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Analysis Spatial Pattern Garbage Bank using Web Geographic Information System in Yogyakarta City

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Abstract. Minimizing waste with independent waste management embodies the 3-R principles, one of which is the waste bank program. There are 448 waste banks throughout Yogyakarta City, around 73% of the total RWs in Yogyakarta City. However, the location of the waste banks has yet to be discovered. Ideally, each location of the waste bank can be known with certainty, so this research produces a visual form in the form of a thematic map of the spatial distribution of waste banks in the city of Yogyakarta and the pattern of distribution of waste banks in the city of Yogyakarta. The objectives of this study are (1) to determine the visual form of the spatial distribution of waste banks in the city of Yogyakarta; (2) to analyze the distribution pattern of waste banks in the city of Yogyakarta. This quantitative research uses the Nearest Neighbor Analysis method to analyze the distribution pattern of waste banks in Yogyakarta City. The results are (1) The visual form of the spatial distribution of waste banks in the City of Yogyakarta is spread over almost all areas of the City of Yogyakarta, with an area of 32.5 km2. There are 448 waste banks whose locations have been mapped; (2) The distribution pattern of the waste banks in the City of Yogyakarta is scattered, or the distribution pattern is uniform/regular. The conclusion is that in Yogyakarta City, the distribution of waste banks is even; it is just that several waste banks need to be reactivated, which are experiencing a vacuum. With a visual form in the form of a thematic map of the spatial distribution of waste banks in the city of Yogyakarta using GIS web technology, this will have an impact, namely making it easier for the DLH (Department of the Environment) Yogyakarta City to do assistance waste banks that experience this vacuum.

Keywords: Nearest Neighbor Analysis, Spatial Spread, Waste Bank, Web Geographic Information System

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1. Introduction

Waste management reduces waste products from the source, namely each household[1]. This is done to create a clean, healthy, and comfortable environment. The first stage of waste management is sorting between organic waste (easily biodegradable) and non-organic waste (not readily biodegradable). The second stage is managing the two types of waste; organic waste can be made into compost, waste briquettes, and eco enzyme[2]. Non-organic waste is also sorted according to its types, namely the type of plastic waste, the type of paper waste, the kind of glass waste, and the type of metal waste, such as electronic devices that are no longer functioning. All these types of non-organic waste can be deposited into the Waste Bank. A garbage bank is a place to collect or save non-organic kind of waste where the waste has been sorted from several households; from the waste bank, the process of selling waste to the collectors will be continued, or some waste that is fit for creation will be converted into new products[3]. Garbage banks with this banking system are like people saving money in the bank, but waste is saved here; waste savers are also referred to as customers eligible to get a waste passbook. This can provide positive value for customers because these waste savings can be disbursed in rupiah whenever they want. Besides being able to add rupiah for customers by saving this waste, it also provides a clean environment, free from rats and mosquitoes for customers' homes because items that are not used can be stored in a waste bank[4].

To minimize the amount of waste that is moved from each TPS in the city of Yogyakarta, the government of the city of Yogyakarta, especially the DLH (Environmental Service) of the city of Yogyakarta, recommends independent management in each region. This independent waste management embodies the 3-R (Reduce, Reuse, Recycle) principle, one of which is the waste bank program. Small things done by households will significantly impact the environment through the waste bank program. The volume of non-organic waste will be reduced by half with this waste bank. In addition to keeping the environment clean from items that are no longer used, it will also reduce the proliferation of diseases such as Dengue Fever from mosquitoes that like to nest in items that have never been touched and larvae that live in bottles, plastic cups, plastic buckets; besides that it can prevent one of the causes of air pollution due to burning waste; and the quality of the soil will be maintained because it is not used to bury used goods from these types of non-degradable waste[5]. So the existence of a waste bank in the community is very important to support the Yogyakarta City Environment Service in creating a healthy, clean, and comfortable environment for the City of Yogyakarta.

The waste bank's operation schedule is determined by the members of the waste bank, which includes the manager and customers of the waste bank. Waste bank managers are obliged to accept non-organic waste from waste bank customers. The received waste is weighed and counted, and the waste bank manager records the results in the customer's savings book. The price of the type of waste saved determines the amount of rupiah for customer waste savings. Waste Bank customers are residents of the local area who save waste, are registered as members of the waste bank, and have waste savings, as evidenced by a waste bank passbook.

In the future, if the waste is not managed correctly from the household scope in every RW in the city of Yogyakarta, there will be environmental problems that are not easy to overcome, considering that the city of Yogyakarta has limited land and a large population, in the future if this is not addressed squinting modifier It is undeniable that with this large population, it will contribute a large number of waste products, if not controlled there will be a waste explosion, the city environment of Yogyakarta will become dirty and slum and an unhealthy environment. You can imagine when the Piyungan TPA stops operating. Garbage will overflow everywhere in every corner of the TPS in Yogyakarta City, even up to the road, and plastics are also flying. The dangling modifier, the Yogyakarta City Environment Agency (DLH), targets that every 1 RW in each region is recommended to have 1 Waste Bank. According to data collection conducted by the Garbage Bank Association throughout Yogyakarta City, the number of waste banks is 448, about 73% of the total RW in Yogyakarta City; there are 617 RW. However, from this temporary calculation data, the visual form of the spatial distribution of waste banks in the city of Yogyakarta has yet to be discovered with certainty. Through these conditions, research to determine the pattern of distribution of waste banks in Yogyakarta City needs to be carried out so that

through this condition, a review related to this research focused on the analysis of the distribution of space (location), which is a study of geography. The research addresses two questions:

1. What is the visual form of the spatial distribution of waste banks in Yogyakarta City?
2. What is the distribution pattern of the waste bank in Yogyakarta City?

2. Methods

The method used in This research is a survey method with a quantitative approach. The geographic analysis uses a spatial approach to analyzing spatial patterns[6]. The data used by researchers are primary data and secondary data. Preliminary data is data obtained through direct measurement or plotting in the field. The data to be collected is about the distribution of waste bank locations in the Yogyakarta City area. Primary data collection will be carried out, namely the field survey method with survey tools, namely GPS and the Indonesian Topographic Map (RBI), a basic map that provides information specifically for land areas; the RBI map used is a 1:25,000 scale. Meanwhile, the secondary data used in this study are (1) Data on waste banks in the city of Yogyakarta, which are 448 waste banks, the data obtained from the Yogyakarta City Environmental Service; (2) Data on the area of Yogyakarta City obtained from the City of Yogyakarta in Figures 2022 by the Central Statistics Agency; (3) Several documents as references collected by researchers in the preparation of proposals to reports later.

The data obtained from the Yogyakarta City Environment Agency contains information, including the name of the waste bank, the name of the person in charge of the waste bank, the number of customers, and the address of the waste bank. The data does not yet have a coordinate reference, so it is not feasible to be displayed in a Web GIS as point data. Therefore, a field survey was conducted to obtain coordinated data. The field survey utilizes the "Avenza Maps" application installed on the Smartphone. The field survey was conducted to get accurate information and update existing waste bank data if it changes. The survey was also conducted online using the Google Form platform. This was done because the field survey found obstacles, namely, not finding the location of the waste bank or the person in charge of the waste bank, and saving time and transportation costs.

Analysis of the potential based on geographical data related to providing an overview or visual form of the location of the distribution of waste banks in the city of Yogyakarta. In this study, two data were processed separately. The data are photos of the waste bank and plotting data on the location of the waste bank using "Avenza Maps." The image of the waste bank is then uploaded to Google Drive so that it can be accessed online, while the plotting data from the field survey results obtained through "Avenza Maps" is exported into a file with the extension KML or KMZ. To be processed into ArcGIS Desktop 10.8 software, the file must first be converted to a file with a .shp extension. The conversion process utilizes a third-party site that can be accessed for free (https://mygeodata.cloud/). After becoming a file with the .shp extension, the file is opened with ArcGIS Desktop 10.8 software. The editing process carried out on the .shp file includes adding a column as a place to enrich waste bank information and adding a URL link for the waste bank photo obtained from Google Drive sharing. The information displayed is the waste bank's name, the person in charge, the cellphone number, the number of customers, and the address. Geographical analysis is a spatial approach with Nearest Neighbor Analysis[7]. The nearest neighbor analysis is an analysis method used to determine a pattern of distribution, whether patterned uniform, random, or cluster. Nearest neighbor analysis, in its calculations, considers distance, the number of points of distribution, and the area; the final result of this analysis is in the form of an index nearest neighbor (T) whose values range from 0 to 2.15[8].

3. Results and Discussion

3.1. Visual Form of Spatial Distribution of Waste Banks in Yogyakarta City

Web GIS creation is done using ArcGIS online. The .shp file processed from the editing results on ArcGIS Desktop is then uploaded to ArcGIS Online. The process carried out in ArcGIS online is divided into two, namely, map making and Web App creation. At the stage of making the process map, what is done is set the symbology in the .shp file that has been uploaded. The symbology needs to be considered

so that map users can well understand information about the waste bank. The distribution of waste banks is displayed using a dot symbol, while the administrative boundary is displayed with an area symbol. The pop-up settings and the information displayed in the pop-up are also set in the map creation process. The map will be shared as a Web App after the pop-up symbology and setup process is complete.

The Web App has several supporting widgets that can be used to integrate .shp files. Some widgets used in making this Web GIS are Layered and base maps. The following is a flow chart for creating a Web GIS (Figure 1).

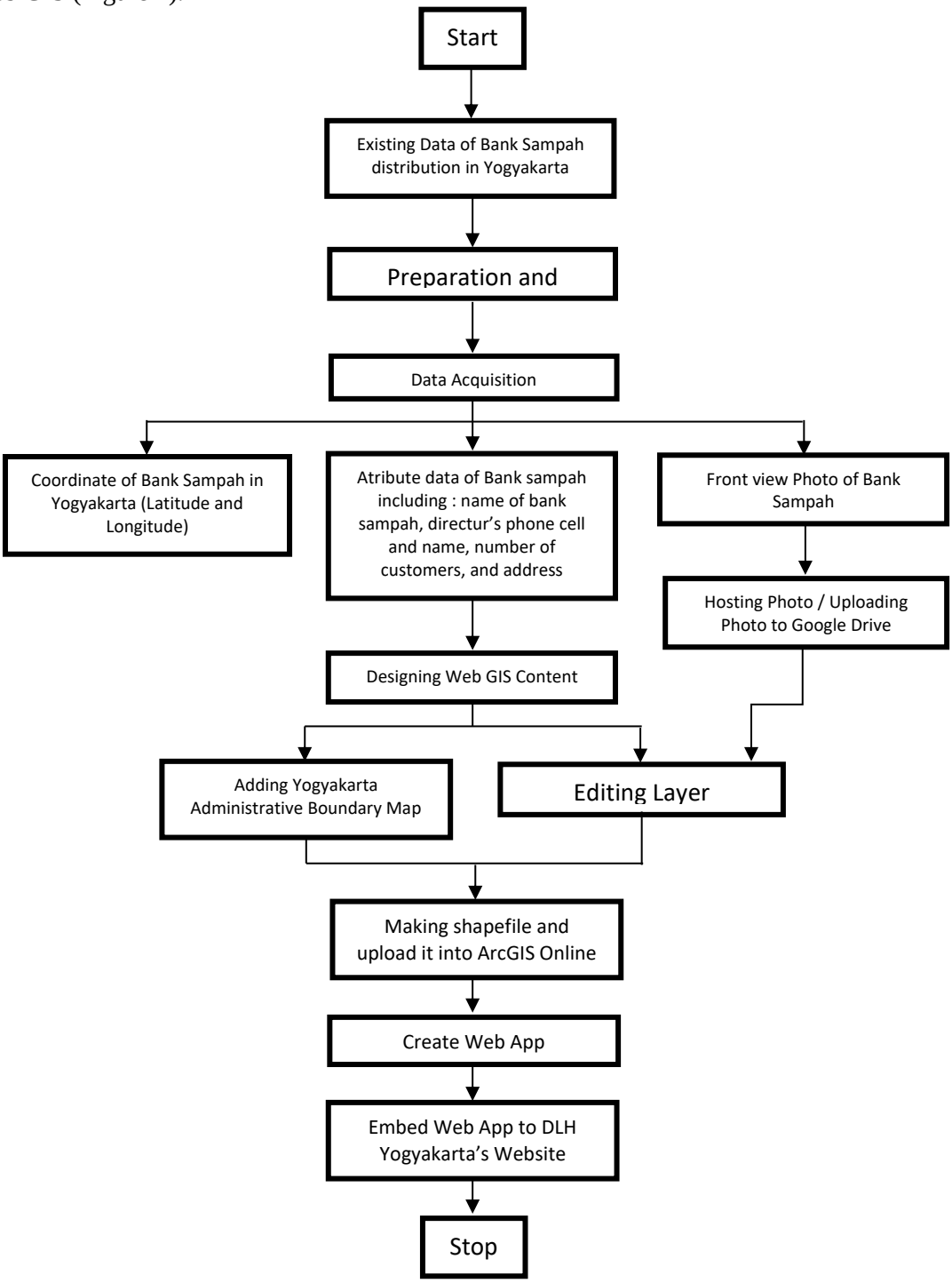

Figure 1. WebGIS creation flowchart

The Yogyakarta City Environment Service's website already has a waste bank map menu but does not yet have map content like in figure (Figure 2). The Embed website, as a result of field processing with GIS applications, will be displayed to model the distribution of waste bank locations. Embed the website as a result of field processing with GIS applications to model the distribution of waste bank locations that can be displayed on the DLH website. Then the Yogyakarta City Environment Service website will look like in figure (Figure 3).

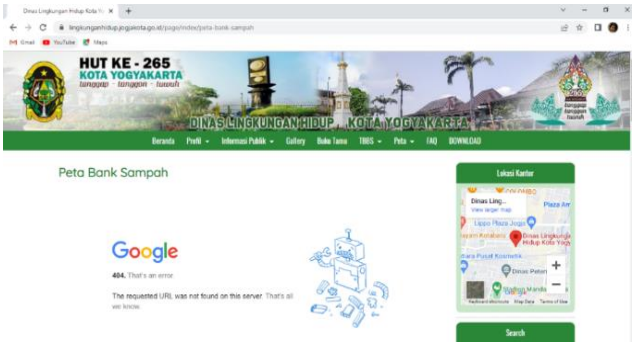

Figure 2. DLH Website Display (https://lingkunganhidup.jogjakota.go.id/page/index/peta-bank-sampah, 2022), Before Embed installation

Figure 3. DLH Website Display (https://lingkunganhidup.jogjakota.go.id/page/index/peta-bank-sampah, 2022), After Embed installation

After completing all the processes, you will begin to enter the final stage of making the map. A following picture is a visual form of the spatial distribution of waste banks in the city of Yogyakarta (Figure 4):

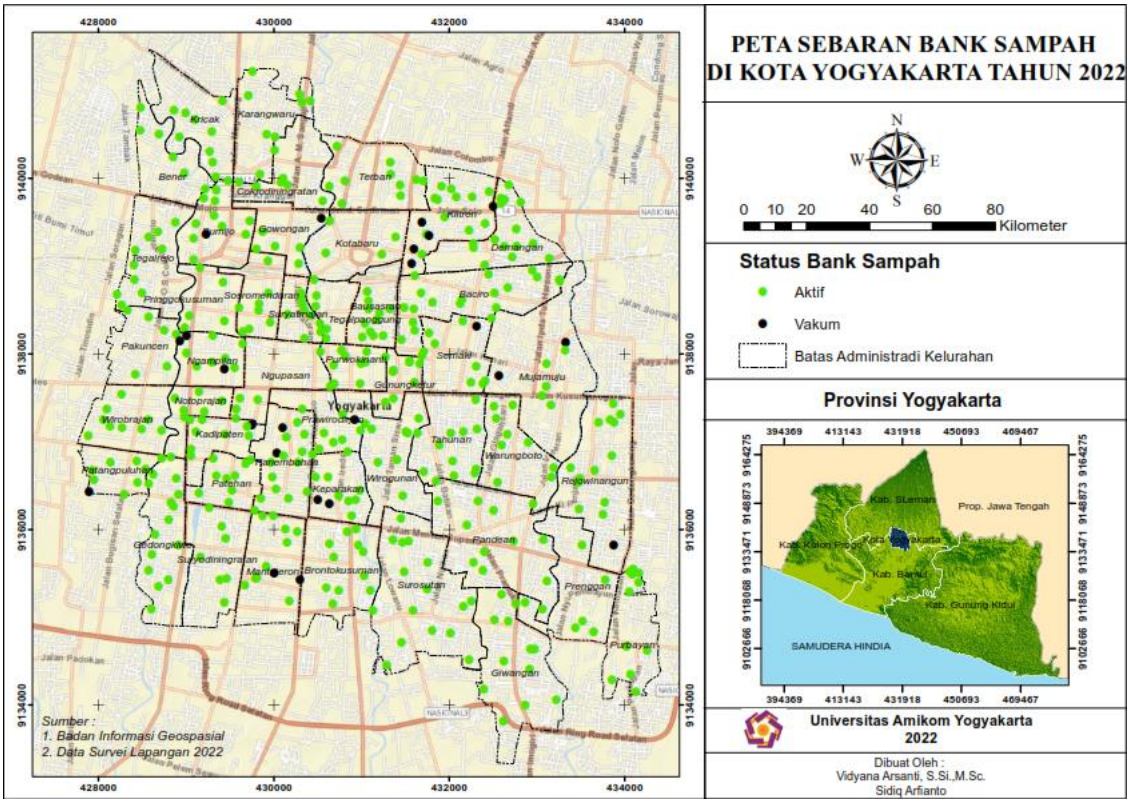

Figure 4. DLH Website Display

3.2. Garbage Bank Distribution Pattern in Yogyakarta City

To determine the distribution of waste banks in the city of Yogyakarta, researchers used the Nearest neighbor analysis method, which previously calculated the arbitrary distance between the point of the waste bank and the nearest one scattered in the city of Yogyakarta. After measuring the distance between these closest points, they are summed and divided by the total location points of the waste bank in Yogyakarta City to find the average distance of the nearest neighbors. After finding the average distance between the waste bank location points and using the area of Yogyakarta City, the final result is obtained in the form of an index calculation ranging between 0 – 2.15. The first step in determining the nearest neighbor analysis, namely the boundaries of this research location, has been determined by the Yogyakarta City administration. After that, the distribution pattern of the location of the waste bank is given in order; here, the researcher gives the serial number of the waste bank that is still in the active category. A serial number will not be given if the Yogyakarta City waste bank status is no longer active. The following figure is as follows the order of distribution of waste banks in the city of Yogyakarta (Figure 5):

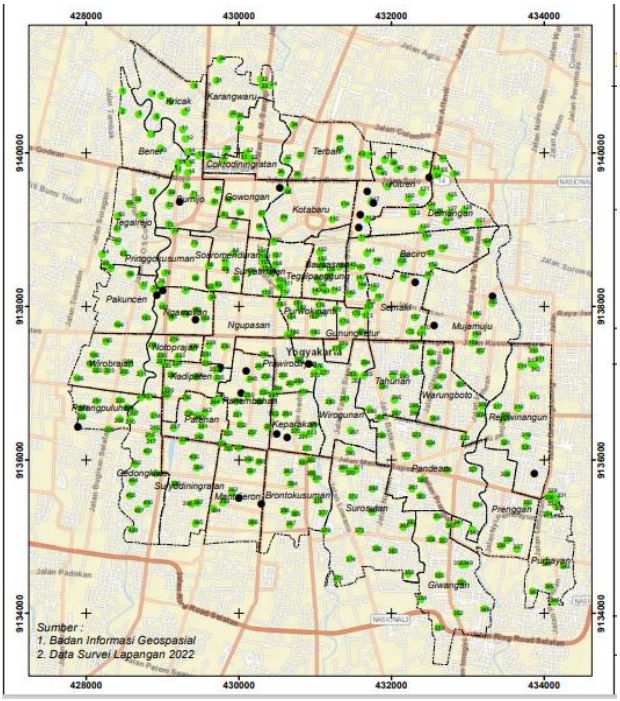

Figure 5. Waste Bank Order Map

The serial number of waste bank locations starts from 1 to 411, so from the total plotting of 448 waste bank locations, there are only 411 active waste banks. This means that there are 37 or 8.26% of waste banks with a status no longer active or vacuum. According to information from the RW head, one example of the Pakuncen area, especially RW 02, is that it is no longer active. For RW 03, according to information from residents, the waste bank there is also no longer operating. After successfully assigning a serial number at each point of the waste bank, the researcher measured the closest distance, namely the distance on a straight line between one waste bank location and the nearest other.

The calculations using the formula for determining the nearest neighbor value give the result of 5.11; it can be concluded that the distribution pattern of waste bank locations in Yogyakarta City is a Dispersed or uniform/regular distribution pattern[9]. This is because the distance between one waste bank location and another is relatively the same. The distribution pattern is uniform if the index value is more than 2.15 (two points fifteen).[10]

4. Conclusion

From the results of the research that has been done, the conclusions obtained are that the visual form of the spatial distribution of waste banks in the city of Yogyakarta is spread in almost all areas of the city of Yogyakarta, with an area of 32.5 km2. The locations of waste Banks that have been plotted are 448 waste banks; there are only 411 active waste banks; this means that there are 37 or 8.26% of waste banks with a status no longer active or vacuum. The visual form of the spatial distribution of the waste bank can be seen via the link: https://arcg.is/1unqD1. The distribution pattern of the waste bank in the city of Yogyakarta is a dispersed or uniform/regular distribution pattern. Because the distance between one waste bank location and another is relatively the same if the index value is more than 2.15 (two points fifteen), then the distribution pattern is uniform.

Acknowledgements

The results of the visual form of the thematic map of the spatial distribution of waste banks in Yogyakarta City can be used by the Yogyakarta City Environment Service as a reference for knowing

areas that already have or do not have a waste bank. In addition, it is also possible to find out several waste banks that have been vacuumed or are no longer active so that it can be easier to provide assistance

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