

Conference Paper

Sustainable Settlement Development: Land Use Change in Lakeside Tourism of Bandung

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Abstract

This article is based on research to analyze the spatial land use development in two lakesides of peri-urban Bandung, Cileunca and Ciburuy lakes. In developing countries, fast-growing populations, urbanization, and rising economic sectors cause a vast demand for residential areas and supporting facilities for the residents, work labors, and office workers. Consequently, in able to deliver those demands, development in the peri-urban area is inevitable. In peri-urban Bandung, some developments tend to happen nearby the lakes; it provides the source for water, basic sanitation, and recreational space for surrounding residents and visitors. Later, the dynamic change of land use also occurs, following the rapid expansion of industrial area and tourism business. Sustainable housing development in urban Bandung is arguably integrated into those dynamic activities of the peri-urban. The method of this research is comparing spatial transformation and empirical investigation to evaluate the driving forces behind the land use conversion in Lakeside area of peri-urban Bandung. The results show that the development and land use alteration in Situ Cileunca's lakeside settlement area is intensifying after the tourism activities take place. Conversely, industrial expansion and proximity to Bandung city more likely influence the development of physical infrastructure in Situ Ciburuy's lakeside.

Keywords: lakeside settlement, land use change, accessibility, tourism, peri-urban Bandung

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Received: 24 May 2019

Accepted: 25 July 2019

Published: 4 August 2019

Publishing services provided by
Knowledge E

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Selection and Peer-review under the responsibility of the ISTECS 2019 Conference Committee.

1. Introduction

The development process in developing country like Indonesia happens unevenly and self-organized, especially in the urban-rural area of Java Island. Urbanization, economic improvement, and population growth in cities create a significant development of physical infrastructure. Later, urban sprawling happens due to the demand of supporting remote area of core cities, especially for residential and services, which causes several

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occurrences, such as deforestation and land conversion, that lead to inefficient land use and environmental degradation in the regions [5].

Lake is one of the desired nature travel destinations which provides good sceneries and refreshing environment. Nowadays, extensive development in the lakeside area and other water shores are inescapably, especially in the well-known destinations [25]. Living close to the lakeside area becomes the solution in fulfilling the needs of water, sanitation, and agricultural purposes for low-income residents in an urban and urban fringe area since they have limited access to city's official water suppliers. Consequently, the lake environment is vulnerable in danger, because of the uncontrolled land use conversion, water pollution, the risk of sedimentation, floods for nearby settlements and deteriorating water quality [13]. Previous studies and literature review related to land use change in lakeside tourism of Bandung were not explicitly available. Therefore this article comes out with literature within different area or disciplines.

Campbell [9] argues that managing land use conversion is one of the most potential tools in reducing the conflict interests between human and natural environments, and able to create sustainability on the three aspects of "sustainable triangle", which consists of economic, social, and environmental. Recognizing the driving factors of land-use transformation is one of the options since land use change mostly stimulated by human activities and could powerfully affect future and ecological life of human and other entities [23]. Addressing the issue, the research aims to evaluate and analyze the driving factors of land use transformation, which are taking place in two lakeside areas in a peri-urban area of Bandung Metropolitan Area (BMA), by using case study analysis with qualitative comparison explanation. Hopefully, this research could fulfill the gap of the transformation study in the built environment, by identifying the transformation initiated by particular tourism activities, in the context of the peri-urban area. The specific contribution is broadening the knowledge on dwelling transformation especially in peri-urban lakeside. The scope of the substantive study is mainly focusing on lakeside tourism.

2. Theoretical Review

Land-use defines as functioning land resources for various purposes in human activities, which also impacts on the land itself [13]. Land is the limited resources, which also habitat for natural entities, and critically depends on human activities. Recently, land use is seen as one of the biggest factors in defining sustainability in urban and its surrounding area [9, 26]. Brissoulis [7] mentioned two types of land use change, which

consist of conversion and modification. Conversion indicates that the land use's mix and the pattern are transformed, while modification signifies the minimum changes or intensification of certain purposes, such as creating the recreational area inside the urban forests. No solid theoretical construct relates sustainable development, land use change in lakeside settlement. The measurement of land use transformation could be determined on the spatial scale, depends on the context in the study itself which could be wider or smaller.

In developing countries, increasing economic in city center invites the rapid growth of population and uneven development of urban-rural area resulting in the emergency needs of urban settlement area because of urbanization [1, 17, 18]. Thus, the demand for residential area is getting bigger for low to middle-income residents who could not afford housing in the city center [2], stimulated by the increase of land market value and self-organization development in urban fringe area [23]. Consequently, these groups of people are sprawling to the peri-urban hinterlands, and mixing with other functions, such as agricultural farms and industrial factories [1, 19]. As expected, land use conversion unavoidably happened, triggered by the combination of population growth, the needs of economic activities and settlement area [20].

Therefore, land use change derived by several driving forces, which are depending on the local and regional context. Based on the research in Nigeria, it was revealed that accessibility, neighborhood relationship, and spatial policy might be the primary drivers for land use change [6]. Other studies in China mention other factors, such as economic development, population growth, demographical, and geographical conditions (e.g., elevation, slope, wetland), education and historical factors (e.g., retrofitted city village and cultural sites) [28–30]. Xiao et al. [32] also disclose that traffic condition, local policies, and expansion of industrial factories could be the major determinant for land-use change. Hall and Härkönen [13] also testify the impact of tourism industries, which could also affect on the land-use conversion. Also, a study by Tsou, Hung, and Chang [23] mentioned about the relationship between spatial analysis and sustainable development, which stated that adequate preserved natural environment and sufficient availability of public facilities could determine the sustainability in the urban and peri-urban area.

3. The Methods

3.1. Area of study

In 2016, Bandung Greater Area, also known as Bandung Metropolitan Area (BMA), is resided by nearly 8.4 million residents. BMA has several lake destinations, and most of the lakes are in West Bandung Regency and Bandung Regency. In BMA, most of the lakes are located within the peri-urban region and surrounded by mountains and valleys. Peri-urban in Bandung is depicted as the mixing between rural and urban, with several classifications of Peri-urban [34], depends on its topography, accessibility, and location towards main cities [8].

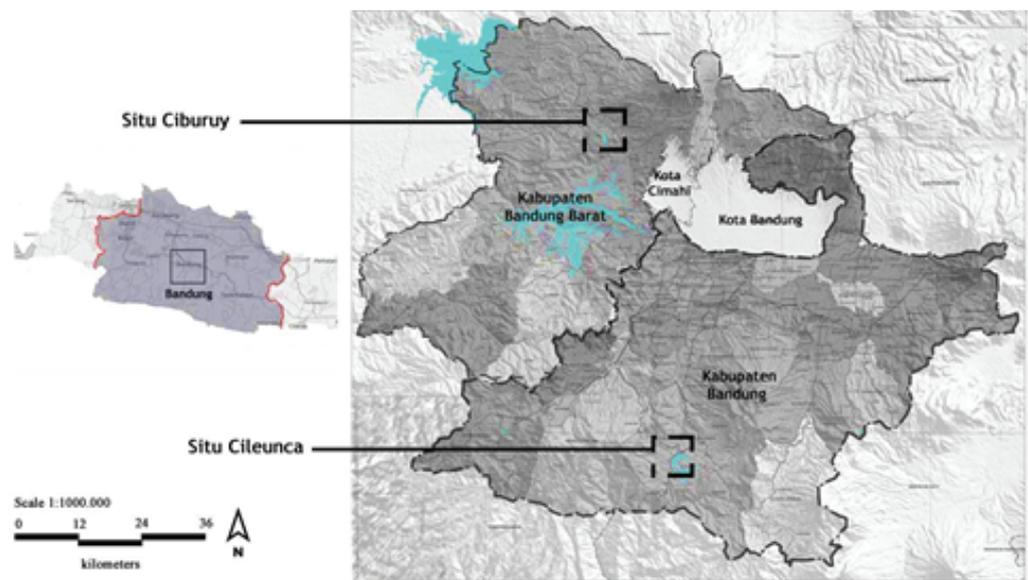


Figure 1: Maps of Bandung Greater Area, showing the blue area. (Source: Adapted from *petatematikindo.wordpress.com*)

The objectives of this study are to evaluate and analyze the spatial land-use changes between two lakesides in a peri-urban area of Bandung Metropolitan Area (BMA), by comparing the transformation of spatial land-use pattern nearby the lake shores within a particular period and several indicators which derived from recent studies. The data observation and desk study later will support the overview of existing conditions of settlement area and which factors drive the land-use conversion in each lakeside. The spatial transformation will be observed in two best-known lakesides which sited in a peri-urban cluster in different regencies: Situ Ciburuy lakeside in West Bandung Regency (*Kabupaten Bandung Barat*) and Situ Cileunca lakeside in Bandung Regency (*Kabupaten Bandung*). The dominant land-use around these lakes is residential, agricultural, fisheries, and industrial area.

3.2. Research strategy and data analysis

This study applies a case study as the primary research strategy, in which able to explore the current issues in a particular area or region and dealing with several sources of data [33]. The data for this paper was acquired from both primary and secondary sources. The primary data was obtained directly from the lakeside area, while desk study was utilized to get more overview of the area and its historical stories. In results, both of the primary and secondary sources are required to develop the knowledge about the spatial land-use change in lakeside of Situ Ciburuy and Situ Cileunca. Yin [33] argues that the fundamental instruments in case study analysis are data investigation and categorization, in helping the authors to match their initial objectives with the verified evidence. This article is utilizing data from Google Earth as well as observation and empirical verification for spatial analysis. However, the authors aware of the detail and possibility in using other methodologies, such as GIS and remote sensing; for example, the articles were written by Firman & Dharmapatni [11] and Rani [22].

For this reason, comparative spatial pattern analysis is implemented in this study to understand the historical land-use distribution [7]. The analysis begins with the historical spatial land-use model through satellite imagery from Google Earth; it will give the overview about the ‘demand and supply points’, and give the insight of chronological conditions about the spatial transformation in particular area and help in identifying potential future demand and supply area. For spatial data observation, this study employs Google Earth imagery, which could be the powerful tool in analyzing and detecting the dynamic change of land-use annually [14, 30] since Google Earth produces the good visualization of remote sensing by satellite imagery [22]. Those analyses would be combined with the empirical investigation and desk study which adopting several attributes from previous researches in spatial evaluation, such as accessibility [6], geographical conditions [26], existing condition of industrial expansion [31], and tourism activities [13].

4. Results and Discussions

4.1. Situ Ciburuy

Situ Ciburuy is located in Padalarang, the densest sub-district in West Bandung Regency. Ciburuy previously was the intersection between two rivers and considered as a man-made lake with an area approximately 14.76 Ha. In 1918, Indonesia still under the

colonization period, and the Dutch army had constructed the infrastructures around the rivers' intersection area for water reservoir, as a water source for agriculture purposes [16]. Nowadays, the majority of the residents who live nearby this lake are working in industrial and mining sectors, services and commercial, and agriculture. Currently, local tourists could enjoy other entertainments such as boat riding, fishing, and local culinary around Situ Ciburuy. However, Situ Ciburuy struggled over mismanagement which resulted in polluted water and poor waste management.

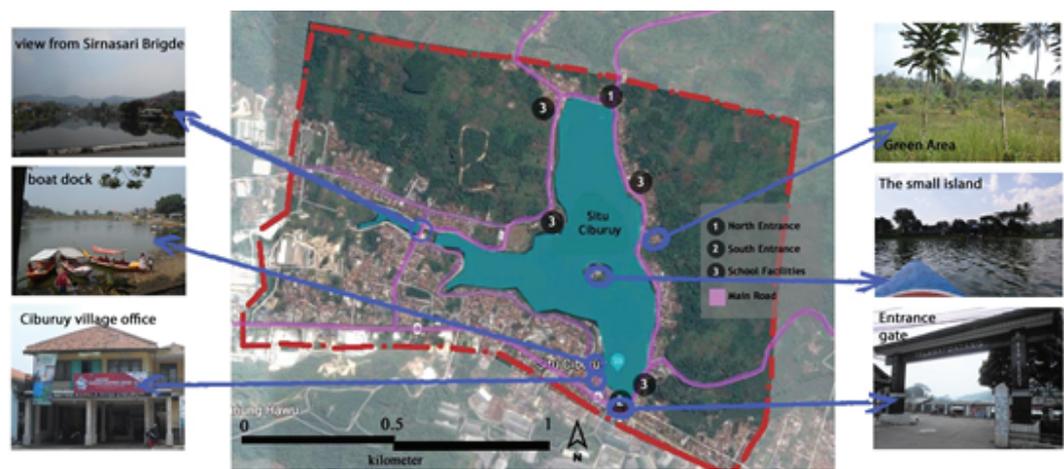


Figure 2: The facilities and attributes in Situ Ciburuy. *Source: Primary observation, 2018.*

Most of the inhabitants of Situ Ciburuy are residing in the south part of the lake, influenced by the accessibility and recreational facilities development. This occurrence has resulted in the demand for daily life and tourism supporting facilities, such as food stalls and *warung* (small marketplace), and guest house around Situ Ciburuy lakeside. In 2015, the settlement area was increasing 59 percent to 796.35 Ha, while sacrificing the area for green open space and rice field, with reducing 103.49 Ha and 420.2 Ha respectively [20]. These land-use transformations were impacted by several factors, such as the development of accessibility through Padalarang toll-road, new settlement development, factories, and tourism.

4.2. Situ Cileunca

Situ Cileunca is located in Pangalengan sub-district, with a total area of 181 hectares and the water surface level reaches 1550 meter above sea level. Situ Cileunca was built within 7 years, from 1919 – 1926, as the water reservoir for Bandung city. Today, the lake is managed by Government of Bandung Region, Tourism Bureau of Bandung Region, and PT. Indonesia Power, which is a national state-owned company in electricity business in West Java, and still functioned as an electricity source. According to the

master plan that assigned by the Government of Bandung Regency for the year 2007 - 2027, Situ Cileunca and Situ Cipanunjang were stated as the integrated tourism area, including camping, rafting, boat riding, and agricultural tourism. The main tourist area is located in the west side of the lake, which consists of entrance gate (with ticket sales), parking facilities, food stalls, boats, and rafting rents operator office, as seen in Figure 3.

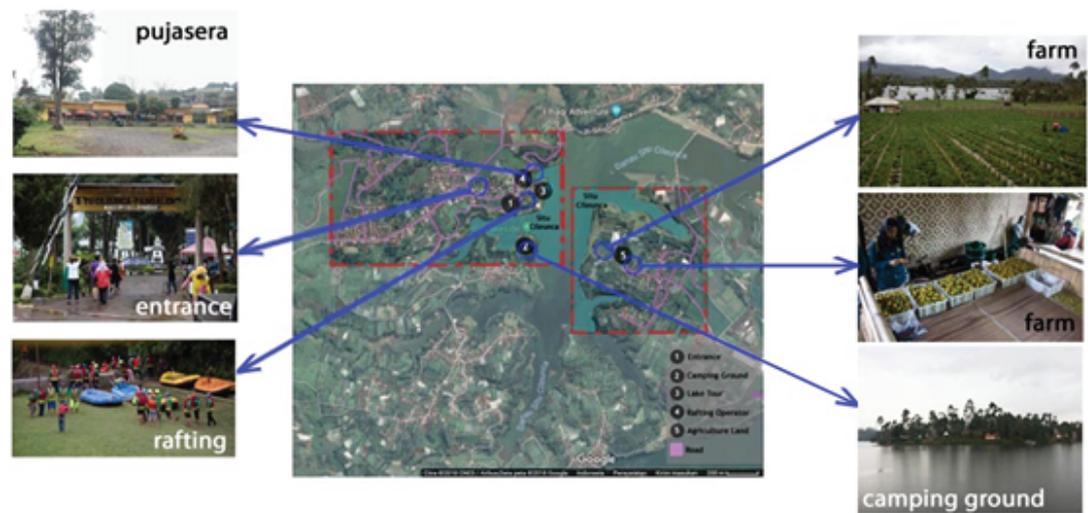


Figure 3: The facilities and attributes in Situ Cileunca. *Source: Primary observation, 2016 and 2018.*

Statistical Bureau of Bandung Regency [4] specifies that Pangalengan Sub-District has relatively low-density settlement area, with approximately 137,497 building per km². The demand for housing is relatively high. Most of the inhabitants of Situ Cileunca are residing in southern part to the north-west part of the lake, influenced by the accessibility and recreational facilities development in those areas. The land-use in the east part of the lake mainly taken by agricultural activities, such as orange and strawberry farms, rice fields, resident's farms, milk farms, and green areas.

4.3. Settlement transformation of the lakeside

Based on the observation that described in the location descriptions part, Situ Cileunca and Situ Ciburuy have several differences in physical appearances and demographic situations. The comparison of these characteristics among two lakeside areas is in *Table 1* below.

As shown in *Table 1*, Situ Cileunca has more new facilities for leisure and recreation purposes, compares to Situ Ciburuy, and it has a direct implication on the growing number of accommodations. These findings indicate that the development of tourism

TABLE 1: The comparison of dwelling characteristics between lakes in West Bandung Regency and Bandung Regency.

No	Contents*	Situ Ciburuy**	Situ Cileunca***
	1. Characteristics of the surrounding location	Located 22 km from West Java capital city, Bandung. The visitors could easily reach the lake through Padalarang entrance highway, regional primary road, or Padalarang rail station. Numerous limestone (as its natural resources) factories were constructed nearby this area. Industrial workers become a popular job in Padalarang sub-district.	Located 50 km from Bandung city. Pangalengan sub-district, the administrative location from Situ Cileunca, is stated as the integrated tourism area by Bandung Regency government. Generally, this area is surrounded by agriculture farms (e.g., tea and vegetable plantations) and rice fields.
	2. Geographical condition and location	Surrounded by limestone hills, open green space, rice fields, and settlement area.	Within the mountainous area, tea and vegetable plantation, and settlement area.
	3. Availability of jobs	Limestone and pharmacy industries, fisheries, agriculture, services, and commercial markets.	Agricultures and plantation, fisheries, and tourism services.
	4. The availability of basic infrastructure and community facilities	Reachable by public bus (direction Alun-Alun - Ciburuy) or <i>Angkutan Kota</i> (small-scale vehicle) from Padalarang train station. The basic infrastructures, such as water, electricity, and sanitation are also available. Moreover, Padalarang sub-district has an adequate range of school; from elementary school to senior high school, mosque, and a large number of available health services, including hospitals and smaller public health center.	Accessible by public bus (direction Pangalengan-Bandung), which located 4.4 km away from Situ Cileunca main entrance. Situ Cileunca's Lakeside has an adequate basic infrastructure for residents, such as electricity, water, and sanitation. Also, Pangalengan sub-district government provides primary education schools, mosques, and public health center. No hospital available within the Pangalengan sub-districts.
	5. Tourism and recreational facilities	Situ Ciburuy lakeside and its surrounding area have 55 units' restaurants. According to the data from Padalarang sub-district in 2016, the administrative location for Situ Ciburuy, only one unit of the hotel and two units guest house are available nearby the lake. The closest hotel or guest house is located 700 meters from the Situ Ciburuy.	Situ Cileunca lakeside has an extensive range of objects to visit, such as three units of the swimming pool, four spring water baths, 14 hotspots for fishing, and 11 units camping ground. According to the data from Pangalengan sub-district in 2017, the available accommodations around are five units of hotel and 15 units of the guest house. Four of these accommodations are walking able from the lake.

* Adapted from Tsou, Hung & Chang [24]; Veldkamp and Lambin [27]; Braimoh and Onishi [6]; Xiao et al [32].

** and *** based on data collected by Masri [15]; Badan Pusat Statistik Kabupaten Bandung Barat [3]; and Badan Pusat Statistik Kabupaten Bandung [4].

accommodation along the lakeside area will follow the attractiveness of certain tourism area, not only depend on the lake itself but also another option of leisure objects and things to do. However, the Padalarang sub-district slightly earned more *Pendapatan Asli Daerah* or regional revenue, with 33.5 billion Rupiah, compares to Pangalengan sub-district with 28.67 billion Rupiah in 2015 [4, 10]. In conclusion, Situ Cileunca lakeside, with

more desirable leisure activities, could invite visitors more than Situ Ciburuy, with the available number of guest houses and hotels. The result is the wide range of land-use transformation in the surrounding area, supporting the argumentation from the previous study [4], to fulfill the tourism activities. Conversely, taking economic factor into account, other factors affected the local revenue, although a tourism activity nearby Situ Ciburuy has not been developed significantly.

4.4. Spatial transformation in Situ Ciburuy

The development in lakeside of Situ Ciburuy not only caused by tourism activities but also several reasons, such as close to pharmaceuticals and limestones industries offices and the high demand for a residential area. The extension of the settlement area shows in *Figure 4*, which illustrates the desirable neighborhood in the west part of the lake. These transformations lead by the necessity of accommodations for industrial workers, and not only for recreational purposes. The new settlement area occurred in 2011 which transformed the green open space in the surrounding lake, following the existing road development.



Figure 4: Land use change in Situ Ciburuy lakeside (2006 – 2017). *Source: Analysis based on Google Earth (2018).*

4.5. Spatial transformation Situ Cileunca

4.5.1. Tourism-destination area

The government of Bandung Regency is declared the Pangalengan sub-district, which is the administrative location for Situ Cileunca and its lakeside, into integrated tourism area in Bandung regency. Regarding this plan, Situ Cileunca's west to north-west part is designed into several land-uses zoning for leisure activities, for instance, camping, boat riding, and rafting. These commotions resulted in the transformation of the settlement of the surrounding region. From 2011, the significant number of buildings is developed close to the entrance gate of the main tourist area along Situ Cileunca street main road, as illustrated in *Figure 5*.

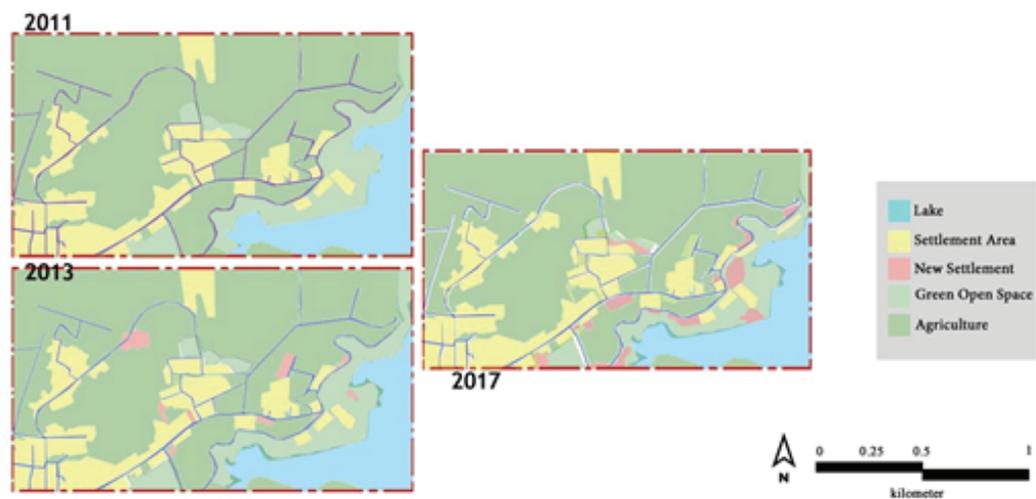


Figure 5: Land use change in west and north-west part of Situ Cileunca lakeside (2011 – 2017). *Source:* Analysis based on Google Earth (2018).

4.5.2. Agriculture area

The eastern part of Situ Cileunca is also recognized for its agricultural farm's destination, including orange and strawberry farms, and it opens for public.

However, this area only accessible by boat from the main tourist area in the west part of the lake, and it requires the visitors to pay the entrance fee. As seen in *Figure 6*, the settlement area has no significant development near the agricultural farms, except the area which closes to the roads. Similar to tourism area in the west until the north-west part, the road does not rapidly increase because of the lakeside zoning, which is dominantly used for agricultural farms. However, the extension in 2017 was built to connect the village to the cattle breeding farm and milk factories. *Figure 4, 5 and 6* illustrate the transformative land use of the two lakesides. Referring to Brissoulis [7],

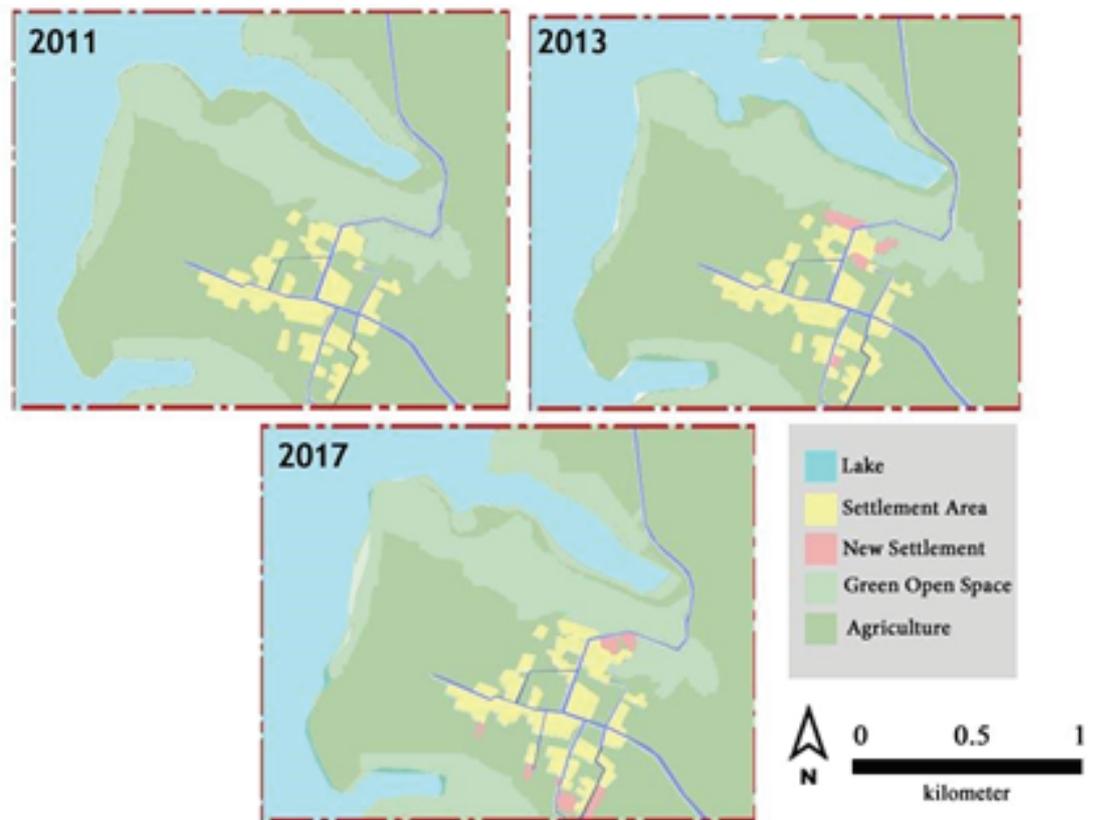


Figure 6: Land use change in west and north-west part of Situ Cileunca lakeside (2011 – 2017). *Source: Analysis based on Google Earth (2018).*

the changes are mainly conversion which designates that the land use's mix and the pattern are transformed. In spite of this, the modification is not analyzed further in this article.

5. Conclusion and Recommendation

The lakeside area of Situ Ciburuy and Situ Cileunca indicates that the extensive development of BMA is sprawling through its peri-urban areas. Lakeside of Situ Ciburuy becomes the desired location for industrial factories and work labors settlement neighborhood because of its geographical characteristics. On the other hand, Situ Cileunca even though with the moderate distance from the capital city of Bandung, able to attracts tourists due to the wide range of leisure activities provided. This research discloses that the driving force in changing land-use of Situ Cileunca and Situ Ciburuy are considerably different per each area and mentioned attributes.

The comparative land use change illustrates the demand for development of settlement nearby the lakeside zones. Based on the land-use conversion analysis from the year 2006 to 2017, Situ Ciburuy's lakeside was rapidly developed from agricultural land

and green zone into industrial factories and residential area, both for factories labors and commuters from surrounding areas. The expansion of roads was following those man-made extensions, which resulted in a dense neighborhood in west and south area of Lakeside. Regarding tourism activities, there are several attempts from local government and nearby residents to manage the lakeside to be enjoyable by visitors. However, the Situ Ciburuy still could not invite more tourists, due to the unattractive image of the lake itself.

In contrast, Situ Cileunca lakeside land-use analysis shows little expansion from 2011 to 2017, and it seems that the housing and other buildings were only growing along the accessible roads in Pangalengan. Despite the moderate demand in a residential area and tourism facilities nearby of the lake, the newly built houses mostly had followed the path of the existing road, and population growth within Pangalengan sub-districts has not significantly increased in the past five years.

In conclusion, the analysis of the spatial land use development in Cileunca and Ciburuy lakesides of peri-urban Bandung disclose the land-use change in peri-urban area of Bandung Metropolitan Area depends on the several factors. These factors include external conditions of the regional areas, such as industrial expansion, ease accessibility, and tourism development. Therefore, Situ Cileunca area is considered as more sustainable compare to Situ Ciburuy, due to the balancing condition of preservation of the natural environment and agricultural area, and availability of public facilities and communal space. In the future, policy maker and government official should take into consideration of those attributes, to develop sustainable housing and settlements.

Acknowledgment

This work derives from research entitled “Tipologi permukiman dan hunian di peri-urban: Transformasi akibat pariwisata” <http://dosen.ar.itb.ac.id/wdp/> conducted within Housing Settlement Research Group <http://dosen.ar.itb.ac.id/pp/> funded by the Kementerian Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia and administered by School of Architecture, Planning and Policy Development, Institut Teknologi Bandung (ITB). Other members of research team: Samsirina, Lukas Alfario Suryo Dewanto, Yuriska Revanar Hendrayana, Nazirah Amalia, Nisrina Hanifah Mallisie, Dwi Ratna Nandini, Arini Shofi Elmia, Laela Susanto, and Aqilah Nurul Khaerani Latif for their effort in data collections and the writing the fieldwork report. Finally, we are grateful to ISTECS 5 Committee, which gives us opportunity to write this thought.

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