Mapping of Land Use Shifting in Tourism Area of Lake Toba, Indonesia

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Abstract. Lake Toba has become a priority destination since it was designated as a National Tourism Strategic Tourism (KSPN) one of which is the village of Tomok. This study aims to analyze the influence of Lake Toba as a National Tourism Strategic Area on changes in land use and the economy of the local community of Tomok Village using GIS modeling. This research uses quantitative descriptive method with descriptive statistical analysis, before-after analysis and interpretation of satellite imagery. The results of this study are that the Lake Toba program as KSPN affects the economy of the local community of Tomok Village. Society experiences changes in income levels, shifts in basic work and the creation of basic and side jobs. Changes in the highest level of income occurred in hotel / lodging businesses, which previously amounted to 4,000,000-6,500,000 IDR, which increased to 10,000,000 IDR. Then, there was a shift in the main work in the agricultural business sector to become the hotel manager and souvenir trader, the souvenir trader became the owner of an inn and the grocery store owner became a souvenir trader. In addition, there is the creation of basic jobs and side jobs. People who previously did not have a basic job became hotel employees as many as 5 people and food stall owners as many as 3 people. In shifting side jobs, the dominant community that previously did not have side jobs. After 2014, the local community chose to work side by side to increase income. Side jobs that arise are farmers, restaurant owners and souvenir traders. Then land use changes that occur are not significant but the change in the function of buildings from residential to commercial buildings is very large. The land that has changed is the transfer of Tomok Ferry Port to empty land which is now the center of trade and services.

Keywords: Lake Toba, Tomok Village, Land use shifting, GIS Modelling

1. Introduction

Tourism is a geographical phenomenon, which includes human movement and spatial distribution patterns related to land use. This has been a major driver of global economic growth in the past few decades. According to the World Bank, there were 1.36 billion departures and total expenditure of 1.37 trillion dollars in 2015, accounting for around 10% of global GDP for tourism activities (World Bank, 2017). Over the past decade, studies of tourism globally have been of extraordinary concern, especially tourism and regional growth [1–3] because in addition to lifting regional growth, tourism also helps drive the local economy and strengthens the marketing of local products [2]. Therefore, it is not surprising that the impact of tourism on regional development is widely studied.

This also happened in Indonesia, one of the archipelago countries with various tourism attractions. In 2014, Indonesia established several regions as national strategic areas. The determination has an impact on the development of several regions. However, preparations for changes must be made immediately to address the tourism issues. One of the areas in the spotlight is Lake Toba in North Sumatra. Since it was established as a National Tourism Strategic Area (KSPN) in 2014, Lake Toba experienced changes both physically and non-physically [4]. These changes indicate the dynamics of regional growth that emerged. The impacts seen include changes in land use and building functions. The change was driven by the change in the pattern of activity of the Lake Toba community from originally only engaged in the port sector, now changing into trade and services.
To detail the discussion, the study was conducted in Tomok Village, Lake Toba as part of the KSPN policy. It is one form of natural wealth owned by Indonesia which is formed by the volcanic eruption of Mount Toba. Based on the area of approximately 1,707 km², Lake Toba is actually more similar to the sea. Therefore, Lake Toba has been named the largest lake in Southeast Asia and the second largest in the world after Lake Victoria in Africa and is included in the Guinness World Records list as quoted from ulinulin the Stunning Indonesia http://ulinulin.com (November, 2016). Since becoming KSPN, Lake Toba is one of the top ten tourism priority destinations in Indonesia. The area around Lake Toba has unique natural wealth and cultural values of Batak and needs to be preserved. The cultural values and natural charm that exist around the Lake Toba region are able to compete abroad in the tourism industry.

Assessing the impact on land use changes (LULCC) and building functions in Lake Toba area is very important to do. This phenomenon globally has become a concern because a change in the pattern of human activity has an impact on LULCC [5–10]. Some previous researchers have observed the impact of LULCC [1,2,11–16] especially in coastal city or on the city near the lake. The focus of those studies is regional economic growth, changes in land cover in urban areas, and changes in rural-urban areas. Furthermore, studies on LULCC and tourism, such as those developed by Boavida-Portugal, have initiated the growth of tourism and land use change (LULCC) on the coastal area of Portugal [11]. The focus of the study is the exploration of the impact of tourism development in areas that are under construction as well as factors that contribute to changes in land cover and development in the coastline area. Furthermore, Pratt [13] identifies tourism in the Small Island Developing States (SIDS). Small Island Developing States (SIDS) are faced with many challenges for economic development. Tourism is seen as a viable and meaningful means of growth. This study compares the economic impact of tourism on seven SIDS so as to obtain an overview of regional growth. The part that differentiates this study with previous research is the variables discussed, the methods used and the study area. Seeing a different focus from previous research, this study aims to see the influence of the National Tourism Strategic Area policy on land use change and local community economy in Lake Toba.

2. Data and Methods
2.1. Study Area
This study took the village of Tomok, Lake Toba as an observation area (Figure 1). The acceleration of development is carried out through promotion, infrastructure, tourist attractions and the development of transportation access to the Lake Toba region. Tomok Village is one of the tourism villages in Samosir Regency, which is currently developing. Tomok Village also experienced several changes due to the development carried out by the Samosir Regency government in the field of tourism.
2.2. Methods

This research uses quantitative descriptive method with before-after analysis techniques and interpretation of satellite imagery and Spatial Modeling using GIS. This research uses accidental sampling method (Accidental Sampling) and purposive sampling. Accidental sampling is used to examine tourists as selected research respondents because they are in the right time, situation, and place. While purposive sampling is used for the local community of Tomok Village and the government / village apparatus and Samosir District Government. Criteria for determining respondents as stated in Table 1.

| Respondents                      | Criteria                                                                 |
|----------------------------------|---------------------------------------------------------------------------|
| **Local Institution**            | • As a responsible in the area                                           |
|                                  | • Having a good sense of the environment of Tomok Village                |
|                                  | • Active in Village development                                          |
|                                  | • Knowing the characteristic and problem of Tomok Village                |
| **Tomok Village population**     | • Having a merchant of souvenir                                          |
|                                  | • Having a mini market or traditional market                             |
|                                  | • Hotel or Cottage owners                                                |
|                                  | • Artist                                                                |
|                                  | • Tourist Guide                                                          |

The number of samples used in this study is obtained from the calculation of the Slovin formula (Equation 1) which uses the number of people in accordance with the criteria of the respondents in Table 1. The calculation of the Slovin formula produces a number of 86.2 for the number of research samples (90 samples).

\[ n = \frac{N}{1+N(e)^2} \] (1)

Where:

- \( n \) = number of sample
- \( N \) = number of population
- \( e \) = critical factor 10% (0.1)

3. Results and Discussions

3.1. LULCC in 2013-2017

Interpretation results of satellite imagery in 2017 and 2013 (Figure 2) show land use change in Tomok Village. Comparisons show insignificant results. Only a small part of the land that has undergone a change of function, including the shifting of the ferry port area, the change of vacant land into trade and services area as well as changes of residential functions to trade and services (Indomart and Alfamart). Table 3 describes the change in vacant land into a port that has an impact on the surrounding area. Tourist visits that cross to Lake Toba by ferry also have an impact especially on the economy of the surrounding community. The number of tourist visits raises demand for goods and services. These advances encourage new activities around the ferry port area, namely the development of food merchants, mini markets and souvenir stalls. Ex-port land becomes a market on Saturdays and Sundays.
Figure 2. LULCC map of Tomok Village, Lake Toba

Table 3. LULCC in Tomok Village, Lake Toba

| No. | Land Use / Land Cover          | Area (Ha) |
|-----|-------------------------------|-----------|
| 1.  | Port of Ferry Traditional Market | 0.097     |
| 2.  | Settlement Mini Market         | 0.023     |
| 3.  | Vacant land Mini Market        | 0.029     |
| 4.  | Vacant Land Commercial Area    | 0.087     |

3.2. The Changes of Local Community Income

Changes in the income level of the local community of Tomok Village changed after becoming KSPN. The average community experiences an increase in basic work. Whereas for side jobs do not experience an increase in income / stagnation. The analysis carried out in the variable changes in the income level of the local community of Tomok Village. Based on Figure 3, the facts show that 84% of
the total respondents in the local community experienced changes in their income level after becoming KSPN. On the contrary, only 16% of people who do not experience changes in income levels or stagnant. The thing that causes a change in the income level of the community is the increase in the number of tourists visiting Tomok Village. The increasing number of tourists visiting opens a great opportunity for local people to experience changes in their income levels. The opportunity is based on the demand of tourists and offers by the public in the field of tourism, especially hotel / lodging accommodation and souvenirs.

**Figure 3. Changes in the Basic Income Level of Local Communities**

On average, the local people of Tomok Village experience changes in the level of income of basic work such as kiosks of residents who sell souvenir items typical of the Toba region. Income changes from Rp 1,500,000-Rp 3,500,000 per month has increased to Rp 4,000,000-Rp 6,500,000. In addition, there are also grocery stalls, food stalls and restaurants whose previous income was 11,000,000 to Rp 1,500,000-Rp 3,500,000, however the increase in the culinary sector was not so significant. This is caused by tourists visiting without prioritizing culinary and more likely to choose to buy souvenirs and visit various cultural sites and enjoy the nature of Lake Toba. Details of changes in income after the KSPN program from the Government can be seen in Figure 4.
Figure 4. Changes in the Basic Income Level of Local Communities in Tomok Village

3.3. Discussion

Previous studies show significant results between tourism activities and LULCC and the economic level of the community [11], but this study shows different results. The economic condition of the community has increased but not much has changed from the LULCC side. Changes actually occur in building functions. For land use in the form of settlements, most of it turns into commercial. This is caused by the demand for souvenirs and various tourist accommodation, which is getting bigger along with the development of the Lake Toba area. Furthermore, even though LULCC did not significantly change but some spots experienced improvements. Some vacant land is used for community activities such as for traditional markets and for traditional community events.
If viewed theoretically [1–3], this phenomenon shows that tourism activities will not always affect LULCC. However, changes in community income and economic levels can be done with changes in building functions and community creativity in meeting tourist demand. In addition, the large number of visits increases the number of homestay requests so that residential areas can be used as homestays. This is very good because changes in building functions have little impact on LULCC and the environment, but they are still able to give effect to increasing the income of local communities.

4. Conclusion
This study succeeded in showing the fact that increased tourism activities do not always have a negative impact on the environment. This is evidenced by changes in activities that have little impact on LULCC. Furthermore, to avoid LULCC that has an impact on the environment, changes in building functions are one solution. The thing is to meet the demand of tourists because visitors not only need souvenirs and food but also lodging. In addition, this study also proves that the small LULCC level still has an impact on increasing community income so that the existence of the KSPN does indeed have an impact on the economy of the community. Future work is needed to be able to detail a number of analyzes such as changes in building functions to the arrangement of the area and physical changes in the environment after increasing community income.

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