Land Use Planning in Geotourism Area: Sipiso – Piso Waterfall, Indonesia

N. Vinky Rahman[1,2], Nurlisa Ginting[1,2]*, Nindya Narisa[1]
[1]*Department of Architecture, Faculty of Engineering, Universitas Sumatera Utara, 9 Dr. T. Mansyur Street, Medan 20155, Indonesia*
[2]*Toba Lake & Sustainable Tourism Working Group, Universitas Sumatera Utara, 9 Dr. T. Mansyur Street, Medan 20155, Indonesia*

Keywords: Land Use Planning, Geotourism, Sipiso-Piso Waterfall

Abstract: Sustainable tourism has become the most popular industry for the last several years. It is not only one of the largest source of foreign exchange income for the country, but also help to remain the sustainability in the future. Geotourism is a part of tourism that prioritizes sustainability of the environment. Improper land use without further planning can make a bad impact on the tourist area. Therefore, a proper plan for land use in geotourism is very important. The purpose of this paper is to create a concept in planning the land use of geotourism area, which is the Sipiso-Piso waterfall, to maintain the sustainability of the place, and also to increase the quality of the tourist area. The method used in this research is a qualitative method with literature studies beforehand, followed by interviews with related parties and field observation. After that, it would be analyzed with elements of land use such as, land use intensity, land function, and relationship between land's function. The results show that the land use element in Sipiso-Piso waterfall is inadequate and needed enchancement.

SCITEPRESS
SCIENCE AND TECHNOLOGY PUBLICATIONS

1 INTRODUCTION

Tourism is one of the industries that has largest contribution towards the foreign exchange income for a country (Ginting, Rahman & Nasution 2017). Today, the concern of tourism revolves around sustainable tourism which not only contribute towards economic aspects for locals but also maintains the area to be sustainable in the future (Edgell Sr 2016). Geotourism is a part of sustainable tourism with the concept of developing an area by prioritizing the natural wealth namely, geodiversity (the uniqueness of rocks). This concept is used as a tourist attraction that educates the tourists while prioritizing the involvement of locals and not neglected the sustainability of the environment (Bujdosó et al. 2015; Dowling 2013). To keep the environment in the tourist area well maintained, a proper planning in land use is needed. Improper or excessive land use can cause damages towards the tourist area (ABUHARRIS & Ruddock 2005; Tyrväinen et al. 2014). Sipiso – Piso Waterfall is one of the geotourism areas of the Caldera Toba, which exists because of the eruption of largest supervolcano in the world 74 thousand years ago (Mucek et al. 2017). Unfortunately, Sipiso-Piso does not have any proper plan for the land use in the area. There are always different changes made to the area annually regarding the land use. This must be handled properly as improper land use can lead to the damage on sustainability of the area. Therefore, this paper discusses how the concept of land use planning so it will be able to maintain the sustainability of the place and increase the quality of tourism.

2 LITERATURE REVIEW

The concept of geotourism is to develop an area focusing on the natural wealth, namely the geodiversity (uniqueness of the rocks) which is used as natural tourist attraction. There are also education for the tourists about the attraction, developed with the participation of the locals and continue to maintain the environmental sustainability (Bujdosó et al. 2015; Dowling 2013). There are four elements that should be considered in planning a geotourism area: geological feature visiting; geo-activity like, tour guide, cultural and educational activities; viewpoints; facilities such as, interpretation panel, tourist

Rahman, N., Ginting, N. and Narisa, N.
Land Use Planning in Geotourism Area: Sipiso – Piso Waterfall, Indonesia.
DOI: 10.5220/0010098603560362
In *Proceedings of the International Conference of Science, Technology, Engineering, Environmental and Ramification Researches (ICOSTEERR 2018) - Research in Industry 4.0*, pages 356-362
ISBN: 978-989-758-449-7
Copyright © 2020 by SCITEPRESS – Science and Technology Publications, Lda. All rights reserved

information center, souvenir shop, accessibility, and other supporting facilities (Dowling 2011; Norrish, Sanders & Dowling 2014; Rahman et al. 2018; Štrba et al. 2016).

Land use is a two-dimensional planning on the functions of a place by considering the natural capacity or the capacity of the environment. Therefore, land use planning is a sensitive process, where the success of physical and socio-economic functions are depending on it (Shirvani 1985). In making a land use plan, the intensity of land use, the permitted function of the land, and the relationship between existing functions must be considered. If land use is not planned properly, there will be lost of spaces and inappropriate distribution of land functions (Shirvani 1985; Trancik 1986). In tourist areas, especially in sustainable tourism, inappropriate land use can damage the area and damage the sustainability of the area (Berke & Conroy 2000; Tyrväinen et al. 2014).

In this study, three elements of land use are: land use intensity, land function, and the relationship between the land's functions. The three elements of land use will be linked to the four elements of geotourism: transportation to geological features, viewpoints, geo-activities, facilities and infrastructure (Table 1) with the aim of obtaining the concept of land use planning in geotourism area.

Table 1: Research Variables.

Land Use Variables	**Geotourism Variables**	
	Geological Features Visiting	**Viewpoints**
Land Use Intensity		– Land used for viewpoints
Land Function		– Viewpoints – Park – Stoppoints
Relationship between land's functions	– Circulation	
Land Use Variables	**Geotourism Variables**	
	Geo-Activities	**Facilities**
Land Use Intensity	– Land used for geo-activities	– Land used for infrastructure and facilities
Land Function		– Restaurant & Café – Souvenirs Shops – Visitors Center – Praying Area – Toilet – Parking
Relationship between land's functions	– Cultural Event – Educative Attraction	

3 METHOD

3.1 The Method

This research was done to find the land use concept in Sipiso-Piso waterfall. The method used to collect date is a qualitative method with observations and interviews. Data from observation is from photographs of the physical conditions of study area in accordance with the research variables (Table 1). In addition, interviews were conducted with stakeholders related to geotourism in the study area, namely tourism activists, government, local figures, geologists and academic to get their perception in the areas related to land use in geotourism area. Furthermore, the data obtained is analyzed used the theory of land use and geotourism to get the concept of land use planning in the geotourism area.

3.2 Research Area

Sipiso-Piso waterfall is part of Caldera Toba with amazing natural beauty. This waterfall was formed from the explosion of the Toba Caldera supervolcano which take place 74.000 years ago (Mucek et al. 2017; Rahman et al. 2018). The results of this eruption created a panoramic view of nature, cultural and biological diversity, and the extraordinary types of rocks in Lake Toba area. This eruption also gave birth to people who have local wisdom and live in harmony with their nature (Mucek et al. 2017). Many things can be done by visitors in there, such as picnicking with family or just taking pictures enjoying the natural beauty of the Waterfall. To reach the bottom of the waterfall, visitors need a long time

of about 1 hour down the stairs and to return to the top visitors must climb the same steps (Figure 1.).

Figure 1: Sipiso – Piso, Tongging, Karo.

4 RESULT

4.1 Land Use Intensity

The open space in Sipiso-Piso Waterfall is still more in number than the built land. The built area is mostly in the form of food and souvenir shops, and also toilets, mushola, and pavilions for a place to relax and sit and see the scenery (figure 2.). it is show that Sipiso- Piso Waterfall still has a good land use intensity, because excessive use of land by reducing existing open space will damage the sustainability of an area (Berke & Conroy 2000; Downs 2005).

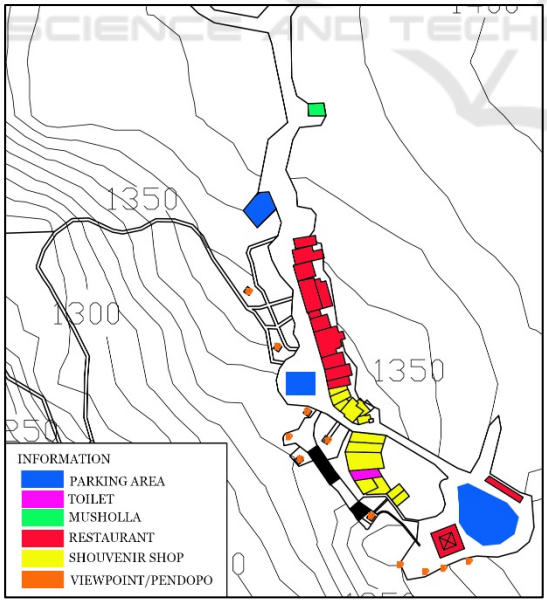

Figure 2: Existing Land Use.

However, most of the open space is used as parking spaces when there were a lot of visitors. In addition, in the past two years there has been an unplanned viewpoint construction (figure 3). If this condition is left unchecked, it will damage the tourist area because excessive and unplanned land use will make the area unsustainable(Berke & Conroy 2000; Tyrväinen et al. 2014).

Figure 3: Unplanned Viewpoint.

4.2 Land Use Function

The land built in Sipiso-piso Waterfall has various functions to support tourism activities there (figure 2). When viewed from the element of viewpoints, Sipiso-piso already has several veiwpoints and a pavillion or seating area (figure 4). But, the viewpoint and seat were not well maintained and not well planned. There are broken seats and some viepoints eventually prevent visitors from seeing the views of the Waterfall. Supposedly, the viewpoint is designed to make tourists feel the beauty of rocks which are the result of natural formation (ARIMA 2016). In addition, when going down to the waterfall, there is no adequate stoppoint place so visitors can't rest. Whereas the places that stopped were not planned, some were too close, some were very far away. This is unfortunate, stoppoints should be made so that visitors do not feel tired and enjoy their journey (Rahman et al. 2018).

Figure 4: Seats that are not well maintained.

From the elements of facilities and infrastructure, the land function built in Sipiso-piso Waterfall is quite complete, there are souvenir shops, eating places, toilets, places of worship, and parking lots (Figure 2). Nevertheless, although it is quite complete, the facilities are inadequate conditions, such as souvenir shops and food places, where the place is less representative and attractive, the existing toilet is also poorly maintained, as well as places of worship that although new but not maintain and have no water (Figure 5). These facilities should be well maintained so that visitors feel comfortable at the tourist attractions, because a tourist place must have good and adequate supporting facilities to support the needs of visitors so that they are comfortable, comfortable, and want to return to the place in the future (Ginting & Sasmita 2018; Inskeep 1987).

Figure 5: Condition of Musholla, Souvenir Shop, and Toilet in Sipiso-Piso Waterfall.

The parking lot at Sipiso-piso Waterfall can be said to be quite adequate, but there is no good planning, because if there are a lot of visitors, their vehicles will parked along the road and open space. Whereas there are three parking lots at there (figure 2), but the parking area are irregular, besides that the most extensive parking lot is rarely used by visitors (figure 6). Supposedly, th parking lot should be well organized, because it can affect tourist satisfaction and make them want to return to the place (Ginting, Rahman & Nasution 2017).

Figure 6: The biggest parking lot that is not used.

Despite having quite complete facilities, Sipiso-piso Waterfall does not have an information center which is one of the most important places that must be in the geotourism area. The information center can help tourists to get information about the area of tourist attractions that they visited, especially in the geotourism information center can inform and offer activities that can be done while educating tourists

about what geotourism and geopark (Burlando et al. 2011; Rahman et al. 2018).

4.3 Relationship between Land's Functions

Between the function of one land use with the other function is related to circulation. Therefore circulation must be good especially in tourist areas. Good circulation will make all the functions that exist in an area come alive (Shirvani 1985). Unfortunately the circulation at Sipiso-piso Waterfall has not been well organized. There is already a special pedestrian route, even in the viewpoint and leisure areas (figure 7) is specially passed by pedestrians only. However, the road is damaged and has many holes. Pedestrian paths must be well designed because tourists will tend to walk around a tourist area if the physical path of the pedestrian route they are going through is comfortable and adequate (Mansouri & Ujang 2016).

Figure 7: Condition of Pedestrian Path.

Although there are already special pathways for pedestrians, but in some functions such as eating places, especially mushollas that are very far compared to other functions, there is no pedestrian facilities. Tourists can walk along the edge of the road and relatively safe, but if it is crowded, the roadside is filled with vehicles such as cars and motorbikes that require tourists to walk a little to the middle of the road, this is very dangerous (figure 8). Supposedly, there is a special pedestrian path that connects one function to another, because if tourists feel that their safety is not guaranteed they will not go to that place (Mansouri & Ujang 2016). This will make some function not visited by tourists.

Figure 8: Vehicles parked on the road.

Sipiso-Piso Waterfall, unfortunately does not have a lot of activities that can be done there besides seeing beautiful scenery while sitting or picnicking. This is very unfortunate, because it should be as a geotourism area, Sipiso-Piso must have many interesting activities such as cultural activities and education to increase the length of time they visit to keep going (Rahman et al. 2018). Cultural activities for example will make tourists feel the local culture that the region has, besides that in geotourism cultural activities can be combined with educational activities such as in Longshuan Geopark, which provides lessons to tourists about the natural rocks that are there while entertaining tourists with their cultural performance (Ginting, Rahman & Nasution 2017; Ren, Simonson & Pan 2013).

4.4 Purpose Land Use Concept

Land use in Sipiso-piso Waterfall using the built-in land intensity is appropriate and quite good, it's just that there is a need improvement for unplanned development restrictions by the local community and misuse of open space for parking. From the elements of land function, most of the land functions needed by a geotourism area are there, but some important functions such as stoppoint and information center still do not exist. Apart from that the position and design of the viewpoint are obstructing the view so it must be fixed. Likewise with other functions such as eating places, souvenir places, and toilets whose designs are less representative. The existing parking space is still not well organized so it must be repaired. For the relationship between function one and other functions, there is still no good circulation and easy for tourists to pass through and there are still no interesting activities to be done by tourists there. Therefore, the land use planning at Sipiso-Piso Waterfall is need to improved to overcome these problems (Figure 9).

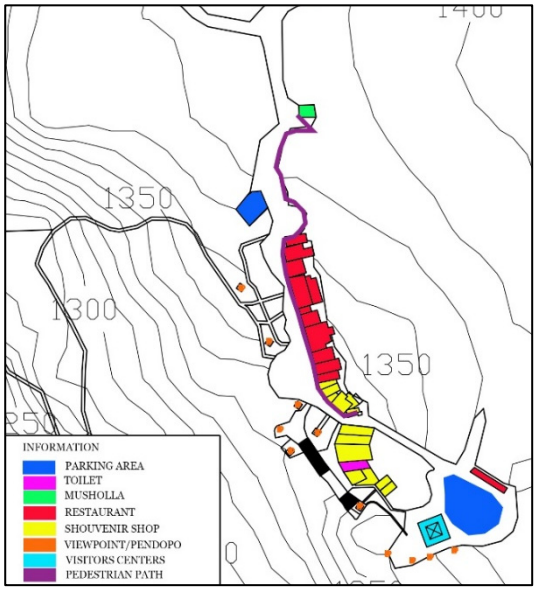

Figure 9: Purpose Land Use.

Changes that made are not many, as for the first change is to make an information center at Sipiso-Piso Waterfall. The information center will used one of the biggest building in Sipiso-piso that used to be dining place only. This is very unfortunate because the largest building there is only used for eating places that also do not use the entire building. So, instead of create new building, the information center used that building instead.

The second change is to reduce the parking space in Sipiso-Piso Waterfall, precisely the parking lot in the middle of the area. This change was made, in addition because the parking lot was very obstructing the beautiful scenery that can be obtained from the middle of the area so that the largest parking space can be used by visitors so that there are no more jostling vehicles in the middle of the Sipiso-Piso Waterfall area. In addition, the central part will be used as an open space to conduct various geotourism activities such as cultural activities.

Other changes are the addition of stoppoints and pedestrian paths around the dining area to the musholla. This addition is done so that tourists when visiting can feel comfortable. The addition of stoppoint will reduce visitors' fatigue when climb down to the location of the waterfall. Then the pedestrian path along the dining area to the musholla will give tourists a sense of security when walking without fear of a vehicle.

5 CONCLUSIONS

Sipiso-Piso Waterfall, seen from the land use is already good enough. The three elements of land use, namely land use intensity, land function, and relationships between functions are quite good. However, even so there are still some deficiencies in these three elements. In the element of land use intensity because there is no land use plan, there are some unplanned viewpoint developments. In the element of land function, there is still an important function in the geotourism area which is not owned by Sipiso-Piso Waterfall, namely Stoppoint and information centers and irregular parking spaces. In the element of relationship between functions, circulation for pedestrian pathways is still not good and adequate. Therefore, this paper provides the concept of land use planning to address these problems. Unfortunately, not all problems can be solved by conceptualizing land use planning, such as the problem of less representative building design and less geotourism activities that cannot be resolved with land use planning. Therefore, the author recommends a study of other planning elements in the Sipiso-Piso Waterfall geotourism area.

ACKNOWLEDGEMENTS

This research is financing supported by DRPM Ministry of Research and Technology and the Higher Education Republic of Indonesia with the research grant of number 155/UN5.2.3.1/PPM/KP-DRPM/2018 Year 2018. And in the field this research is also supported by Toba Lake & Sustainable Tourism Working Group Universitas Sumatera Utara.

REFERENCES

ABUHARRIS, M.R.A.T. & Ruddock, L. 2005, 'Land-use planning and sustainable tourism development in Libya', *June 13th to the 15th of 2008 Athens, Greece*, vol. 97.

ARIMA, T. 2016, 'Overview: The educational capabilities of geoparks: From education to learning', *Journal of Geography (Chigaku Zasshi)*, vol. 125, no. 6, pp. 775–8.

Berke, P.R. & Conroy, M.M. 2000, 'Are we planning for sustainable development? An evaluation of 30 comprehensive plans', *Journal of the American planning association*, vol. 66, no. 1, pp. 21–33.

Bujdosó, Z., Dávid, L., Wéber, Z. & Tenk, A. 2015, 'Utilization of geoheritage in tourism development', *Procedia-Social and Behavioral Sciences*, vol. 188, pp.

316–24.
Burlando, M., Firpo, M., Queirolo, C., Rovere, A. & Vacchi, M. 2011, 'From geoheritage to sustainable development: strategies and perspectives in the Beigua Geopark (Italy)', *Geoheritage*, vol. 3, no. 2, pp. 63–72.
Dowling, R.K. 2011, 'Geotourism's global growth', *Geoheritage*, vol. 3, no. 1, pp. 1–13.
Dowling, R.K. 2013, 'Global geotourism--an emerging form of sustainable tourism', *Czech Journal of Tourism*, vol. 2, no. 2, pp. 59–79.
Downs, A. 2005, 'Smart growth: Why we discuss it more than we do it', *Journal of the American Planning Association*, vol. 71, no. 4, pp. 367–78.
Edgell Sr, D.L. 2016, *Managing sustainable tourism: A legacy for the future*, Routledge.
Ginting, N., Rahman, N.V. & Nasution, A.D. 2017, 'Increasing tourism in Karo District, Indonesia based on place identity', *Environment-Behaviour Proceedings Journal*, vol. 2, no. 5, pp. 177–84.
Ginting, N. & Sasmita, A. 2018, 'Developing tourism facilities based on geotourism in Silalahi Village, Geopark Toba Caldera', *IOP Conference Series: Earth and Environmental Science*, vol. 126.
Inskeep, E. 1987, 'Environmental planning for tourism', *Annals of Tourism Research*, vol. 14, no. 1, pp. 118–35.
Mansouri, M. & Ujang, N. 2016, 'Tourist'expectation and satisfaction towards pedestrian networks in the historical district of Kuala Lumpur, Malaysia', *Asian Geographer*, vol. 33, no. 1, pp. 35–55.
Mucek, A.E., Danišík, M., De Silva, S.L., Schmitt, A.K., Pratomo, I. & Coble, M.A. 2017, 'Post-supereruption recovery at Toba Caldera', *Nature Communications*, vol. 8, p. 15248.
Norrish, L., Sanders, D. & Dowling, R. 2014, 'Geotourism product development and stakeholder perceptions: a case study of a proposed geotrail in Perth, Western Australia', *Journal of Ecotourism*, vol. 13, no. 1, pp. 52–63.
Rahman, N.V., Ginting, N., Narisa, N. & others 2018, 'Planning a tourism landscape in geosite area: Sipiso-piso waterfall', *IOP Conference Series: Earth and Environmental Science*, vol. 126, p. 12196.
Ren, F., Simonson, L. & Pan, Z. 2013, 'Interpretation of geoheritage for geotourism--a comparison of Chinese geoparks and national parks in the United States', *Czech Journal of Tourism*, vol. 2, no. 2, pp. 105–25.
Shirvani, H. 1985, *The urban design process*, Van Nostrand Reinhold Company.
Štrba, L., Kršák, B., Molokáč, M. & Adamkovič, J. 2016, 'Geotourism and geoparks—a sustainable form of environmental protection', *Production Management and Engineering Sciences*, vol. 279, ROUTLEDGE in association with GSE Research, pp. 279–84.
Trancik, R. 1986, *Finding lost space: theories of urban design*, John Wiley & Sons.
Tyrväinen, L., Uusitalo, M., Silvennoinen, H. & Hasu, E. 2014, 'Towards sustainable growth in nature-based tourism destinations: Clients' views of land use options in Finnish Lapland', *Landscape and Urban Planning*, vol. 122, pp. 1–15.

SCITEPRESS SCIENCE AND TECHNOLOGY PUBLICATIONS