Spatial pattern of supporting facilities in mangrove ecotourism Karawang regency, West Java

P Angelika, T Handayani and M H D Susilowati
Department of Geography, Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Indonesia, Depok 16424, Indonesia

Corresponding author’s email: tuty.handayani@ui.ac.id

Abstract. Karawang regency has the second area of mangrove forest in West Java Province with an area of 10,005.93 Ha, which encourages the formation of mangrove ecotourism in Karawang regency. Tangkolak mangrove ecotourism, Cilamaya Wetan district and Pasir Putih mangrove ecotourism, Cilamaya Kulon district is ecotourism that developed in 2018. However, the place has had thousands of visitors, even though it’s classified as a new ecotourism and the facilities that provided are still quite simple. This research purpose is to find out the spatial pattern of supporting facilities based on the interval distance. This study uses a descriptive spatial analysis method. The result is the distance interval affects the formation of facilities patterns around ecotourism. The spatial pattern of these supporting facilities also affects the amount of income and the development purpose, where the facilities that located in close range will have a greater income than intermediate and long-distance intervals as well as the purpose of approaching tourist attractions.

Keywords: Mangrove ecotourism, supporting facilities, spatial pattern

1. Introduction
Indonesia has various natural, cultural and ethnic potentials. Indonesia has approximately 17,508 islands which have great potential for the development of ecotourism [1]. According to the Minister of Environment, Indonesia has a wealth of abundant and unique natural resources that have great potential to take advantage of the development of ecotourism [2]. Indonesia has the potential for good mangrove ecotourism. The reason is Indonesia has the largest mangrove ecosystem in the world, equivalent to 23% of the world's mangrove ecosystem [2]. According to the marine and fisheries service of West Java province in 2018, Karawang regency has the second mangrove forest area in West Java Province of 10,005.93 Ha besides this district has the best category of mangrove land in West Java Province. This is what drives mangrove ecotourism in this district [3].

There are three mangrove ecotourism in Karawang regency, among others Sedari mangrove ecotourism, Pasir Putih mangrove ecotourism, and Tangkolak mangrove ecotourism. Sedari mangrove ecotourism is located in Cibuaya district, Pasir Putih mangrove ecotourism is located in Cilamaya Kulon district, and Tangkolak mangrove ecotourism is located in Cilamaya Wetan district. Cilamaya Wetan and Cilamaya Kulon subdistricts are sub-districts that have the widest area of mangrove land in Karawang regency with an area of 1,461 Ha with a high density of mangroves [3]. Based on findings in the study area, different from Sedari mangrove ecotourism which was previously managed and has developed into a tourist attraction under the auspices of the tourism office, Pasir Putih and Tangkolak
are still relatively new, which were only managed in 2018, but this ecotourism has many visitors who come [4].

The attraction of each tourism attraction certainly has differences in each tourism attraction. This is based on various factors that affect the interests of visitors so that the level of attractiveness also varies [5]. The attraction in a tourism attraction is caused by a number of geographic elements in which the element unwittingly causes development in the tourism destination [5]. The attractiveness of tourist destinations becomes a very important aspect to attract the interest of visitors who come [6]. The existence of these attractions can attract visitors who come, and unwittingly it also affects the economic activities for people who live around the tourism attraction. The existence of attractions as primary facilities stimulates the growth of supporting facilities and develops over time. Since the formation of this tourist attraction has encouraged the surrounding community to take advantage of attractions as a means of selling [6]. According to Amalu it is a common phenomenon that facilities in ecotourism and ecotourism attractions stimulate the development of ecotourism. The growth of supporting facilities has increased the number of supporting facilities that are spread out from the center of the tourist attraction to the outside of the tourist attraction. [7]. The distribution of these supporting facilities forms a spatial pattern that is closely related to distance.

2. Materials and method

2.1. Study area
Tangkolak mangrove ecotourism is located in Tangkolak hamlet, Sukakerta village, Cilamaya Wetan subdistrict, Karawang regency. Tangkolak mangrove ecotourism has been developed since 2018. In Tangkolak ecotourism region has two tourism attraction areas located in east Tangkolak and west Tangkolak. These two attractions are separated by the hamlet administration and the natural boundary that is panggelang river. While Pasir Putih mangrove ecotourism is located in Pasir Putih hamlet, Sukajaya village, Cilamaya Kulon district, Karawang regency, the Pasir Putih mangrove ecotourism has been developed since 2018 as the Tangkolak mangrove ecotourism.

2.2. Variables
The variables in this study refer to the tourism facility theory in [8], among primary facilities, secondary facilities, conditional facilities, and accessibility. In this study, secondary and conditional facilities are categorized as supporting facilities from primary facilities. Secondary facilities in this study are divided into three types are shopping facilities, culinary facilities, and accommodation facilities. As for conditional facilities, there are places of pray room, toilets, parking lots, seats, trash bins, huts, and information center. The geographic units in this study are primary facilities, accessibility and distance intervals. This study uses primary data and secondary data. Primary data used are data on the location of mangrove and facilities ecotourism objects obtained through plotting using Avenza Map and distributing questionnaires. A while for secondary data is data related to supporting maps or spatial data.

2.3. Spatial pattern
Location is related to the distance that unites each of the location points, so that they are related to each other [9]. According to Lee and Wong, a spatial pattern is something that indicates the location of an object or arrangement of objects on the surface of the earth [10]. Each spatial pattern will describe the spatial process shown from the encouragement of environmental and social factors. The form of spatial distribution in this study refers to the distribution pattern of Bintarto et al. which classifies the distribution patterns into three types namely uniform, random, and clustered [11].

2.4. Spatial descriptive analysis
The analysis in this study uses a spatial analysis method descriptively. The descriptive analysis method is to make a description, picture or painting systematically, factually and accurately about the facts,
properties, and relationships between the phenomena under study [12]. This study focused on the distance interval as the unit of analysis.

3. Results and discussion

The spatial pattern of supporting facilities in a tourist attraction will vary based on the characteristics of the location of the tourist destination and the distance of the supporting facilities from the primary facilities and the road network. The spatial pattern of supporting facilities for mangrove ecotourism studied in the study was divided into two research areas namely Tangkolak mangrove ecotourism and Pasir Putih mangrove ecotourism. The spatial patterns seen in the discussion were analyzed based on the relationship between the points of the object supporting facilities with the points of the primary facility analyzed based on the interval of distance.

Based on table 1, the distance interval of the secondary facilities are mostly found at near intervals (< 100 meters) and the number of secondary facilities decreases at medium distance intervals (100–200 meters) and far intervals (> 200 meters). Table 1 shows that east Tangkolak mangrove ecotourism has the highest number of secondary facilities at 34 facilities, followed by 27 Pasir Putih mangrove ecotourism and 21 west Tangkolak mangrove ecotourism.

Similar to the spatial patterns that are formed based on primary facilities, based on the road network also formed a pattern that decreases with increasing intervals in each distance of mangrove ecotourism. Based on table 2, that the pattern formed is related to the area of the ecotourism object itself which is the main attraction, so it raises the number of supporting facilities that are relatively more at the interval of dean distance to the object of ecotourism compared to the distance away from the object of tourism. Meanwhile, the road network as accessibility plays a role in the formation of spatial patterns of supporting facilities where supporting facilities, especially secondary facilities, will be more often found at near intervals range from the road network.

The pattern formed from the two ecotourism relates to the direction of the development of the two supporting facilities. The mangrove ecotourism areas in this study were developed since 2018. In 2019 many secondary facilities were found in both mangrove ecotourism areas. Whereas for medium intervals the growth of secondary facilities decreases to far intervals.

| Table 1. Total of secondary mangrove ecotourism facilities based on primary facilities. |
|---------------------------------------------------------------|
| **Type of facility** | **Mangrove ecotourism** | **Interval (m)** | **Total** |
| | | **Near (< 100 m)** | **Medium (100–200 m)** | **Far (> 200 m)** |
| Secondary facilities | east Tangkolak | 17 | 13 | 4 | 34 |
| | west Tangkolak | 12 | 7 | 2 | 21 |
| | Pasir Putih | 13 | 10 | 4 | 27 |

| Table 2. Total of secondary mangrove ecotourism facilities based on road network. |
|---------------------------------------------------------------|
| **Type of facility** | **Mangrove ecotourism** | **Interval (m)** | **Total** |
| | | **Near (< 40 m)** | **Medium (40–80 m)** | **Far (> 80 m)** |
| Secondary facilities | east Tangkolak | 17 | 13 | 4 | 34 |
| | west Tangkolak | 12 | 3 | 6 | 21 |
| | Pasir Putih | 20 | 7 | 0 | 27 |
One that encourages the growth of secondary facilities at near range intervals because this is one of the opportunities for the community to make a living as a provider of facilities for visitors who come. In the discussion of the direction of development, it is grouped into three categories of years, among facilities that were formed before 2016, were formed in 2016 to 2017, and were formed in 2018 until 2019.

Based on figure 1, in Tangkolak mangrove ecotourism the direction of development in the near interval (0–100 meters) found 2 secondary facilities that appeared before 2018 when the year before the development of primary facilities and found 10 secondary facilities that appeared in 2018 until 2019. At a distance medium interval while (100–200 meters) secondary facilities by year have begun to vary in their patterns, namely 5 secondary facilities that appear before 2016, 1 secondary facility that appears in 2016 to 2017, and 1 facility that appears in 2018 until 2019, while for far intervals (> 200 meters) that is not secondary facilities have appeared above 2016 where as many as 2 secondary facilities have been found before 2016.

Based on figure 2, in the direction of the development of secondary facilities, the Pasir Putih mangrove ecotourism by year of formation also has the same spatial pattern as the direction of the development of secondary facilities in the Tangkolak mangrove ecotourism. At near distance intervals (< 100 meters) there is 1 secondary facility that appears before 2016 type of staple food stalls, 5 secondary facilities that appear in 2016 to 2017, and 7 secondary facilities that appear in 2018 until 2019. At medium distance intervals (100–200 meters) there are 3 secondary facilities appear before 2016, 5 secondary facilities that appear in 2016 to 2017, and 1 secondary facility that appears in 2018 to 2019. Whereas for far distance intervals (> 200 meters) there are 4 secondary facilities which appeared before 2016 and no secondary facilities found above 2016.

In addition to the direction of development, many factors affect the income of each secondary facility in the two mangrove ecotourism areas such as the distance interval and the type of secondary facilities offered because each secondary facility has different advantages. The income in this study is categorized into three classes, namely low (Rp. 0.00–Rp. 200,000.00), moderate (Rp. 200,001–Rp. 400,000.00), and high (Rp. 400,001–Rp. 600,000.00). The discussion on secondary facility income is intended to determine whether the spatial pattern of secondary facility points at near, medium and far distance intervals affects the income earned on secondary facilities.

![Figure 1. Direction of development in Tangkolak.](image-url)
Figure 2. Direction of development in Pasir Putih.

Table 3. Income matrix for each ecotourism based on total of secondary facilities.

| Ecotourism       | Primary facility | Road network |
|------------------|------------------|--------------|
|                  | Near  | Medium | Far | Near  | Medium | Far |
| East Tangkolak   | 13    | 10     | 4   | 20    | 7      | 0   |
| West Tangkolak   | 12    | 7      | 4   | 4     | 3      | 6   |
| Pasir Putih      | 17    | 13     | 4   | 17    | 13     | 4   |

Table 4. Income matrix for each ecotourism based on income.

| Ecotourism       | Primary facility | Road network |
|------------------|------------------|--------------|
|                  | Near  | Medium | Far | Near  | Medium | Far |
| East Tangkolak   | moderate | moderate | low | moderate | moderate | low |
| West Tangkolak   | high   | moderate | low | high   | low     | moderate |
| Pasir Putih      | high   | high    | low | high   | moderate | moderate |

From Table 3 and Table 4, it can be seen that the distance interval affects the income of each secondary facility in each ecotourism based on primary facilities and the road network. It can be seen that secondary facilities that are at near distance intervals based on primary facilities or road networks will have higher revenues than facilities that are at medium or far distance intervals (can be seen in the gray box). Secondary facilities that are at far intervals will have lower income. It because of the location of secondary facilities that are far from the primary facilities and road network. Visitors will tend to choose secondary facilities that are close to attractions and road network.
The development of mangrove ecotourism can be one of the economic sectors of the local community's income so that people get a more prosperous life and ensure sustainability. It can be concluded that the location factor influences the income of each secondary facility, where secondary facilities that are close to the location of the primary facility will have a higher income as well as secondary facilities that are located close to the road network. Visitors prefer secondary facilities that tend to be close to primary facilities and have easy accessibility or close to the road network. As the mangrove ecotourism object in Karawang regency, although it is still classified as a new tourist attraction and there are still many shortcomings of facilities and infrastructure, this tourist attraction has been able to attract the attraction of visitors who come. The existence of these attractions can attract visitors who come, and without realizing it also affects the economic activities for people who live around the tourist attraction.

4. Conclusion
Distance intervals form a pattern of supporting facilities in Tangkolak and Pasir Putih mangrove ecotourism. Supporting facilities will be more commonly found at near distance intervals and decrease with increasing distance. So, the pattern is related to the direction of development and income of each secondary facility. It is seen that the direction of development and income of each secondary facility appears to approach the primary facilities and road network at near distance intervals and have higher incomes. Visitors tend to choose secondary facilities that are closest to primary facilities and have the easiest accessibility so that secondary facilities located at close range intervals based on primary facilities and the road network will have the highest income.

Acknowledgments
This work was financially supported by Universitas Indonesia under Communities Engagement grants with theme 'Technology for Society' with grant contract number NKB-1377 / UN2.R3.1 / HKP.05.00 / 2019. We also want to thank Sukakerta local communities and its officer for their help.

References
[1] Yoeti O 2000 Ekowisata Pariwisata Berwawasan Lingkungan Hidup (Jakarta: PT Pertja)
[2] Kementerian Lingkungan Hidup dan Perhutanan 2017 Miliki 23 % Ekosistem Mangrove Dunia, Indonesia Tuan Rumah Konferensi Internasional Mangrove 2017 available at http://ppid.menlhk.go.id/siaran_pers/browse/561
[3] Status Lingkungan Hidup 2013 Buku Data Status Lingkungan Hidup Kabupaten Karawang (Karawang: Pemerintah Kabupaten Karawang Propinsi Jawa Barat)
[4] Tangkolak yang Berbenah Jadi Obyek Wisata Bahari 2019 available at https://www.karawangkab.go.id/berita/tangkolak-yang-berbenah-jadiobyek-wisata-bahari-0
[5] Pratama O 2016 Tingkat Daya Tarik Objek Wisata Pantai di Kabupaten Banyuwangi B.Sc. Final Projects (Depok : FMIPA Universitas Indonesia)
[6] Lee C F, Wei M O and Husn I H 2009 Asia Pac. J. Tourism Res. 14 17-38
[7] Amalu T E, Otop O, Oko U and Oko-Isu P E 2018 SGG 2 1-15
[8] Burton R 1995 Travel Geography 2nd edition (London : Longman Pub Group)
[9] Sihombing I and Nurman A 2017 Tunas Geografi 6 25-37
[10] Lee J and Wong D W S 2001 Statistical Analysis with Arcview GIS (United Stated of America: John Wiley & Sons, Inc)
[11] Bintarto R and Surastopo 1979 Metode Analisis Geografi (Jakarta: LP3IS)
[12] Nazir 1988 Metode Penelitian (Jakarta: Ghalia Indonesia)