Assessment of Environmental Sustainability in Ecotourism at Tanaka Waterfall, Mount Kawi, Malang, Indonesia

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Abstract. This study examines the ecotourism features in the Tanaka Waterfall area of Mount Kawi. It focuses on attractions, access, facilities, and local organizations to help improve tourism for the community and protect the environment. The researchers used interviews, surveys from 30 people (including foreign and local tourists), reading existing materials, and direct observation. The findings reveal that Tanaka Waterfall offers unique natural scenery, special Japanese decorations, and beautiful mountain views. Most people found access to the waterfall good, but some had issues with the roads and signs. More than 70% of respondents said public facilities, such as toilets and rest areas, were adequate. The local community, especially the Arjomulyo hamlet, manages the area using a community tourism approach. People in the community are active participants, but there is a need for better organization and online promotion. Overall, the Tanaka Waterfall area has much potential for sustainable ecotourism. However, it needs improved infrastructure, better access to information, and more organized management. This study's results help guide eco-friendly and inclusive tourism development plans.
Keywords: community-based tourism, ecotourism, Mount Kawi, Tanaka Waterfall, tourism component inventory.

1 Introduction

Indonesia features considerable natural and cultural diversity, rendering it one of the nations with substantial tourism potential. A growing form of tourism is nature tourism, or ecotourism, which emphasizes environmental preservation, local culture, and community empowerment. The Tanaka Waterfall on Mount Kawi is a natural tourist destination with significant potential to develop into a conservation- and sustainability-oriented attraction. Nevertheless, overseeing places of this nature requires a precise database and comprehensive information concerning all tourism elements. The advancement of ecotourism is regarded not merely as an alternative leisure pursuit but also as a means of environmental preservation and

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of bolstering the local economy. Ecotourism may foster harmonious interactions between humanity and nature by sustainably utilizing natural and cultural resources. Assert that ecotourism locations must feature natural attractions, community engagement, and a management framework that facilitates sustainable conservation. Globally, Honey (2019) emphasizes that successful ecotourism depends on maintaining ecological integrity while ensuring that local communities are the primary beneficiaries of tourism development. Consequently, the planning process for a tourist region must commence with an inventory exercise to thoroughly identify its supporting components [1].

Tanaka Waterfall is a notable tourist attraction in Bangelan Village. This waterfall offers a natural swimming experience, with pools carved by the Tanaka River. The place features an array of captivating ornaments, including swings, bridges, and, notably, the stunning waterfall, the primary attraction for travelers visiting Bangelan Village. Despite its distant location, accessibility is improved by motorbike taxi services that bring visitors from the parking area to the Tanaka Waterfall site. To appreciate its natural beauty, tourists must pay a reasonable entrance fee between Rp 8,000 and Rp 10,000. With its amenities and distinctive features, Tanaka Waterfall is an appealing destination for individuals seeking a genuine, enchanting natural experience [2].

Cataloguing tourist elements is an essential first phase in developing a tourism region. This inventory comprises attractions, accessibility, facilities, and management entities that contribute to the sustainability of the tourism destination. [3] asserts that inventory data is the primary basis for planning and advancing sustainable tourism rooted in local potential. This research seeks to identify these components in the Waterfall Tanaka area as a preliminary step for professional and sustainable management.

The tourist component inventory in the Tanaka Waterfall region is anticipated to provide foundational data for management, village authorities, and other stakeholders to formulate sustainable, eco-friendly tourism development strategies. The acquired data is expected to evaluate the region's preparedness for tourism and sustainably enhance the local community's welfare.

Furthermore, technological advancements and digitization in tourism promotion introduce distinct issues in area management. Destinations that fail to adapt to digital marketing and social media advancements often remain obscure, although possessing significant potential [4]. Consequently, tourism destinations such as Waterfall Tanaka need to focus on physical and environmental factors, promotional tactics, and the strengthening of local community institutional capacity. This method is consistent with the tenets of ecotourism, emphasizing conservation, education, and the empowerment of local economies [5].

2 Methodology

The research at Tanaka Waterfall concentrated on interviewing participants regarding the elements of ecotourism, employing a descriptive qualitative methodology to elucidate the potential and conditions of these components in the Tanaka Waterfall region. This methodology sought a comprehensive understanding of the ecological, social, and infrastructural elements of ecotourism at the study location. To gather thorough and reliable data on the growth and management of the Waterfall Tanaka ecotourism area, this study employed several complementary approaches. Interviewing the management chairman and members of the local community participating in tourism management was the first method used. To learn more about the research participants' opinions, experiences, and perceptions about the state and administration of the tourism area, interviews were conducted verbally and in writing.

This study used online surveys and interviews disseminated via the Google Forms platform. With a target of 30 respondents, these surveys were aimed at visitors and the local population. This survey gathers information on visitor satisfaction levels, preferences for tourist amenities, opinions about the caliber of services, and expectations and recommendations for the Waterfall Tanaka area's future growth. The poll also emphasized tourist attractions, cleanliness, safety, comfort, accessibility, and the desire for better facilities and sustainable tourism initiatives. Using Google Forms will streamline and expedite data collection, leading to more accurate and efficient outcomes. Another technique is a literature review, in which the researcher looks at pertinent books, journals, articles, documents, and historical records to gather secondary data. Without field data, this literature study seeks to establish a theoretical basis, understand earlier concepts and findings, and strengthen research arguments. A descriptive qualitative method was then used to assess the collected data. The data is processed, selected, and presented as narratives, tables, and graphs to make it more comprehensible. The findings are analyzed to inform inferences and suggestions for initiatives to enhance and grow the Tanaka Waterfall ecotourism destination. The outcomes of surveys, interviews, and observations are contrasted to guarantee the data's objectivity and validity.

Quantitative descriptive analysis is used alongside the qualitative technique when processing questionnaire data to determine the proportions or averages of respondents' perceptions. This approach makes it simpler to spot trends in public and visitor response patterns by presenting data as graphs or frequency distribution tables [12]. By combining surveys, field observations, and interview results, data triangulation is utilized to improve validity and provide a comprehensive, scientifically sound picture.

3 Results and Discussion

Waterfall Tanaka was located at Arjomulyo Hamlet, Bangelan Village, Wonosari, Malang district, East Java, Indonesia. Accordingly, this tourism location is near a river that flows into Karangkates Dam. Tanaka Waterfall, also known as Umbulan Tanaka, is adorned with ornaments such as lamps and sakura-flower replicas, creating a unique atmosphere in Japan. These ornaments do more than only depict the location; they also vividly illustrate the jerky Kesegaran River and the natural water source, creating a sense of realism and beauty in the Malangsea. Tourists can engage in various adventurous activities, from tubing on the river to dining at a cafe with unique concepts along the riverside. This destination is about 36 kilometers from Malang, sits atop Mt. Kawi, and is easily accessible by bicycle.

Being a part of Mount Kawi's slopes, this region possesses the traits of a highland ecology conducive to endemic plants and animals. Moist-tropical trees such as *Schima wallichii*, *Toona sureni*, and various fern species comprise the vegetation of the waterfall region. These trees have significant ecological importance and contribute to the area's aesthetic appeal. One benefit of the growth of conservation-based ecotourism may be the preservation of biodiversity. Tourist destinations with distinctive ecosystems and biodiversity can be transformed into special-interest tourism attractions, such as scientific nature tourism and educational tourism, claim [1].

The area's natural springs contribute significantly to the sustainability of water resources for the local population and their ecological value. The idea of resource-based tourism, which prioritizes sustainability and conservation, can leverage this [3]. Tanaka Waterfall has significant environmental and social value that merits consideration beyond its aesthetic appeal.

Interviews with Tanaka Waterfall's top manager revealed that Arjomulyo Hamlet, not the village, has complete control over the administration of this tourism destination. According to the head manager, this was done to give the hamlet's residents a greater say in managing the tourism potential in their community. The head of the tourism area administration stated that on weekdays, the average attendance at Tanaka Waterfall is between 150 and 250. At the same time, on weekends and national holidays, it can reach 500 to 700 tourists. Over a month, the total number of visits may surpass 2,000. The information indicates that the general population, particularly those from the Malang Raya region and its environs, has taken notice of this location. The post-pandemic trend in nature tourism, which has significantly increased in Indonesia, also contributes to the high volume of visits. Nature tourism saw the most significant increase in visits, up 27.5% from the year before, according to [11]. One of the primary drivers behind management's efforts to maintain environmental sustainability and improve facilities in the tourist area is the enthusiasm of locals and visitors. The elements of Tanaka Waterfall tourism are explained in greater depth below, based on responses to the Google Forms survey administered to managers, visitors, and locals.

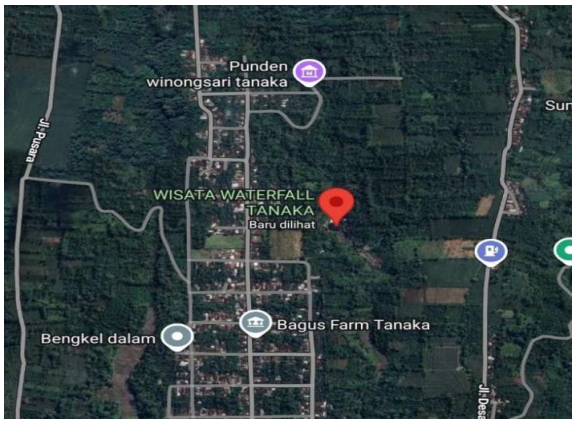

Fig. 1. Map location of waterfall Tanaka, Bangelan, Wonosari, Malang, East Java, Indonesia (Google Earth)

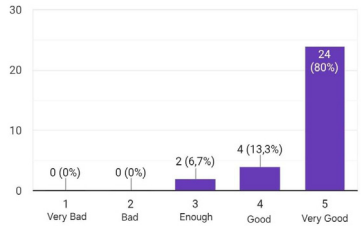

Fig. 2. Survey results regarding the satisfaction of Tanaka Waterfall based on its natural beauty and uniqueness.

According to a survey of 30 visitors and locals on their satisfaction with Tanaka Waterfall, 80% cited the area's natural beauty and distinctiveness as its primary draw. This is demonstrated by the river's clear appeal, Japanese-style decorations, and the calm, lush ambiance surrounding the waterfall, all of which effectively made a lasting positive impact on guests. Most respondents believed that blending local natural beauty with Japanese motifs was a special benefit rarely found in other tourist destinations. This result is a crucial guide

for management looking to preserve and enhance Tanaka Waterfall's natural authenticity and culturally innovative tourism attractions.

According to data gathered from questionnaires administered to visitors and locals in the Tanaka Waterfall region, 66.7 percent of respondents said comfort and safety significantly affected their happiness. According to this research, most tourists are happy with the secure, orderly environment and safe surroundings that allow them to enjoy their vacation without any worries. The local community also values the management's emphasis on maintaining the cleanliness and orderliness of the tourism area. This demonstrates that management effectively prioritized comfort and safety when providing services to tourists, thereby raising Tanaka Waterfall's appeal and annual visitor count.

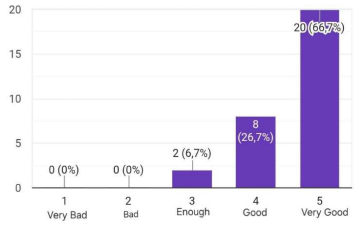

Fig. 3. Survey results regarding Tanaka Waterfall satisfaction based on safety and comfort

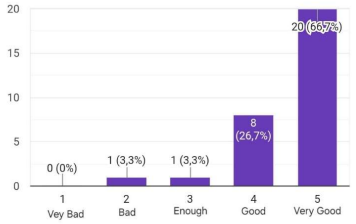

Fig. 4. Survey results regarding Tanaka Waterfall satisfaction based on tourism experience

Data gathered from surveys of visitors and locals regarding their satisfaction with Tanaka Waterfall tourism showed that 66.7% of respondents were satisfied with the amenities, ambiance, and cleanliness provided by the location. The respondents all praised the space's layout, which created a Japanese vibe, the well-kept river, and the warmth of the managers and locals. However, a small percentage of respondents also suggested including auxiliary amenities, such as a larger parking lot and improved road access to the site. These findings show that most tourists and locals are content with Waterfall Tanaka's status as one of the top tourist attractions in the Malang area.

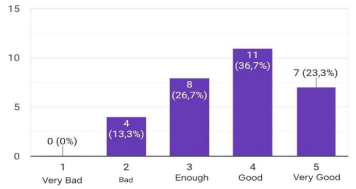

Fig. 5. Survey results regarding Tanaka Waterfall satisfaction based on accessibility to the location

A diverse range of opinions was gathered from visitors and locals through a survey on accessibility to the Tanaka Waterfall tourism area. A score of five on the rating scale denotes an "excellent" opinion of the location's accessibility, whilst a score of one represents an "inferior" opinion. A relatively negative opinion of accessibility was indicated by the 13.3% of respondents who rated it 2. 26.7% gave a grade of 3, which denotes a neutral or moderate evaluation. In contrast, most respondents rated access to Tanaka Waterfall as ranging from reasonably good to very good, with 36.7% rating it 4 (good) and 23.3% rating it 5 (very good). Even so, nearly 40% of respondents assigned a score lower than 4, suggesting that issues with road infrastructure, transit options, or directions to popular tourist destinations persist. Therefore, to make the region more comfortable and appealing, management should consider adding directional signs, boosting public transportation, and improving road quality.

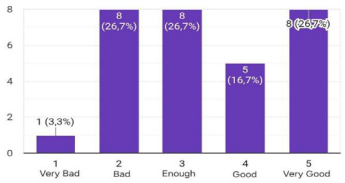

Fig. 6. Survey results regarding Tanaka Waterfall satisfaction were based on information about the easily accessible tourist area.

To find out how easy it is to find information about tourist destinations, a poll with 30 respondents was conducted. According to the findings, respondents gave information access an average rating of 3.37, suggesting it is adequate but still needs work. The scores' distribution reveals that: 1. Eight respondents (26.7%) scored a two overall, suggesting that they had a less than positive opinion of how easy it was to obtain information. 2. Additionally, eight respondents (26.7%) scored 3, signifying a moderate or indifferent perception. 3. In contrast, eight respondents (26.7%) rated the tourism area as having effortless access to information, giving them a score of 5. 4. Five respondents (16.7%) rated the accessibility of acquiring information as being fairly excellent, with a score of 4. 5. Just one respondent (3.3%) assigned a score of 1, suggesting that getting such knowledge is viewed negatively. When the most significant number of ratings is equally distributed across the 2, 3, and 5 scales, the distribution is often dispersed. This illustrates how respondents' experiences or perceptions differ. Some people believe that information is readily available, whereas others disagree. To more fairly reach and satisfy the needs of all kinds of tourists, this is a crucial metric for management to assess the tourism information distribution system.

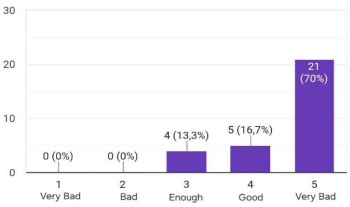

Fig. 7. Survey results regarding Tanaka Waterfall satisfaction based on the availability and suitability of facilities.

Thirty respondents were asked to rate the acceptability and availability of public amenities—restrooms, rest areas, and parking lots—using the diagram. According to the data, most respondents had a favorable opinion of the facilities, as evidenced by the average rating of 4.57. According to the response distribution, 21 respondents (70%) gave the facilities a score of 5, meaning that most were highly delighted with their availability and condition. 2. Despite some minor flaws, five respondents (16.7%) scored 4, indicating a reasonably good level of satisfaction. 3. Four responders (13.3%) assigned a score of 3, signifying a neutral opinion or the belief that certain facilities were not being used to their full potential. 4. No respondent rated the facilities as extremely subpar or inadequate, as indicated by no one assigned a score of 1 or 2.

These findings show that the tourism area's public amenities are excellent and satisfy most visitors' needs. This accomplishment may gauge how well tourism area managers have provided adequate auxiliary infrastructure and enhanced visitor comfort. Several major themes emerged from guest feedback, highlighting areas that still require improvement in the tourism sector. A few key ideas that can be summed up as follows:

Many respondents found access to the site, especially to the waterfall, challenging. Tourists' biggest complaints are that the roads are narrow and hard to navigate, requiring more work or extra money (e.g., motorbike taxis). This suggests that tourism routes should be better organized and improved to make them more accessible to people of all ages.

Absence of Vendors or Sales Locations: Several respondents noted that a disadvantage was the limited number of vendors in the area. Local vendors are crucial to providing guests with necessities such as food, beverages, and mementos. If handled properly, this could also strengthen the local economy.

Underutilized Supporting Facilities: Despite the facilities' strong ratings in the prior survey, some participants noted that there weren't enough rest spots, such as huts or gazebos. The lack of facilities makes it difficult for some people to find a place to rest, particularly in crowded areas. Feedback was also received on regular maintenance to improve restroom cleanliness and the absence of mirrors in the toilets.

Inadequate Information: Issues were raised regarding unclear or insufficient access to information about facilities, locations, or routes. This suggests that the information system needs improvement, perhaps by adding digital information services, signposts, or tourist maps.

Absence of tourist attractions or interests: The river course was too short, according to one tourist, which made it seem less thrilling. Concerns about easier trekking routes for adults are also present, underscoring the need to create more interesting and varied attractions.

In addition to the area's aesthetic and natural features, Tanaka Waterfall significantly contributes to community empowerment. Village-based management allows the community to participate directly as ojek service providers, ticket booth attendants, tour guides, and facilities managers. The community-based tourism (CBT) concept, which effectively promotes fair sharing of financial gains from the travel and tourism industry, is reflected in this strategy. The additional ecological benefit that the secondary forest vegetation surrounding the Tanaka Waterfall region offers is equally significant. Shade vegetation species, including Albizia chinensis, Pterospermum javanicum, and other ferns, are abundant and help stabilize slopes and conserve soil moisture, as observed visually. This enhances the ecosystem's ability to buffer against hydrometeorological hazards such as floods and erosion. For tourists to comprehend the significance of preserving the region's ecological balance, this possibility must be included in tourism interpretation materials.

Thus, the objectives of this research, namely to identify the tourism components at Tanaka Waterfall and the potential and constraints in its development, have been achieved. The results of this report are expected to serve as a basis for policy-making and the development of environmentally friendly, inclusive, and long-term tourism management strategies.

Sustainable ecotourism management requires an integrated approach that balances environmental conservation, local community participation, and visitor satisfaction. In the case of Tanaka Waterfall, the adoption of community-based management has demonstrated the potential for inclusive growth. However, there is still a need for structured environmental monitoring, including waste management systems and water quality assessments. Implementing an environmental certification program for local tourism businesses could also help ensure that sustainability principles are followed consistently.

Modern ecotourism evaluation emphasizes integrating ecological, social, and economic aspects into a sustainable management system. According to, the success of ecotourism is primarily determined by the balance between economic benefits for the community and the protection of natural resources. In the context of Tanaka Waterfall, community-based management in Arjomulyo Hamlet has shown positive results. However, a sustainable evaluation mechanism is needed to minimize negative impacts on the ecosystem early on. Furthermore, [14] emphasizes that ecotourism is an instrument of sustainable development that enhances community welfare and protects biodiversity. The evaluation results at Tanaka Waterfall show strong natural attractions and significant community participation. However, weaknesses in accessibility and information remain obstacles. Improvements can be made through environmentally friendly innovations, such as optimizing digital media for promotion and conservation education. From an environmental perspective, [15] state that evaluating the carrying capacity of tourist areas is key to preventing ecosystem degradation driven by surges in visitation. Monitoring visit counts, water quality, and the condition of the surrounding vegetation should apply the carrying capacity principle at Tanaka Waterfall. This monitoring data is essential for policies, such as quota restrictions.

4 Conclusion

In conclusion, based on the data analysis, the Tanaka Waterfall area has tourism components —attractions, accessibility, amenities, and institutions — that are suitable for development as a community-based ecotourism destination. From an attraction perspective, this area offers natural attractions such as waterfalls, a pristine mountain atmosphere, and a Japanese-style ornamental concept that adds a unique value. Accessibility components were rated quite variably by respondents, with some visitors finding them difficult due to narrow roads and limited directions. Meanwhile, most visitors considered facilities (amenities) such as toilets, rest areas, and parking areas adequate. Beyond economic gains, ecotourism offers educational and social benefits for local communities. Involving local schools and youth organizations in conservation education and environmental awareness programs can strengthen the region's cultural and ecological identity. At Tanaka Waterfall, initiatives such as guided nature walks, biodiversity interpretation panels, and eco-workshops could enhance visitor understanding and generate additional income for the local population. To ensure long-term sustainability, Tanaka Waterfall's management must develop a comprehensive ecotourism policy that includes environmental monitoring, visitor capacity control, and digital-based promotion. Collaboration between the village government, local businesses, and academic institutions is key to achieving sustainable growth. Continuous evaluation of visitor impact and resource use will help maintain the site's natural integrity while providing economic opportunities for residents.

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