Riverfront Development - A Public Realm, Its Adaptations, and Environmental Impacts

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Abstract. Sidemen District is one of the tourist attractions in Karangasem Regency. One of the prominent tourist attractions in Sidemen District from the past until now is the natural attractions of Iseh and Tebola as well as the sidemen songket weaving craft centre. Then, in 2010 began to expand tourism with the concept of “river tourism” namely tourism by making the Tukad Unda river as the main attraction. The development of tourism in Sidemen District is increasingly felt by the emergence of various tourism supporting facilities in the river border area. Of course, with the development of the construction of these facilities, it has an impact on the environment in the river border area, especially the spatial function seen from land use. The method used in this research is mapping analysis method with overlay technique. The results of the analysis explain that changes in land use that occur are clearly visible from the year of observation, namely in 2010 before the construction of tourism facilities until 2021. Changes in land use that occur lead to incompatibility with the direction of land use that has been determined. There are several land functions that have changed, including the function of plantation land/moor, and the function of agricultural land/rice fields. Of the two land functions, the one that shows the most changes because it is used for tourism facilities is the plantation/moor function of 5.43%. This percentage of land use change area is evidence that an activity such as tourism can have an influence on land function in an area. If this is left unchecked, it can result in arbitrary land use and not in accordance with the direction of the land function designation that has been stipulated in the spatial planning rules.

Keywords: riverfront development, environmental impact, tourism, uncontrolled land use

1. Introduction

River border areas tend to be in demand by investors to build tourism facilities and settlements. This tendency is caused by the attractiveness of the river border area as “river tourism” [1], which is an area that has a great opportunity in developing tourism potential whose attraction comes from the potential of the river itself [2]. The river border area is described as an area located on the outskirts of a dynamic village. From a spatial point of view, the river border area is a buffer zone between aquatic and terrestrial ecosystems [3]. However, the river border area also has challenges as a place or area with various social pressures and the dynamics of social change in it [4, 37, 38, 39].

The interest of investors in river border areas can encourage the phenomenon of changes in land function to the culture of the local community [5, 32, 33]. Changes in land use in an area can also be caused by several internal (local residents) and external factors. External factors can be in the form of industrial expansion, increasing ease of access to the location, and tourism development [6, 35, 36]. In planning
studies, land use has two conflicting dimensions, namely the conservation aspect and the economic aspect. From the conservation aspect, ecological protection, water protection, and local area protection are needed.

From an economic point of view, land is very important as a factor of production, and land productivity is closely related to economic growth [7, 35, 36]. The occurrence of changes in land use patterns can expand the impact on employment, increase state income [8] creating a multiplier effect [9], and increase people's income [10,11]. In connection with the rapid development of tourism in Bali, many tourism activities use green land as tourism facilities [12]. Ecologically this can reduce the quantity of green open space that is actually intended for conservation functions. Tourist visits to Karangasem Regency each year have increased both foreign and domestic tourist visits. From 2015-2019 tourist visits to Karangasem Regency reached 2,991,709 people [13].

The conversion of land use for the construction of tourism facilities in the river border area mostly occurs in Sidemen District. Judging from the 2020 Karangasem Regency Spatial Plan, it states that the river border area has a function as a protected area. Protected area is an area designated with the main function to protect environmental sustainability which includes living natural resources and artificial natural resources, securing river flow, and preventing flood hazards. Seeing the strategic functions of the Tukad Unda river border area, it is necessary to take an action to control land use by looking at the trend of land development that occurs.

2. Land Use Change

Land is a natural resource that has a very broad function in meeting various human need. From an economic perspective, land is the main fixed input for various agricultural and non-agricultural commodity production activities. Developments and changes in land use patterns in residential and urban areas run and develop dynamically and naturally to nature [14], and are influenced by:

- Human factors, which consist of: the human need for a place to live, human potential, financial, socio-cultural and technological.
- City physical factors, including activity centres as urban growth canters and transportation networks as accessibility for ease of achievement.
- Landscape factors in the form of slope and land height.

3. Mapping Overlay Technique

Overlay is an important procedure in GIS (Geographical Information System) analysis. Overlay is an overlap between two maps that produces a new map unit of analysis and has the ability to place the graphics of one map on top of another map graphic and display the results on a computer screen or on a plot [15]. In short, overlay overlays a digital map on another digital map and its attributes and produces a combined map of the two that has attribute information from both maps [16].

4. Similar Research

So far, research on land use change has been carried out with a thematic, holistic, and integrative approach. However, in this study the researchers tried to use a spatial approach by using overlay mapping techniques to determine the magnitude of land use changes that occurred. In order to add insight and better understand the problems in this study, the researchers conducted a literature review of previous similar studies, namely the Changes in Spatial Functions As a Result of Tourism Development in Banjar Kedungu, Belalong Village, Kediri District, Tabanan Regency [17], Factors Affecting Functions Land in Subak Daksina, Tibubeneng Village, North Kuta District, Badung Regency [18], and Peri-Urban Spatial Transformation Around the Ciliwung River and Sustainability of River-Based Tourism Activities [19]. The first study describes changes in spatial functions seen in the context of tourism development and uses a spatial approach with mapping. Then, in the second study, we dissect the changes in land use that occur in subak land with the theory of land use changes. Meanwhile, the third study describes the pattern of changes in the area around the Ciliwung River as well as the evolution and direction of development of Saung Pustaka Air as alternative river-based tourism.
5. Method

This research was conducted in the Tukad Unda river border area in Sidemen District which covers Sidemen Village, Sangkan Gunung Village, Wisma Kerta Village. The research approach used is a qualitative approach and a quantitative approach. Limiting the problems that will be discussed in this study, the scope of this research is the conversion of land functions that occur due to the construction of tourism facilities in the Tukad Unda river border area, Sidemen District. The types of data in this study are qualitative and quantitative data. Data collection techniques used in this study include field observations and document review. Field observations to determine the use of existing land in the Tukad Unda river border area. The analytical method used in this research is to use the analysis of overlapping mapping (map overlay) with analytical instruments using GIS applications. The maps that will be analyzed are the land use maps in 2010 and the existing land use maps in 2021. The results of the overlay are then overlaid with the map of the land use plan that has been determined in the RTRW of Karangasem Regency. The types of data and data collection techniques needed can be seen in Table 1. as follows:

Table 1. Data Used

| Data                        | Type        | Source                                      |
|-----------------------------|-------------|---------------------------------------------|
| RTRW Kabupaten Karangasem   | Secondary Data | Publick Work and Spatial Planning Department Kabupaten Karangasem |
| Sidemen District Map        | Secondary Data | Google Satelit                              |
| Sidemen Distric in Figure   | Secondary Data | Statistic Kabupaten Karangasem              |
| Land Use Map                | Secondary Data | Kecamatan Sidemen                           |
| Existing Land Use Map       | Primary Data  | Survey, Google Satelit                      |

![Construction of Tourism Facilities in the River Border Area](image)

Figure 1. Research Model
The process of compiling the data obtained from the results of observations, interviews, literature studies, and documentation is described systematically and then the data analysis stage is carried out. In this study using descriptive analysis method. This research method is described through the research model scheme (Figure 1).

6. Tukad Unda River Border Area, Sidemen District

Geographically, the border area of Tukad Unda river is at coordinates: 8.484467°S and 115.444729°E in the administrative area of Sidemen District, Karangasem Regency, Bali Province. Physically, the research area of the Tukad Unda area has an area of about 63,684 hectares. The Tukad Unda area, Sidemen District, was chosen as the research location with the consideration that the river border area is a protected and cultivated area which is set at 50 (fifty) meters from the riverbed, while the development of tourism facilities such as hotels, villas and tourism facilities has been built in the river border area. To see more clearly the location of the Tukad Unda river border area, Sidemen District.

7. Result and Discussion

The impact of tourism in various areas in Bali is starting to threaten and cannot be avoided anymore. The incessant development of tourism brings negative influences and effects, especially for the natural and socio-cultural community [20,21]. Tourism activities that are closely related to social processes are slowly starting to affect all elements in tourism, including the community. The process of tourism activities in the Tukad Unda river border area, Sidemen District, raises hope for the community to get the maximum benefit from these activities. The hope to benefit from tourism activities is then realized by the community through the provision of tourism services to complement the needs of visiting tourists such as the construction of tourism facilities [22].

Tangibly, the growth of tourism facility development in the Tukad Unda river border area, such as homestays, villas, resorts, restaurants & SPAs, turned out to have a lot of negative impacts. And if it is associated with the manifestation and latency approach, this phenomenon is latency or an unexpected form of the tourism development process that naturally always accompanies or appears [23,24,25]. The negative impact is the impact on the land use of plantations/moor and rice fields whose existence is threatened because the development of community-managed tourism facilities is built on a river border area with land functions as plantations/moorlands and rice fields. To be further elaborated in the following explanation:

7.1 Existing Land in the Tukad Unda River Border Area, Sidemen District

Land use in the Tukad Unda river border area, Sidemen District, is dominated by land use for food crops (gardens/moor) and wetland areas (rice fields). Based on the results of the inventory of existing land use in the Tukad Unda river border area, it can be seen that the land use conditions on the Tukad Unda river border are not only developed for food crop activities (gardens/moorlands) and wetland agricultural cultivation (rice fields), but other types of uses have developed. such as areas for tourism facilities, settlements, and MSMEs. Land use in the Tukad Unda river border area in the existing year can be seen in Table 2.

The research area of the Tukad Unda river border area has an area of ± 63,684 covering the administrative areas of Sidemen Village, Sangkan Gunung Village, and Wisma Kerta Village. From the data in the table above, it can be seen that the dominant land use in the Tukad Unda river border area in 2021 is the use of plantation/moor land with an area of 38,190 Ha or 59.67% of the total area of the study area. Land use in the Tukad Unda river border area, Sidemen District, can be seen through the use map in Figure 2.
Table 2. Land Use in the Tukad Unda River Border Area, Sidemen District in 2021 (Existing)

| Type of Land Use | Land Area in 2021 (Ha) |
|------------------|------------------------|
| Plantation/Moor  | 38.190                 |
| River            | 12.039                 |
| Rice Field       | 8.055                  |
| Settlement       | 0.637                  |
| Tourism          | 4.042                  |
| MSMEs            | 0.718                  |
| **Amount**       | **63.684**             |

Source: [26]

Figure 2. Land Use in the Tukad Unda River Border Area, Sidemen District in 2021

Source: [27]
7.2 Land Function in the Tukad Unda River Border Area, Sidemen District

The development of tourism in Sidemen District involves a wide range of issues, ranging from experience during the trip to the condition of the supporting facilities. The quality of a tourist area depends on the attractions, transportation, accommodation, places to eat, and entertainment of tourists who are far from where they live. To accommodate all these activities, it is necessary to build various physical facilities. This means that tourism causes changes to land use and function [28]. In its development, land use with a function as carrying capacity and the environment in the Tukad Unda river border area cannot maintain the composition of its area because of the factors that cause changes. One of them is because of the construction of tourism facilities. Changes that occur more clearly can be seen from the land use in the Tukad Unda river border area in the 11-year period before the start of the construction of tourism facilities. In this study, the year of observation taken was 2010. In 2010 it was clear that land use in the Tukad Unda river border area was still dominated by land use with the function of environmental carrying capacity, which can be seen in its distribution in Table 3. below:

| Type of Land Use | Land Area in 2020 (Ha) |
|------------------|------------------------|
| Plantation/Moor  | 42,305                 |
| River            | 12,039                 |
| Rice Field       | 9,170                  |
| Settlement       | 0,167                  |
| Tourism          | 0                      |
| MSMEs            | 0                      |
| **Amount**       | **63,684**             |

Source: [26]

Based on table 3. above, it is known that land use in the Tukad Unda river border area in 2010 was dominated by plantation/moor land use, which amounted to 42,305 Ha or 66.42% of the total area of the study area. In 2010 there has not been any development of tourism facilities. This indicates that before the development of tourism, the main occupation of the people in the Tukad Unda river border area, Sidemen District, was as farmers and sidemen songket weaving craftsmen.

If you compare the land use map before the construction of tourism facilities (in 2010) with the land use map after the construction of tourism facilities (in 2021), it can be clearly seen that there are differences in land use which can be illustrated in Table 4, and Figure 3. as follows:

Table 4. Comparison of Land Use in 2010 and 2021 in the Tukad Unda River Border Area, Sidemen District

| Type of Land Use | Land Area in 2010 (Ha) | Land Area in 2021 (Ha) | Percentage (%) | Info |
|------------------|------------------------|------------------------|----------------|------|
| Plantation/Moor  | 42,305                 | 38,190                 | 5,43%          | Down |
| River            | 12,039                 | 12,039                 | 0%             | Same |
| Rice Field       | 9,170                  | 8,055                  | 1,35%          | Down |
| Settlement       | 0,167                  | 0,637                  | 0,01%          | Up   |
| Tourism          | 0                      | 4,042                  | 6,74%          | Up   |
| MSMEs            | 0                      | 0,718                  | 0,03%          | Up   |
| **Amount**       | **63,684**             | **63,684**             |                |      |

Source: [26]
**Figure 3.** Land Use in the Tukad Unda River Border Area, Sidemen District in 2010
Table 4. shows that over a period of 11 (eleven) years (2010-2020) the Tukad Unda river border area, Sidemen District has experienced very rapid land use changes. For more details can be described in Figure 4.

From Table 4. and Figure 5. above, it can be analyzed that there are changes in several land functions in the Tukad Unda river border area which is the impact of the construction of tourism facilities. The construction of this tourism facility utilizes plantation/moor land which is a food crop area with a protected function. This condition is further supported by the data analysis that has been carried out regarding land use changes that occurred in the Tukad Unda river border area before and after the construction of tourism facilities. In accordance with the table above, it can be seen that the plantation area/moor area has decreased in area, from 42,305 Ha in 2010 to 38,190 Ha in 2021. This shows that there is land use in the plantation area which causes the area to decrease. Not only the area of plantations/moor which has decreased in area, the same case also occurs in the use of agricultural land/rice fields. Agricultural land/rice fields decreased from an area of 9,170 Ha in 2010 to 8,055 Ha in 2021. Then, the use of land for the construction of tourism facilities showed an increasing number from an area of 0 Ha in 2010 and until now in 2021 it has grown to 4,042 Ha. This proves that the development of tourism facilities in the Tukad Unda river border area, Sidemen District has increased. Tourism facilities in this river border area can be in the form of homestays, villas, resorts, restaurants & SPAs, and food stalls. Spatially, the areas undergoing changes can be compared through Figure 5. as follows:

**Figure 4. Changes in Land Use in 2010-2021**
Figure 5. above shows a comparison of land use functions in the 2010-2021 period. This can be seen in the garden/moor land which decreased by 5.43% and the paddy field decreased by 1.35%. Meanwhile, for land that has increased its use, tourism is 6.74% and MSMEs is 0.03%. From these figures, if accumulated, it shows that the development of tourism facility development in the Tukad Unda river border area, Sidemen District, in addition to having an impact on the community’s economy, also has an impact on land use with a tendency to decrease open land that functions as an ecological function. When viewed from a spatial perspective, it is analyzed using the Arc GIS 10.5 application juxtaposed with satellite imagery in 2021 and then overlaid with the spatial pattern of the Karangasem Regency RTRW. At this stage of analysis, the existing land use, area, and percentage of spatial use will be determined according to and not in accordance with the spatial plan (RTR). The area of the river border is measured as far as 50 m from the left and right of the river without embankments for rivers outside the residential area, using GIS, the research area is ± 63,684 ha.

The results of the overlay analysis above obtained 3 (three) types of activities that utilize space in the Tukad Unda river border area, Sidemen District which are not in accordance with their designation. Utilization of space on the river border that is not in accordance with the spatial plan includes (homestays, villas, resorts, restaurants & SPAs, and food stalls), settlements, and MSMEs located within the radius of the river border with an area of 5,397 ha or 6.78% of the total inappropriate utilization. the total area of the research area as presented in Table 5. and Figure 6.

Source: [26]
Table 5. Incompatibility of Land Use in the River Border Area Tukad Unda, Sidemen District

| No | Utilization Type    | Area | %    |
|----|---------------------|------|------|
|    |                     | Ha   | %    |
| 1  | Tourism Facility    | 4,042| 6.74%|
| 2  | Settlement          | 0.637| 0.01%|
| 3  | MSMEs               | 0.718| 0.03%|
|    | Amount              | 5,397| 6.78%|

Source: [26]

The discrepancy in the use of space in the Tukad Unda river border area, Sidemen sub-district, from the results of questionnaires and interviews, can be concluded due to several things including:

1. Angga Silver Homestay
2. Jembatan Kuning Resort
3. Uma Ayu
4. Pondok Tepi Sungai
5. Darma Eco Resort
6. Wapa di Uma
7. New Villa
8. New Villa

Source: [31]

Figure 6. Comparison of Land Use in 2010 and 2021

The discrepancy in the use of space in the Tukad Unda river border area, Sidemen sub-district, from the results of questionnaires and interviews, can be concluded due to several things including:
• Lack of public understanding of the function of river borders
• Conflicts between activities/sectors in the use of river border space
• There is no detailed spatial plan (RDTR) that is legalized
• Weak enforcement of the Karangasem Regency RTRW Regional Regulation

8. Conclusions and Recommendations
This study shows that the development of tourism facilities in the Tukad Unda river border area, Sidemen District, can arise through individual or group interest in the issues and challenges of the conditions that develop around them. Although, at the same time, this also encourages the emergence of the phenomenon of land function changes/shifts that occur due to the need to develop a tourism facility that can support tourism activities in Sidemen District. The land function that experienced the most changes in function was the function of plantations/moorlands from 42,305 Ha in 2010 to 38,190 Ha in 2021 or decreased by 5.43%. The change in land use function in the Tukad Unda river border area from a protected area function to a built area appears to be very significant in the downstream part of the river compared to the other side of the river. The related parties who carry out this activity have their own reasons for using land that is actually not in accordance with the designation plan.

The suggestions that can be conveyed in this research are: a) The need to maintain and maintain the environment in the river border area as an object and tourist attraction in order to continue to provide a beautiful and original atmosphere while still providing value for benefits for the community, b) Preserving the attractiveness of the border area river by compiling in detail an integrated tourist attraction spatial plan, c) Researching alternative regional developments, especially western to reduce tourism spatial agglomeration in the Tukad Unda river border area so as to reduce the environmental burden, d) Conduct training and socialization to stakeholders related to tourism development so that In the future, Sustainable Tourism Development will be created. Tourism that has a positive impact on social, economic, and cultural aspects without destroying the environment, and e) This research is expected to enrich the reference literature in the field of regional development, especially rural and sub-district areas regarding land use plans and controls that must be carried out, and the results of this research is expected to be a useful reference for understanding and further developing this kind of research or a more in-depth study.

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