity Classification

Very Urgent	Urgent	Normal
> 1 a year	1 a year	0 a year

Source: Team Analysis Results, 2021.

Table 2. Population Density Classification

Very Urgent	Urgent	Normal
> 201 person/Ha	151 - 200 person/ Ha	< 150 person/ Ha

Source: SNI 03-1733-2004 with modification

Table 3. Building Density Classification

Very Urgent	Urgent	Normal
> 60%	31 – 60 %	< 30 %

Source: Permen PU No.378/KPTS/1987 with modification

Table 4. Air Quality Classification

Very Urgent	Urgent	Normal
AQI > 151	AQI = 101 - 150	AQI = 0 - 100

Source: Iqair with modification

Table 5. Road Proximity Access Classification

Very Urgent	Urgent	Normal
< 100 meters	100 – 200 meters	> 200 meter

Source: (Dewi, 2018) with modification

Distance to Green Open Space Asset

According to (Pantalone, 2010) and (Abebe and Megento, 2017), the farther green open space an area is from the existing green open space, the greater the potential for green open space development due to the lack of green open land, as shown in table 7.

Analytical Hierarchy Process

Regarding the weight of the parameters in determining the potential of green open space based on needs using GIS -MCA, it is carried out using the AHP method. Questionnaires related to filling out the AHP were given to several competent resource persons who work in the field of land acquisition and Green Open Space. The total sample taken is determined to be less than 7 to minimize assumption errors (Saaty and Özdemir, 2014). There are 8 parameters that were proposed to the informants related to the priority factors for the procurement of green open space as shown in table 8.

GIS-Multi Criteria Analysis

GIS-Multi Criteria Analysis is a method used to analyze potential green open space based on needs. GIS-MCA can be thought of as a process that transforms and combines geographical data and value judgments (the decision-maker's preferences) to obtain information for decision making (Malczewski, 2015). There are 8 criteria being used and for objective weight using AHP data from expertise.
((weight1* [Score1])+ (weight 2* [Score2])+(weight 3* [Score3])+ (weight 4* [Score4])+ (weight 5* [Score5])+ (weight 6* [Score6])+ (weight 7* [Score7]) +(weight 8* [Score8])

Decision Tree for Potential Green Urban Space

One of the methods used for modeling potential land for Green Open Space is Decision Tree. A decision tree is a type of multistage classifier that can be applied to a single image or a stack of images. It is made up of a series of binary decisions that are used to determine the correct category for each pixel. Using this method can provide more specific results in determining priority location of Green Open Space without the potential for repetition of different classes at the same location. Characteristics are determined based on considerations taken from expertise through modified AHP analysis.

Table 6. River Proximity Access Classification

Very Urgent	Urgent	Normal
< 500 meters	500 – 1000 meters	> 1000 meters

Source: Team Analysis Results, 2021

Table 7. Classification of Proximity to Green Open Space Assets

Very Urgent	Urgent	Normal
> 750 meter	374 – 750 meter	< 374 meter

Source: Pantalone, 2010 with modification

Table 8. AHP Criteria

Criteria	Weights	+/-
Distance from Green Open Space Assets	8.5%	2.6%
Access Road Proximity	9.1%	3.9%
Access to River Water Sources	10.9%	3.2%
Population Density	10.6%	3.8%
Building Density	6.5%	2.0%
Flood/Inundation Frequency	21.4%	8.8%
Air Quality	19.2%	8.7%
Land Subsidence	13.7%	5.1%

Source: K. D. Goepel, 2018 with modification.

3. Result and Discussion

The result came from analysis Based GIS modelling (Figure 3), there are 12 parameters used to determine whether a land has the potential to become a priority for green open space or not. Using the AHP and Decision Tree methods as well as the GIS-MCA method, the distribution of priority green open spaces is generated. This priority green open space consists of 2 types of green open space analysis, namely in terms of the ease of procurement and the need or urgency.

Potential Land Based on Easiness

Potential land based on easiness is compiled from the parameters of Potential Land use, Potential Zoning RDTR, Green Open Space non assets and Land Parcel. For potential land use, it is land that has not been built, making it easier for the government and especially agencies related to land procurement for land purchases and acquisitions. For potential Zoning RDTR is divided into 2 groups, namely Green Zoning and Non-green Zoning. For land that is in the green zone, it becomes a very potential land. Land that is in the green zone will be easier to buy and acquire because residents will not get a building permit (IMB) so that the selling price can be reduced, closer to NJOP. For the status of land parcel rights taken are SHM, HGB and Right to Use. The determination of land parcel rights is determined so that the land acquisition field will later be easy in purchasing land and of course land that already has land rights shows that land parcels are not problematic. In total there are 4070 potential land parcels based on the ease of land acquisition.

Based on the results of the analysis of the distribution of potential land, the largest potential is in the Kalideres sub-district with an area of 123.95 Ha with a total plot of 552. Kalideres is the largest contributor because it has a large area of non-built land, and is in a green zone. The distribution of potential green open space locations based on convenience can be seen in Figure 4.

Potential Land Based on Needs

The next analysis is used to determine the potential for green open space based on needs. There are 8 parameters used in determining potential green open space based on needs according to Figure 3. The parameter determination is determined based on the condition of the study area, namely the West Jakarta area where the need for green open space is very much needed to improve environmental quality, prevent disasters and fulfill environment friendly public facilities. The parameters used were analyzed using the reclassify, buffer and interpolation methods with the following details:

Analysis of Green Open Space Potential based on Flood Disaster Events

Flood intensity was analyzed for 5 years starting in 2015 – 2020 which was then included in the mapping of the smallest administrative unit, namely RT/RW. Based on the resulting distribution for areas that have a normal class of 1422 plots of land, for an important class of 2096 plots of land and a very important class of 552 plots of land. The distribution can be seen in the Figure 5.

Analysis of Green Open Space Potential based on Air Quality

Air Quality Index data was collected from air quality sampling on 23 April 2021 at 08.00. Determination of the time of collection is a solid hour so that it is the most optimal to determine the condition of air pollution in West Jakarta. Air quality in West Jakarta, which is monitored from 12 points, ranges from 125 – 165. In accordance with the modified global IQ Air classification, Jakarta is in the unhealthy air quality class for sensitive and unhealthy people which is an important class and is very important for the provision of green open space. . The highest pollution is in the sub-districts of Kalideres, Cengkareng, etc. as shown in Figure 6.

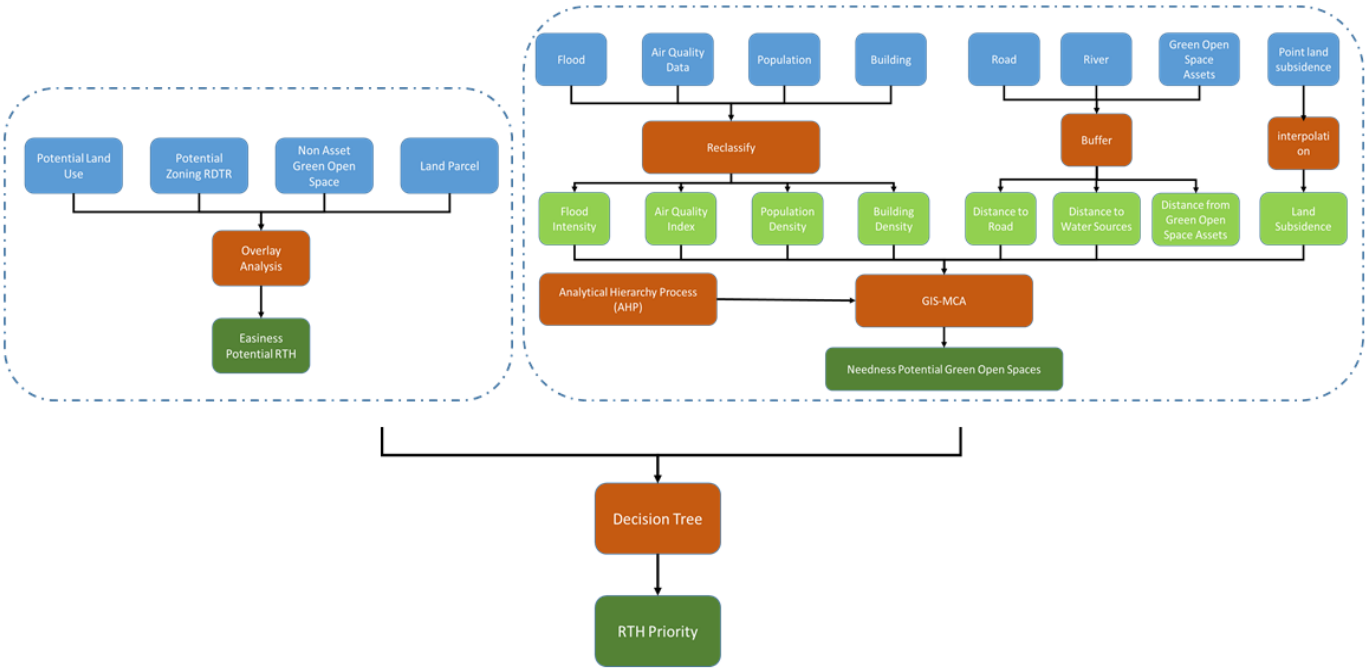

Figure 3. Research Flow Chart

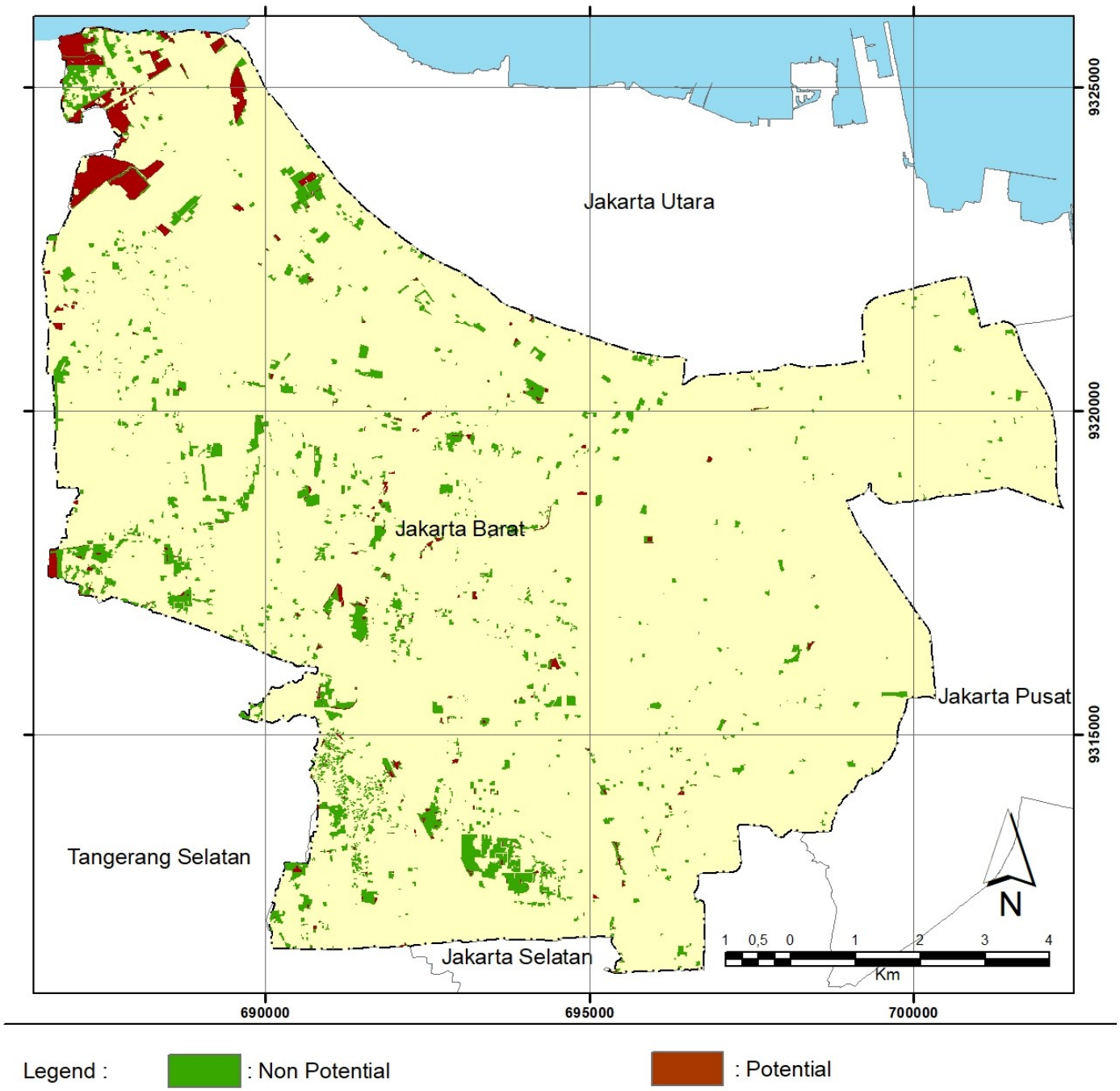

Figure 4. Distribution of Potential Green Open Space Land Based on Needs

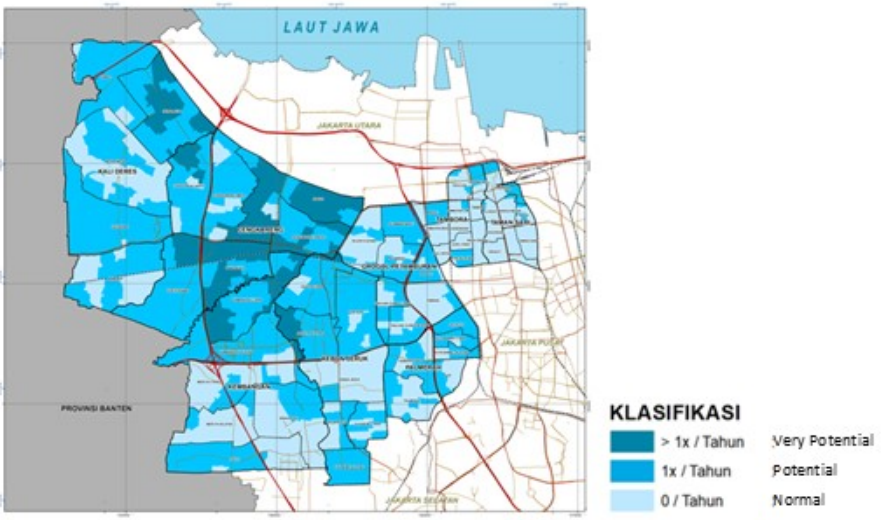

Figure 5. Disaster Distribution Map 2015 -2020 West Jakarta

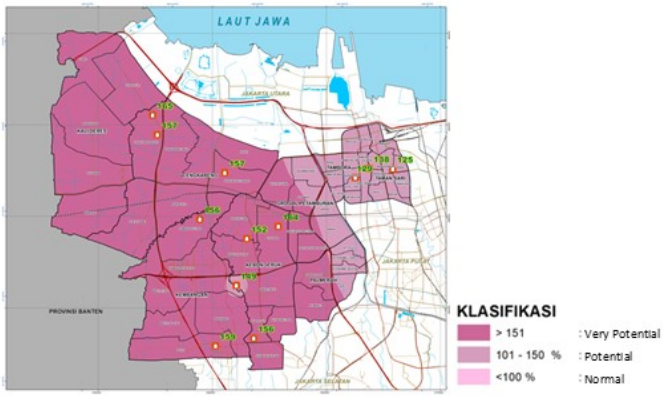

Figure 6. Air Quality Map West Jakarta.

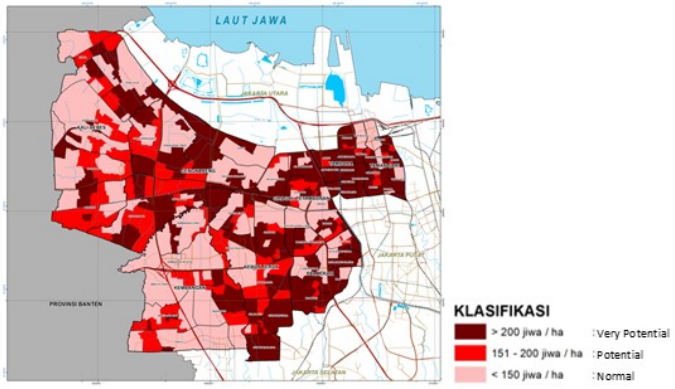

Figure 7. Population Density Distribution Map West Jakarta 2020

Analysis of Green Open Space Potential based on Population Density

Population density is a link in the provision of green open space because the dense population is directly proportional to the need for public facilities. Green open space which is a public facility has ecological, economic and social benefits for residents. Based on the analysis of population density per RT/RW, it is known that 746 land parcels are in the very important class, 114 parcels are in the important class and 2210 parcels are in the normal class according to Figure 7.

Analysis of Green Open Space Potential based on Building Density

Building density is a parameter in the provision of green open space because it is related to the area of non-built land that can be used as absorption land. The building density used is derived from the KDB obtained from the overlay of building parcel data in an RT with an area of RT. Based on the results of the analysis, locations that have a very high building density are in the sub-districts of Tambora, Taman Sari and Grogol Petamburan. There are 314 parcels belonging to the very important class, 2540 parcels to the important class and 1216 parcels to the normal class as shown in Figure 8.

Analysis of Green Open Space Potential based on Road Proximity Access

The road is the main access to reach a location. The development of a green open space is not only intended for residents around the area but also for people outside the environment so that the parameter of access to the

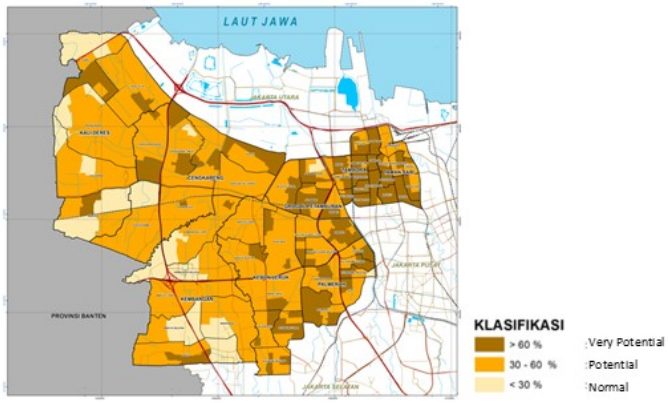

Figure 8. Building Density Distribution Map West Jakarta.

proximity of the road becomes one of the parameters in determining potential green open space. The road that is used as a reference is a road with a width of 3.5 meters where four-wheeled vehicles can access because in the development of green open space it requires the provision of clothing and equipment materials and the reach of green open space to the community is wide. Based on the results of the analysis, there are 3313 land parcels with a very important class, 485 land parcels with an important class and 447 land parcels with a normal class as shown in Figure 9.

Analysis of The Potential of Green Open Space Based on Access to Water Sources

Water is a source of survival for Green Open Spaces where most of the cover is plants. To be able to ensure the sustainability of green open space without reducing the groundwater of an area, a continuous water source is needed, one of which is a river. Based on the Ministerial Regulation (Permen) PUPR 28 of 2015 regulates the river border which is required to become a green zoning of the river border as an artificial embankment in the naturalization concept. Based on the analysis results, there are 3178 land parcels classified as very important class, 703 land parcels classified as important class and 189 land parcels classified as normal class as shown in Figure 10.

Analysis of Green Open Space Potential based on Distance to Green Open Space Assets

In the provision of green open space, things that need to be considered in addition to the physical and social aspects are the aspects of the existence of green open space. The determination of this parameter is to avoid overlapping with the existing green space so that its usefulness and function become ineffective and inefficient. Based on the analysis, there are 260 very important class parcels, 2503 important class parcels and 1307 normal class parcels with a distribution as shown in Figure 11.

Analysis of Green Open Space Potential based on Land Subsidence

Land subsidence is one of the dangers that threatens West Jakarta because the massive use of groundwater is inversely proportional to the area of absorption for groundwater. Through the analysis of land subsidence, it is known which areas experience the highest land subsidence so that the urgency for the procurement of green open

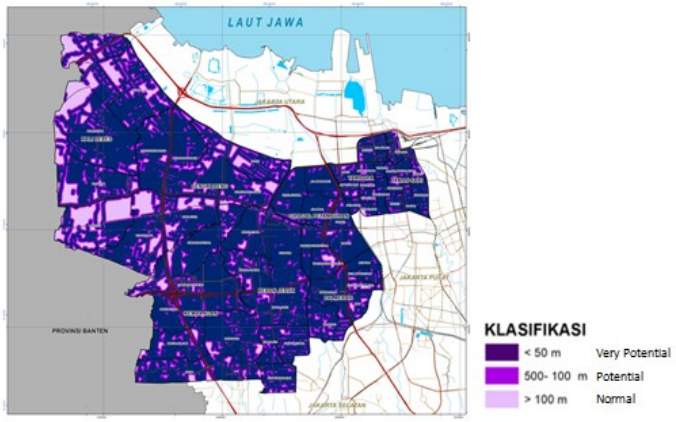

Figure 9. Road Proximity Access Map West Jakarta.

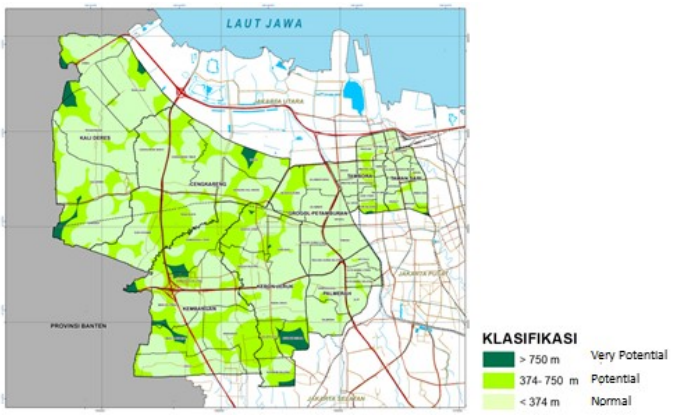

Figure 11. Distance to Green Open Space Asset Maps in West Jakarta.

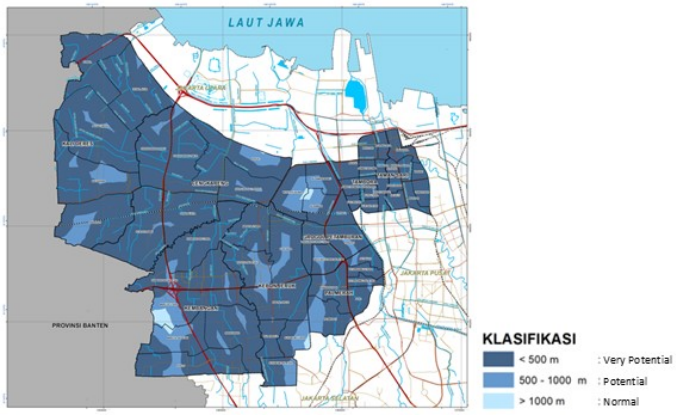

Figure 10. Access Proximity to Water Source Map West Jakarta.

space as absorption land is higher. Based on the analysis, it was found 2242 land parcels classified as very important, 1627 land parcels classified as important and 201 land parcels classified as normal according to Figure 12.

Analysis GIS-MCA and AHP

To obtain potential green open space based on needs, from the eight parameters obtained, processing is carried out using the GIS-MCA method. To get the weight of each parameter, the AHP method was used which was obtained from competent and related sources in the procurement of green open space in West Jakarta. The resulting weights from AHP are as follows:

((0.089 [Green open space Asset distance score])+ (0.091* [Road Proximity Access Score])+(0.109* [Access to Water*

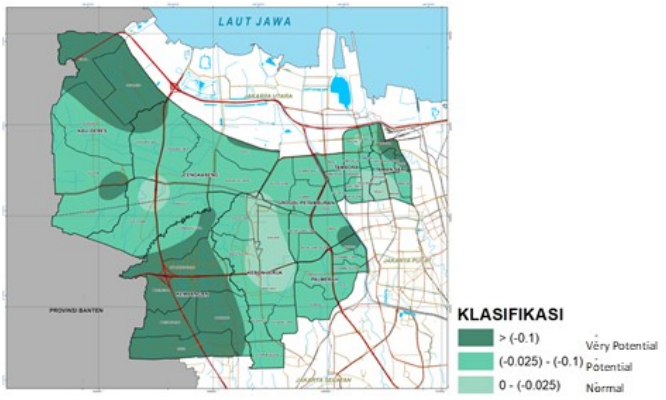

Figure 12. Land Subsidence Map West Jakarta.

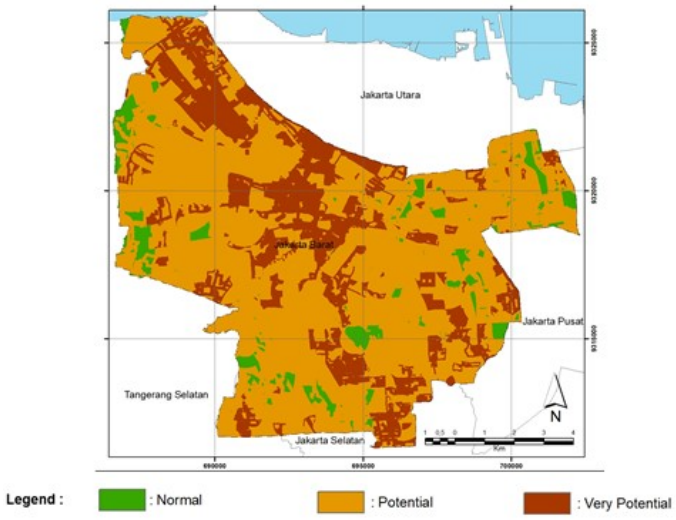

Figure 13. Distribution of Potential Green Open Space Land Based on Needs

Resources Access])+ (0.106 [Population Density Score])+ (0.065* [Built Density Score])+(0.214* [Flood Frequency Score])+ (0.192* [Air Quality Index Score]) +(0.137* [Land Subsidence score])*

After obtaining the score and weight of each parameter, GIS -MCA processing is carried out to obtain potential green open space based on needs as shown in Figure 13.

Priority Land for Procurement of Green Open Space

Priority land for green open space is obtained from processing the distribution of potential green open space based on convenience and need using the decision tree method. The determination of the priority class for green open space is based on Table 9.

The modeling results show that the land modeled as very priority land is 444 parcels with an area of 95.57 Ha and the majority distribution is in Kalideres District. Priority land has 581 plots of land with an area of 116.197 Ha, while for normal priority lands there are 3046 plots of land with an area of 270.47 Ha.

Based on the results of the field survey (Table 10), it turns out that there are some very priority lands that have changed the function of land into built-up land or have become HGB of a company, indicating that supervision related to licensing and land use in DKI still needs to be improved.

Figure 14. Sample Photo Location of Very Priority Class.

Table 9. Green Open Space Priority Class Criteria

Priority Class	Criteria	
	Easiness	Needs
Very Priority	Very Potential	Very Potential
	Very Potential	Potential
Priority	Potential	Very Potential
	Potential	Potential
	Very Potential	Normal
Normal	Normal	Very Potential
	Normal	Potential
	Potential	Normal
	Normal	Normal

Source: Team Analysis Results, 2021.

Table 10. Field Survey Sample

KODE	KECAMATAN	KELURAHAN	X	Y	POTENSIAL	EKSISTING	HAK_BPN	HAK_VAL	POLA_RUANG	H_PASAR	NJOP	FASUM	ISU	URGENSI
KD-SMN-433	Kalideres	Semanan	688507,2	9317631	H.1	Pembangunan Perumahan Green Royal	Hak Guna Bangunan	SHM (Observasi)	Hijau	7000000	5625000 - 5625000	Masjid	Dibangun Perumahan (Obeservasi)	H.2
KD-KML-302	Kalideres	Kamal	687260,2	9323547	H.1	Lahan Kosong	Hak Milik	Sertifikat Hak Milik (Bhumi ATR)	Hijau	10000000	1934000 - 2091000	Hotel	Tidak Ada (Observasi)	H.1

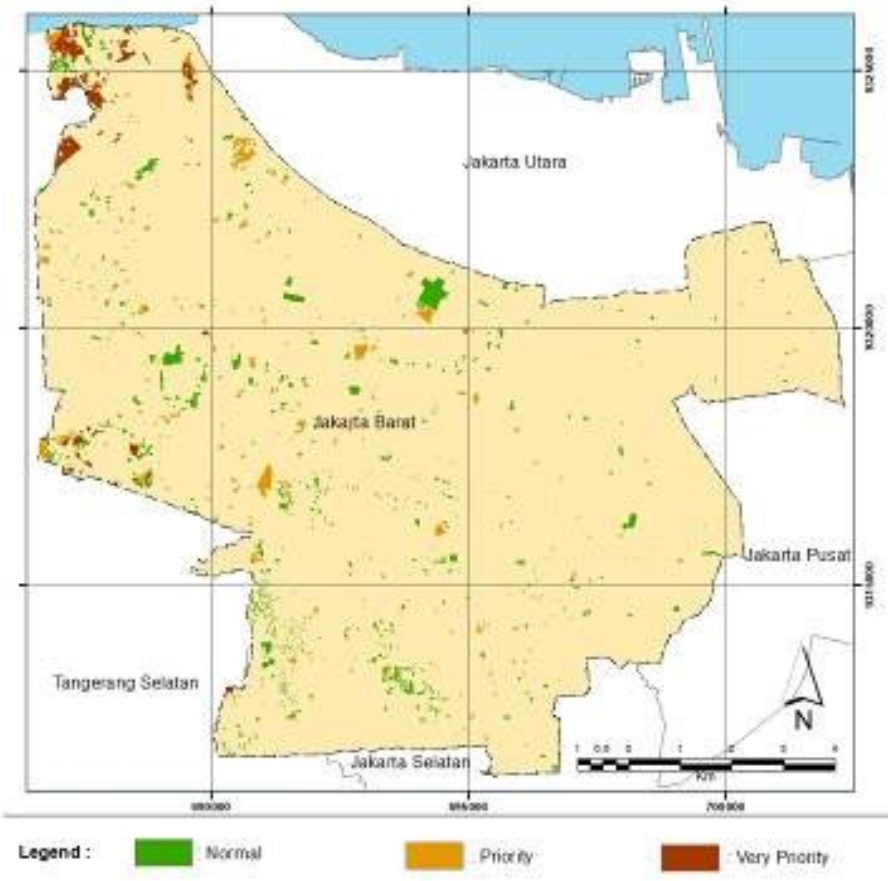

Figure 15. Distribution of Priority Green Open Space Map in West Jakarta.

Based on the field survey, there was a change in the existing condition, so that from a total of 4070 plots of land to 3554 plots of land. These very priority lands, which are in the zoning pattern of green space and the land use is still non-developed, is a priority for the West Jakarta government to be converted into green open space so that conversion does not occur so that it will make it difficult for the local government to acquire land later which can be seen in figure 14.

The results of interviews with the community regarding the urgency of the need for a green open space typology that is desired to be built in their environment show that 2202 plots of 4070 plots of land surveyed are of the urgency to build city/environmental parks. This shows that the need for parks as a means for children to play, gather, study and socialize is very much needed by the community, especially in dense settlements. Community expectations with the establishment of urban/environmental green open space will improve the quality of the environment and the quality

of life of the surrounding community so as to create a physically and mentally healthy society. Through a map of the distribution of priority land with all the complete information in it, ranging from land status, priority level, market land prices, existing land use conditions, issues related to the land, public facilities around the land, and spatial pattern zoning can facilitate local governments in determining planning in the procurement of Green Open Space in West Jakarta (Figure 15).

4. Conclusion

Green Open Space Priority Land in West Jakarta can be modeled using spatial analysis. There are 4 parameters used to develop potential land based on convenience and 8 parameters to develop potential land based on needs which will later be analyzed to become priority land for green open space. Each region has different parameter weights depending on the conditions in a region. For West Jakarta, the most decisive factor in modeling potential green open space based on need is the risk of flood disaster with a weight value of 0.214. The results of the Green Open Space priority land model show that the Kalideres sub-district has the most priority land for green open space compared to other sub-districts.

Acknowledgement

Thank you to the Department of Human Settlements, Land Affairs and ATR/BPN DKI Jakarta Province who have assisted in providing the data needed in this research. Thanks are also given to Esa Unggul University for funding research assistance so that it can be carried out properly.

References:

Abebe, M. T., and Megento, T. L. (2017). Urban Green Space Development using GIS-Based Multi-Criteria Analysis in Addis Ababa Metropolis. *Applied Geomatics*. *9*(4). 247–261. https://doi.org/10.1007/s12518-017-0198-7

Aryaguna, P. A., Gromiko, H. M. A., and Pratiwi, K. (2022). Study of Potential Locations of Green Open Space Based on Procurement Convenience in West Jakarta. *Jurnal Geografi*. *14* (1). 22. https://doi.org/10.24114/jg.v14i1.27520

Babalola, M. (2018). Application of GIS-Based Multi-Criteria Decision Technique in Exploration of Suitable Site Options for Anaerobic Digestion of Food and Biodegradable Waste in Oita City, Japan. *Environments*. *5*(7). 77. https://doi.org/10.3390/environments5070077

Chandio, I. A., Matori, A.-N., Lawal, D. U., and Sabri, S. (2011). GIS-based Land Suitability Analysis Using AHP for Public Parks Planning in Larkana City. *Modern Applied Science*. *5*(4). https://doi.org/10.5539/mas.v5n4p177

Dewi, A. S. (2018). Analisis Ruang Terbuka Hijau Dan Arahan Rencana Pengembangannya Di Kota Bandung Provinsi Jawa Barat. *Doctoral Dissertation*. Regional Planning, IPB University.

Manlun, Y. (2003). Suitability Analysis of Urban Green Space System Based on GIS. International Institute for Geo-Information Science and Earth Observation Enschede, The Netherland. *Master Thesis.* Geo-information Science and Earth Observation with specialisation in Urban Planning and Management, International Institute for Geo-Information Science and Earth Observation Enschede, The Netherland.

Nawangsari, G. M and Mussadun, M. (2018). Hubungan Keberadaan Ruang Terbuka Hijau dengan Kualitas Udara di Kota Semarang. *RUANG: Jurnal Perencanaan Wilayah Dan Kota*. *4*(1). 11–20.

Nuryuningsih, N., Syuaib, M., and Rahim, R. (2021). Efektivitas Ruang Terbuka Publik Sebagai Titik Kumpul Bencana di Kelurahan Maccini Sombala, Sulawesi Selatan. *TEKNOSAINS: Media Informasi Sains Dan Teknologi*. *15*(1). 109. https://doi.org/10.24252/teknosains.v15i1.17766

Pantalone, S. (2010). *Creating The Urban Forest: Suitability Analysis for Green Space in The City of Boston*. USGS Land Cover Institute, Tufts University. Boston

Pareta, K. (2013). Remote sensing and GIS based site suitability analysis for tourism development. *International Journal of Advanced Research in Engineering and Applied Sciences*. *2*(5). 43–58.

Piran, H., Maleknia, R., Akbari, H., Soosani, J., and Karami, O. (2013). Site Selection for Local Forest Park Using Analytic Hierarchy Process and Geographic Information System (case study: Badreh County). *International Research Journal of Applied and Basic Sciences*. *6*(7). 930–935.

Saaty, T. L., and Özdemir, M. S. (2014). How Many Judges Should There Be in a Group ? *Annals of Data Science*. *1*(3–4). 359–368. https://doi.org/10.1007/s40745-014-0026-4

Tahmasebi, E., Jalali, M., Gharehghashlo, M., and Nicjnamfar, M. (2014). Urban Park Site Selection at Local Scale by Using Geographic Information System (GIS) and Analytic Hierarchy Process (AHP). *Eur. J. Exp. Bio*. *4*(3). 357–365.

Widyawati, L. F., Aryaguna, P. A., First, A. Y., and Gromiko, A. (2020). Land Procurement for Green Open Space in South Jakarta Using GIS-based Multiple Criteria Analysis. *LIFEWAYS: International Journal*, *4*(1). 35–47.