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Research Article

Evaluation of Waste Management in the Bromo Tengger Semeru National Park Tourism Area: A Case Study of the Bromo Sand Sea

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ABSTRACT

Effective waste management is one of the key efforts to achieve sustainable tourism development. The purpose of this study was to examine the waste management model in the Bromo Tengger Semeru National Park area, particularly in the Sea of Sand. The results of this study are expected to provide normative benefits to all stakeholders managing Bromo as a tourist destination and serve as evaluation material for addressing waste issues in the Sea of Sand area. The study was conducted in May 2022 using a qualitative method with a descriptive approach. Data collection methods included observation, in-depth interviews, and documentation. The sampling technique used in this research was purposive sampling, or criterion-based selection, considering the validity of information provided by specific respondents with relevant expertise. The primary informants consisted of the management of the Bromo Tengger Semeru National Park, government officials, guides, and the local community. The research findings indicate that waste management in the Bromo destination area is still suboptimal. Existing facilities are insufficiently representative, and utilities related to solid waste need further development. Furthermore, the coordination of waste management efforts has not been effectively implemented. Recommended measures for stakeholders in Bromo Tengger Semeru National Park to improve waste management include: (1) developing waste management systems; (2) restricting the number of visitors to Bromo; (3) enhancing tourism utilities, such as environmentally-conscious signage systems; and (4) developing and maintaining tourist facilities and infrastructure.

Keywords: evaluation; waste management; tourist area; the bromo sand sea

INTRODUCTION

National Parks are government efforts to preserve nature and the biodiversity in it. National Parks have a role in conserving the biodiversity of the local natural environment [1], [2]. However, government policies in the sustainability of national parks also determine, for example, the rules for visitors when carrying out activities in the national park area [3]. According to [4], effective management of National Parks requires a balance between conservation efforts and community involvement to ensure long-term sustainability. Additionally, the enforcement of stricter regulations and proper monitoring is essential for minimizing human impact on the park's ecosystems [5].

One of the national parks in Indonesia is Bromo Tengger Semeru National Park (TNBTS). This National Park is located in the province of East Java which covers four districts at once namely Probolinggo, Lumajang, Malang, and Pasuruan [6]. Therefore, it is quite natural that when formulating regulations related to the use of national parks, overlaps may still occur, depending on the interests of each district [7], [8].

The existence of Bromo Tengger Semeru National Park is very crucial in maintaining the preservation of the natural surroundings. As mandated by Indonesian Law Number 5 of 1990 which states that the Conservation of Biological Natural Resources and their Ecosystems, including protected animals, is the main function of the existence of a national conservation park. This is also confirmed through Government Regulation Number 7 of 1999 concerning the conservation of species of plants, animals, and the natural environment that are in the national park area, must not be polluted or damaged by human activities [9]. This role is not easy considering that the National Park area also includes the Bromo tourist area which is almost never deserted by tourists.

The Bromo Tengger Semeru mountain area was officially declared a National Conservation Park by the government on May 23, 1997 through the Decree of the Minister of Forestry Number: 278/Kpts-VI/1997. The Bromo Tengger Semeru National Conservation Park area has a special character and a unique phenomenon in the form of natural formations, namely the active caldera of Mount Bromo, and the enchanting stretch of sea of sand. The existence of this National Conservation Park provides many benefits for the community around the Bromo Tengger Mountain area [10]. The Bromo Tengger Semeru National Conservation Park not only contributes to biodiversity conservation but also plays a vital role in local tourism and economic development, as noted by [11], who emphasized that sustainable management of such areas can provide both ecological and socio-economic benefits for surrounding communities.

The Bromo mountain area, which is part of the Bromo Tengger Semeru National Conservation Park, has become a leading destination for both domestic and foreign tourists. Located between the active range of the Tengger Mountains complex, accessibility to Bromo is sufficient, though tourists must pass through the Sea of Sand to reach the Bromo crater. This Sea of Sand is a unique feature within the park, contributing to its appeal as a major tourist attraction. The Bromo sand sea is especially remarkable as it is the only conservation area in Indonesia with this rare natural phenomenon [12]. According to [13], [14], the Sea of Sand significantly enhances the park's status, with its distinctive landscape features attracting visitors from around the world. Furthermore, sustainable tourism management plays a crucial role in preserving these unique natural attractions while providing economic benefits to local communities [15], [16].

Most of the Bromo sand sea area does not have vegetation that grows perfectly. This is due to dry conditions and the lack of available water. However, the Bromo sand sea is increasingly exotic and more beautiful with sturdy circular cliffs with a height varying between 200-600 meters and a slope of 60-80 degrees. This cliff is one of the factors for the formation of the Bromo sand sea [17].

Due to the beauty and uniqueness of Bromo's attractions, currently most of the surrounding community depend on Mount Bromo's tourism activities such as trading, hotel business, and transportation service providers. On the other hand, in addition to having an impact on the economy of the surrounding community, the Mount Bromo tourist area also has an impact on environmental damage. Including the damage in the bromo sand sea area. Some of the causes of these impacts include vandalism, the absence of visitor restrictions, to the behavior of tourists who litter. Therefore, real efforts are needed to re-emphasize sustainable development in the development of Mount Bromo destinations [18], [19].

Sustainable development is an effort to use natural resources for the welfare of society in a sustainable manner. This means that development is pursued not only for short-term interests, but for the long-term sustainability of life in the future. Sustainable development must carry out a balanced management between the existence of resources, the environment, and the community as the manager. To achieve these conditions, it is necessary to formulate appropriate development policies to avoid unsustainable use patterns. Included in the management of tourist destinations, special treatment is also needed, namely sustainable tourism development [20].

The existence of tourism has a positive impact on people's lives, particularly in terms of its social and economic benefits [21]. However, tourism also makes a significant contribution to waste production in the environment [22]. For example, in China, the increase in tourist numbers has led to a rise in the daily waste generated by tourists, demonstrating a strong and significant correlation

between tourist arrivals and waste production [23]. Therefore, in developing tourism, it is essential to implement appropriate policies for its management [24].

Another study on waste management in the tourist area of Hammamet City, Tunisia, revealed that during the holiday season, when the number of tourists increases, the amount of waste produced also rises. The results of this study showed that an organized management system, supported by sustainable financial governance by stakeholders, helps keep tourist destinations clean, thereby reducing waste production and enabling the implementation of sustainable tourism practices. The study also recommends several policies, including legal and technical interventions, such as waste prevention, minimizing waste, sorting at the source, and providing educational programs for citizens and tourism businesses [25].

Similarly, in coastal cities that are tourist destination areas in Vietnam, the tourism industry is the largest and fastest-growing segment [26]. However, city infrastructure is being developed without adequate waste management capacity, creating gaps in achieving sustainable waste management. The research findings reveal a causal relationship between community participation, stakeholders, tourism activities, and policies and legal frameworks, all of which impact sustainable tourism [27], [28], [29]. Furthermore, greater emphasis needs to be placed on the environment of tourist destinations, as it holds the highest priority value and contributes to raising awareness of various issues in the development process [30].

Based on survey data and national media reports, the condition of several spots in the Bromo tourist area has been in the spotlight because some of them are very dirty due to tourist waste [31], [32]. Among the most of the existing waste is plastic waste used for food and drinks from tourists. Through a search in the field, the spot refers to the Bromo sand sea. This happens because the awareness of tourists to the environment is still very low. In addition, the management seems to have lacked attention and there seems to be no concrete effort to solve the problem. It is evident from observations that problems such as lack of trash can facilities, inadequate toilet availability, and minimal efforts to persuade and socialize stakeholders are found.

In line with [33], [34] that some of the problems found in Bromo tourist destinations, especially in the sea of sand, are waste management that has not been maximized. The waste is the production of the activities of visiting tourists. The types of waste that exist are mostly anorganic waste in the form of food and drink wrappers scattered along roads and certain spots in the sea of sand. Thus, even though it is a nature conservation area, Bromo's sea of sand is not completely free of waste.

On the other hand, the absence of daily visitor limits allows most visitors to Mount Bromo to enter freely through four district gates, namely the Cemoro Lawang Probolinggo Gate, Penanjakan Pasuruan, Lumajang, and Malang [35]. That condition exacerbates the execution of regulations governing visitor production waste management if there is no concerted effort to overcome them. Therefore, the purpose of this research is to find out how the waste management model in the Bromo National Park area, especially in the sea of sand area. The results of the study are expected to provide normative benefits to all stakeholders managing the Bromo tourist destination, mainly as an evaluation material in overcoming the waste problem in the Bromo Sand Sea area. In addition, academically this research is also expected to contribute to the development of science, especially in the regulation of environmental, social policy, and tourism development.

METHODS

The research was conducted in the sea of sand area of Bromo Tengger Semeru National Park, East Java, in May 2022. This study employed a qualitative method with a descriptive approach. According to Bogdan and Taylor, qualitative research is a process that produces descriptive data in the form of written or spoken words from people and observed behavior [36], [37]. [38] emphasized that qualitative research aims to understand social events from the perspective of participants, namely people who are interviewed, observed, or asked for data, opinions, thoughts, and perceptions. To describe the existing problems, this study utilized data and information systematically, credibly, and

factually at the research location, focusing primarily on waste problems, management, and alternative solutions in the Bromo Tengger Semeru National Park tourist area, particularly in the Sea of Sand.

This study used both primary and secondary data. Primary data were obtained directly through observation and interviews with relevant informants in the field, while secondary data were gathered from various reference sources, including scientific journals, books, news websites, and other media related to the research topic. Data collection techniques included interviews, observation, and documentation. The sampling technique used in this research was purposive sampling, based on the validity of information from specific respondents with relevant expertise. The primary informants consisted of the management of Bromo Tengger Semeru National Park, government officials, guides, and members of the local community.

This study employed interactive data analysis. The stages of interactive data analysis include; (1) data collection; (2) data reduction; (3) data display and; (4) data verification and conclusion [39]. Additionally, to support data analysis, the researcher also triangulated data to compare and re-examine field results with existing theories. The data processing sequence is explained in the table below.

Table 1. The stages of research data processing

No.	Stages	Description
1	Data collection	Data collection in the field began with in-depth interviews conducted with informants at the research location, including national park officers, guides, visitors, and several members of the local community. Additionally, data collection was further supported by field observations related to the presence of garbage in the Sea of Sand.
2	Data reduction	• After data collection, data reduction was performed by grouping the interview data based on the predetermined themes, specifically focusing on waste management in the Bromo Sand Sea area. • Set aside information that does not align with the waste management theme.
3	Data display	• Create a comparative matrix of waste management factors in the Bromo Sand Sea area, along with the reasons why the program is not fully optimal. • Develop a waste management process flow for the Bromo Sand Sea
4	Data verification and conclusion	• Initial conclusions are formulated during data analysis and then verified to ensure validity. • The verification process is conducted through triangulation, member checks, or re-analysis of data, along with verifying the conclusions through additional interviews or document comparison.

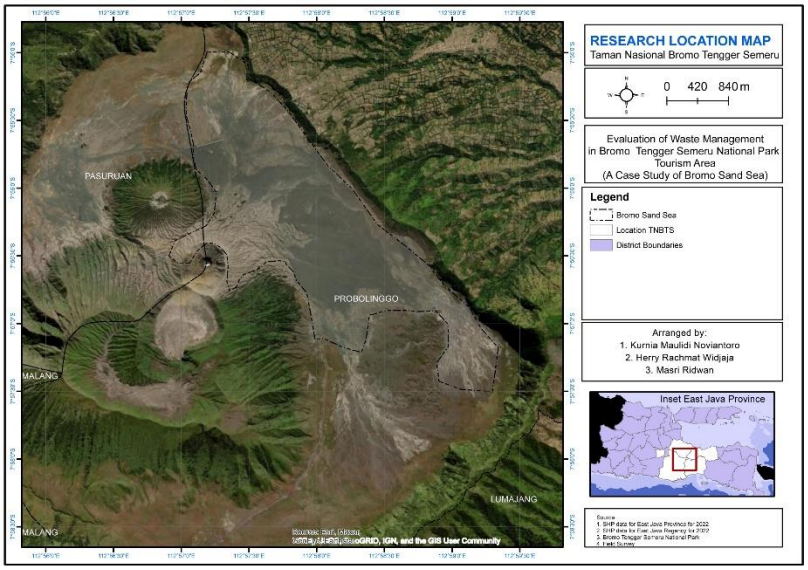

Figure 1. Study Area

RESULTS AND DISCUSSION

Cleanliness of the Bromo Sand Sea

The important thing in supporting the comfort of tourist destinations is cleanliness. For this reason, natural tourist destinations should prioritize environmental cleanliness [40], [41](Wulandari et al., 2020). Based on the theory of sustainable tourism development, the existence of tourist destinations must contribute significantly to environmental sustainability, culture, to the welfare of the people around the destination area [20]. In this study it was found that the environmental conditions of the Bromo sand sea area have not fully described sustainable tourism. This is evidenced by the discovery of piles and scattered garbage at several points around the Bromo sand sea area.

Among the many factors that cause some spots of the sea of sand to have a lot of garbage is due to the abundance of tourists. The booming of visitor has resulted in tourist destinations being very crowded and producing a lot of waste so that it has an impact on the environment. The garbages is often scattered around the pedestrian area or also piled up at certain points which will eventually disturb the comfort of the tourists themselves. In this case, visitors or tourists often complain directly to tour guides or express their discomfort in writing through a complaint book located at the entrance counter. This environmental condition will of course cause tourists to feel uncomfortable and disturbed, so that if there is no effort to evaluate waste management, it will have an impact on the sustainability of tourist destinations.

The amount of waste produced in the Bromo Sand Sea area tends to fluctuate. The Bromo Tengger Semeru National Park Office stated that each visitor disposes of approximately 0.5 kilograms of garbage in the National Park area, including the Sand Sea area. If there are at least 200 to 500 visitors, then the rough assumption is that there will be approximately 250 kilograms of waste every day [42].

Garbages usually increases on weekends and certain seasons, for example during the national holiday season such as the New Year's holiday and Eid al-Fitr holiday. Garbage accumulation usually occurs around jeep parking locations and ravines near Bromo’s crater. That's because the location is the center of the crowd of tourists and business people.

Garbages in the Bromo sand sea area can cause environmental degradation which will have an impact on decreasing environmental functions [31]. Most of the waste that comes from tourists is plastic, while organic waste is mostly produced by business actors such as hawkers. If there is no concrete effort early on, it is feared that the Bromo sand sea area, which is also a conservation area, will eventually become a slum tourist spot.

Waste Management Model

The problem of waste is often associated with the paradigm of humans as individuals or groups. Additionally, understanding the existing concept reveals that waste has been present since the beginning of human civilization. Furthermore, in a simple paradigm, waste is perceived as something worthless and useless, and thus it is often disregarded [43].

The waste problem persists, fueled by the perception that waste is useless and can be disposed of carelessly. This paradigm views waste processing as a distasteful activity—looked down upon and even considered detrimental. This is because it inevitably requires sacrificing cleanliness, time, energy, and significant financial resources. On the other hand, the root of the waste problem is also closely tied to the culture of discipline and public awareness of environmental issues [31]. Therefore, when communities are indifferent to the environment, the problem of waste and environmental cleanliness becomes increasingly complex and difficult to resolve.

Law Number 18 of 2008 states that waste management is a systematic and continuous effort consisting of two main components: waste reduction and waste handling. In this context, waste management includes activities such as collection, storage, transportation, processing, and final disposal [44]. Poor waste management can lead to the spread of various diseases, environmental pollution, and a negative impact on the aesthetics and comfort of the environment.

In waste management, the main goal is to transform less useful items into something of economic value. Methods that can be used as alternatives in waste management include (1) reducing; (2) reusing; and (3) recycling. Additionally, the concept of waste management often aims to ensure that waste is not harmful to living beings or the surrounding environment. Furthermore, waste management focuses on preventing waste accumulation by utilizing it optimally to minimize its impact, particularly on the environment ([45], 2017).

Currently, the waste management model at the Bromo destination is still carried out on a daily basis, namely pickets by officers and collaboration with volunteers. Cleaning of garbage in the Bromo sand sea is usually only done in the afternoon by the manager who is then transported by truck to the final disposal site. This management model has been going on for a long time, but there are still weaknesses that should be evaluated for improvement. Some of them are limited and unrepresentative of the waste transport fleet, lack of field officers, and not regularly recording the amount of daily waste. Therefore, it is so important to make thorough efforts by the government and stakeholders for the creation of a cleaner and more well-maintained Bromo destination environment. In addition, a special allocation of funds must also be budgeted for waste management and its facilities [46].

Environmental management in the Mount Bromo area is currently at the Entropy level. This means that the managerial level is in the ineffective phase of a system that is suspected of having environmental pollution in tourist areas. Thus the manager must be able to solve the problem through system evaluation in order to create a sustainable tourist development [47].

The destination manager and the Bromo Tengger Semeru National Park actually already have a clear formula in environmental planning, but the implementation cannot run optimally. One of the crucial obstacles in this regard is the lack of orderly data collection of daily waste volume production in the Bromo destination area. The existing waste volume data is usually only recorded after certain events are held in the area of the sea of sand such as Kasada ceremonies etc. This is very important considering that it is also related to facilities and for the subsequent use of processed waste. Thus, this phenomenon deserves to be a reference and evaluation in the next waste management.

Efforts to be Made by The Stakeholders of Bromo Tengger Semeru National Park in Revitalizing Waste Management

✓ ***Waste Management Development***

The decline in environmental quality can be an indicator of the quality of tourist destinations. For this reason, it is necessary to carry out strategies and efforts that are guided by sustainable development in their managemen [48]. In this regard, waste management should be the main

guideline for ecosystem integrity. The development of waste management requires appropriate policies so as not to cause environmental pollution. Among some of the actions that must be taken are; minimize waste production, improve recycling processes, improvements ecosystems, and no less important is the socio-economic development of the community.

Tourism waste produced by a tourist destination can be simultaneously managed and developed as part of tourism management. This is a vital role because it involves the image or impression that tourists feel for the first time, usually regarding cleanliness. A clean environment makes visitors more comfortable in the tourist destination area. Therefore, a clean environment is one of the elements of a tourist attraction that must be maintained to keep the sustainability of tourist destinations [49]. Some concrete efforts that can be made to support the waste management development model include:

1. Re-invigorate the waste management association which is only tasked with specifically evaluating waste. The management can start from sorting the types of waste and then managing it to become useful things that are ready to use. For example compost from organic waste and making handicrafts for anorganic waste. The above activities can also be carried out through the establishment of a waste bank initiated by the local community as a form of empowerment.
2. Prioritizing recycling after sorting anorganic waste. That is waste originating from food or beverage packaging is used as crafts of economic value such as souvenirs, decorations and household furniture. This activity can also be developed into an exhibition to complement existing tourist attractions.

✓ ***Restrictions on the Number of Tourists***

Ideally, a sustainable tourist destination must still pay attention to the carrying capacity of the environment [50], [51]. Especially in relation to the daily capacity of tourists to natural attractions. Because if tourists come to visit simultaneously in large numbers, it is feared that it will damage the environment. Starting from the destruction of plants, the disruption of fauna life to the most important is the irregular garbage disposal by tourists [52], [53]. Therefore, it is appropriate for natural tourist destinations such as Bromo national park to have tourist restrictions.

Currently, the rules for limiting the number of tourists have never been implemented in the Bromo Tengger Semeru National Park area. Although tourist destinations in other countries have implemented it, the Bromo Tengger Semeru National Park has never even implemented it except during a pandemic which of course is due to an outbreak of emergency situation [12]. This is because there is no readiness from the management in implementing the rules for limiting the number of tourists.

Restricting the number of tourists appears to be a solution that is unfamiliar to many people, particularly to the government, which, instead of limiting tourism, aims to continue profiting from the increasing number of tourists in Bromo. In this context, there are two main choices: (1) the government can continue to prioritize material profits, which, in the short term, will result in environmental damage, or (2) adhere to the principles of sustainable development, ensuring the environment is preserved through appropriate policies, ultimately resulting in long-term positive impacts for everyone. Research conducted by [54] has demonstrated that restricting the number of tourists to certain destinations can have a positive impact by mitigating environmental damage caused by tourists. Similarly, other studies conclude that proper and well-regulated waste management, combined with tourist restriction policies, can improve the cleanliness of tourist areas, making tourists more comfortable during their visits and ultimately contributing to a cleaner, well-maintained environment [55].

Limiting the number of tourists really needs to be done considering that this is one of the concrete efforts of the concept of sustainable tourism development. In addition, natural tourist destinations must have a carrying capacity that must be considered in their management for the sake of environmental sustainability due to tourism activities [18]. If not, it can cause environmental

damage as happened in the tourist attraction of Goa Pindul (pindul cave) at Yogyakarta. The damage that occurred in Pindul Cave was the destruction of stalactites and stalagmites, resulting in the reduction of nearly 75% of the fauna species that inhabited the cave, such as bats and fish species along the river. This phenomenon occurs due to none other than tourism activities [56]

On the other hand, limiting the number of tourists in a nature conservation area is also useful in reducing social unrest in the community. As happened to the tourist attraction on the island of Komodo Flores and the case of Benoa Bay in Bali, which in the end, despite massive infrastructure development, the community wants the location of the tourist attraction to remain a natural conservation area that contributes significantly to the local community [57], [58]. The effort is restrictions the number of tourists with the provision of increasing the cost of tourists to premium class.

The policy of restricting tourists by increasing reservation tickets or changing them to premium class is proven to be more effective in achieving greater income. An example is the management of the Rivers Fiji tourist destination in Viti Levu, Republic of the Fiji Islands. The management only limits daily tourists to a maximum of 36, but the annual income can reach 164,530 USD [59]. Similarly, what is applied in Bhutan, through restricting tourists for a certain period, the manager and the government achieve maximum income. Bhutan imposes an obligation on travelers to use government-only travel agencies where the average accommodation cost is a minimum of US$200. That way, even though the number of tourists is low, the income is relatively higher. Moreover, the experience and comfort felt by tourists are of higher quality. Therefore, some experts agree that Bhutan has succeeded in optimizing revenue from the tourism sector [60], [61].

Domestically, tourism with the method of restricting the number of tourists has also produced positive results. An example is applied to the Ancient Mount Nglanggeran (gunung purba Nglanggeran), Yogyakarta . By limiting tourists and increasing entry ticket rates, during the period 2016 and 2017 there has been a decrease in the quantity of tourist visits, from 172,863 to 151,673 respectively. However, this situation actually got an increase in income to IDR 2,000,000,000 from the previous IDR 1,800,000,000 (Darmawan, 2019). The benefits obtained in addition to contributing positively to the surrounding community, also supports nature conservation efforts through tourism activities.

Tourist restriction regulations can also provide an opportunity for the environment to recover. In this case, tourist interactions that occur in tourist destinations are automatically reduced by minimizing the damage caused so that eventually the slightly disturbed natural environment will also recover. For example in the Penguin conservation area in New Zealand. Penguin with yellow-eyed species that was originally threatened with extinction, now with limited tourists visiting finally managed to increase the penguin population [59].

Meanwhile, accommodation that is integrated with nature, should also apply provisions for restrictions the number of visitors or tourists. As has been applied by Chalalan Ecolodge-Bolivia and Green Island Resort-Australia, each daily visitor is a maximum of 24 and 90 visitors. Thus the volume of waste generated by visitors/tourists can be minimized and can be easily controlled (Buckley, 2003).

✓ ***Development of Tourism Utility Sign System For Environmental Insight***

Sustainable utilities are an integral part of the development of tourist destinations. With the development of good utilities, it will have a positive impact on tourist comfort and environmental conservation. In this context, utility is not only meaningful for the satisfaction and benefits provided to tourists, but also for the tourism destination environment [62].

As a result of tourists who are almost never deserted, in the Bromo destination the main problem is the unresolved waste in the sea of sand. In the sea of Bromo's sand, there is often a lot of irregular garbage. Lack of public awareness of environmental cleanliness is also suspected to be a contributing factor. Therefore, it is necessary to improve the management of environmental scale waste in order to reduce the intensity of waste in the Bromo Semeru National Park area. One thing that needs to be developed to overcome these problems is to increase the utility of waste.

The utility system in the tourist destination area must be able to meet all the needs of tourists and pay attention to maintenance. Based on observations in the field, one way that needs to be developed is the addition of a sign system that contains appeals or texts about environmental insights. A sign system is a collection of signs or symbols designed to provide information on prohibitions and/or appeals to visitors to regulate order in tourist areas. In addition, other synergistic efforts are also needed to support this development. For example, verbal appeals by national park officials, guides, or influencers through social media about environmental insight and nature conservation. It is also supported by the existence of ideal and representative trash bins at certain points. The following are the results of mapping the ideal trash bin position based on field analysis.

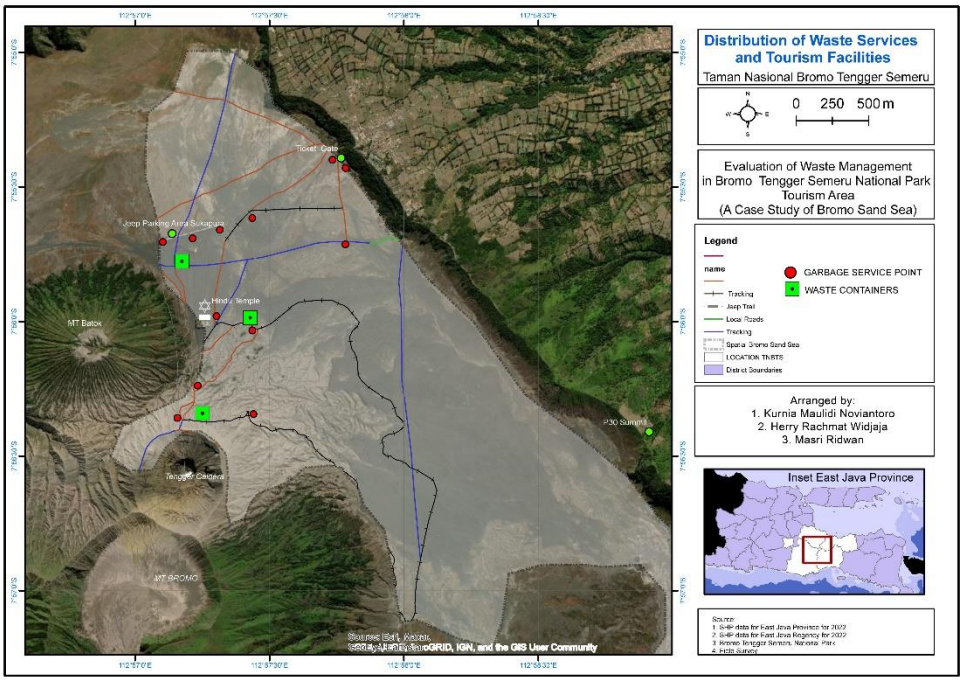

Figure 2. mapping the position of trash cans in the Bromo sand sea area

✓ ***Development and Maintenance of Tourist Facilities and Infrastructure***

Most tourism activities usually have the potential to threaten the preservation of the environment and culture of the community. Therefore, good control efforts are needed so that negative impacts can be minimized. Through the development of facilities and infrastructure, it is hoped that it can support environmental sustainability of tourist destinations and reduce its damage. The development is carried out so that the environment that was originally not well organized, will then be planned and undergo changes for the better [63].

In the development of facilities and infrastructure in the Bromo sand sea area, it is hoped that native (guides, or other tourism service providers) can be the main actors to take advantage of them. Especially in terms of maintaining these facilities by being a good controller when there are tourists who are less responsible when in the Bromo tourist destination area. In addition, to increase knowledge, awareness of maintenance, education or socialization efforts are also needed both to local communities, managers, and tourists so that the existence of tourism supporting infrastructure can be more maintained and durable [64], [65].

The most important effort to maintain tourism facilities and infrastructure is the prevention of vandalism by tourists. It is intended that the existing facilities are not damaged or function properly when used. Such actions include checking, cleaning, adjustment, repair or replacement of spare parts as well as other actions that essentially carry out maintenance so that they remain fit for use and function optimally. Based on the findings in the field, the maintenance of facilities and infrastructure in the Bromo sand sea area has not been maximized due to the lack of Human Resources as labor. All existing officers, both permanent employees and volunteers, are still lacking in optimizing the

environmental maintenance of the Bromo sand sea area. Apart from the quantity of employees, the quality of human resources in the surrounding community is felt to be lacking, thus becoming a major problem in the maintenance of existing facilities.

In addition, the internal mental attitude of the local community, as part of the tourism stakeholders, is suspected to still lack support and concern for cleanliness. This is evidenced by observations in the field, where there are almost no individuals or sanitation officers on standby daily in the Sea of Sand area to act as garbage collectors or cleanliness controllers. Most of the locals are engaged as guides, jeep drivers, or food sellers. Even when there are sanitation efforts, they are usually temporary and occur only during specific, periodic events, with volunteers being called upon to participate in community service.

CONCLUSION

The Bromo Sand Sea is part of the Bromo Tengger Semeru National Park area and is also a conservation area. However, the findings of this study reveal that the environmental conditions of the Bromo destination do not fully align with the principles of sustainable tourism, as there is still a significant amount of garbage in the Sand Sea area. Other findings indicate that waste management in the Bromo destination area remains suboptimal. Existing facilities are insufficient, and utilities related to waste management need further development. Additionally, the current waste management system lacks proper coordination. Therefore, systematic and integrated management efforts are essential to address these issues. Efforts that must be undertaken by stakeholders of the Bromo Tengger Semeru National Park to address the waste problem in the Bromo Sand Sea area include: (1) improving waste management by optimizing the role of POKDARWIS (community-based tourism groups) in waste awareness education and recycling initiatives; (2) restricting the number of tourists visiting Bromo; (3) developing an environmentally-conscious tourism signage system; and (4) enhancing and maintaining tourist facilities and infrastructure.

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DECLARATIONS

Conflict of Interest

The authors declared that they had no known competing interests.

Ethical Approval

The research was approved by the University of Jember and conducted in accordance with its research ethics guidelines applicable to studies involving human participants.

Informed Consent

On behalf of all authors, the corresponding author confirms that all participants provided informed consent and agreed to participate in this study.

DATA AVAILABILITY

Data used to support the findings of this study are available from the corresponding author upon request.

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