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Impact of Tourism and Solid Waste Generation on Saif-Ul-Malook National Park, Khyber Pakhtunkhwa, Pakistan

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Abstract

Currently ecotourism in protected areas has received much consideration, particularly in developing nations. Tourism is a major contributor to garbage production. Narran and Saif-Ul-Malook National Parks (SMNP), tourism is their main source of income for the local residents. Approximately 90% of visitors to the Kaghan/Narran Valley come to the lake located in the SMNP, which has become a popular destination for tourists and is the most frequented location in the National Park. In the last five years, the months of June through August have seen the highest number of visitors (1162266–1072069) in this area. The current study found that, between 2015 and 2017, there was a steady increase in the number of visitors visiting the SMNP. Problems with solid waste management arise when tourism grows, making it difficult to handle solid waste in mountainous regions like SMNP with a large tourist concentration. In the SMNP, a questionnaire survey was carried out between June and October of 2018. There were 296 tourists in all; 56.4% of them were men and 43.6% were women. According to the questionnaire survey, 33.1% of visitors agreed that the SMNP's environmental quality is significantly worse than it was in previous years, 72.6% agreed that solid waste is a major problem currently affecting the SMNP, 46.6% wanted to recycle solid waste, and 43.6% were willing to pay more than Rs. 100 for waste management. In both seasons, the remaining garbage from visitors and local hotels and restaurants

comprises 37.5% packaging material, 30.7% plastic (bottles and bags), and 19.6% paper waste. The fragile ecology of the SMNP is under threat due to poor waste management and an annual rise in visitor traffic. In addition to degrading the land and aquatic ecosystems in the SMNP, the increasing amount of trash and solid waste produced by tourists, local businesses, and hotel owners puts human, marine, and wildlife health at serious risk.

Keywords: Tourism, Solid waste management, National Park, Waste disposal, Pollution, Degradation, Environmental Quality

1. Introduction

Ecotourism is the balanced management between nature conservation and tourist requirements (Amalu *et al*., 2018). At the beginning of sustainable development in the 1980s, ecotourism was developed as a means of directing tourism profits to the development and conservation of native people (Amanda *et al*., 2019). The National Park is one of the most effective and comprehensive environmental protection tools available. A region where native plants and animals are preserved in their original forms and are accessible to the public for educational, scientific, and recreational reasons is to be set aside as a national park (Shah *et al*., 2013). Since tourism plays a significant role in creating garbage, ecotourism in protected regions has drawn a lot of attention, especially in poor countries. For local people in safe areas, particularly in poor countries, ecotourism is the main source of income (Salerno *et al*., 2013). The country's economy can be strengthened via ecotourism. However, the garbage that ecotourism generates can have a detrimental impact on the ecosystem, degrading national parks and hilly areas due to seasonal tourists and inadequate solid waste management techniques (Bashir *et al*., 2016). Soil erosion and ongoing land degradation are caused by this sharp rise in tourism. The quantity of solid trash that builds up along tracking routes in mountainous regions contaminates the ground and water, seriously degrading the ecosystem in the mountains. The ecological manageability of mountainous regions is seriously threatened by trash generation spurred by ecotourism. In the Himalayas, this threat can be mitigated by failing to create an adequate solid waste management strategy (Salerno *et al*., 2013). To preserve the environment in protected areas, it is crucial to practise sustainable development in these regions and place legal restrictions on waste management in national parks. In North America, specific regions are bound by waste management laws that are in line with regional requirements for national parks. Low environmental knowledge among locals and visitors contributes to environmental degradation; this is especially true in Asia (Grzegorz, 2019). In summer, around

1500 visitors visit the SMNP every day, which generates a troubling scenario for the wildness of the National park. Around 200,000 people visit the Saif-ul-Malook National Park every season. The number of visitors is rising each year, which causes water contamination, soil contamination, air contamination, and soil disintegration by cars (Jeeps), and so forth (Shah *et al*., 2013). Because of the degradation of the flora and fauna of the SMNP caused by open burning, solid waste dumping, cattle grazing, and local community interventions, special concern is anticipated to safeguard the highest zones of this National Park, in particular (Rauf *et al*., 2019). The sensitive environment of the SMNP, where the ecosystem is slowly deteriorating due to a lack of awareness regarding proper solid waste management among tourists, locals, and management agencies, is seriously threatened by the solid waste left behind by visitors and the inappropriate transfer of solid waste by inns and guesthouses (Shah *et al*., 2013). Open dumping and sanitary landfilling are the two most common ways to dispose of solid waste (Dhokhikah *et al*., 2012). When solid waste is improperly disposed of, it can lead to various environmental problems such as soil, ground, and surface water contamination through leachate formation, air pollution from open burning of solid waste, disease spread, and landfill odor. These factors collectively cause the degradation of the ecosystem (Ngoc *et al*., 2009). The high levels of SO_2 and particle matter in the air within Ayubia National Park were identified during an assessment of the park's air quality, demonstrating a direct correlation between air pollution and the amount of solid waste produced (Rauf *et al*., 2021). Following an analysis of the many types of waste produced, this research focuses on the various safe disposal methods, such as composting, landfills, incineration, refuse-derived fuel, and biogasification.

2. Research Methodology

2.1 Study Area Background

The SMNP is the first national park to be officially declared on private territory. The leisure center received the designation of National Park on April 28, 2003. Saif-ul-Malook Lake is a calm lake located within the National Park. The lake spans 906 Kanals, all of which are located inside the SMNP National Park, which is 10500 feet above sea level (Shah *et al*., 2013). The majority of the locals in the national park are from Mansehra, Balakot, and Kohistan. They moved back in the winter after spending five months (May–September) at the national park above Saif-ul-Malook Lake as shown in the Figure 1. Every day in the summer, Saif-ul-Malook National Park receives between 6600 and 7000 visitors, which puts the park's wildness in jeopardy. The SMNP receives between 160891 and 146136 visitors on average each season. Due to open burning, the disposal of solid waste, cattle grazing, and local community interventions, the flora and fauna of the SMNP

are declining; thus, special concern is anticipated to safeguard the highest zones of this National Park, in particular (Rauf *et al*., 2019).

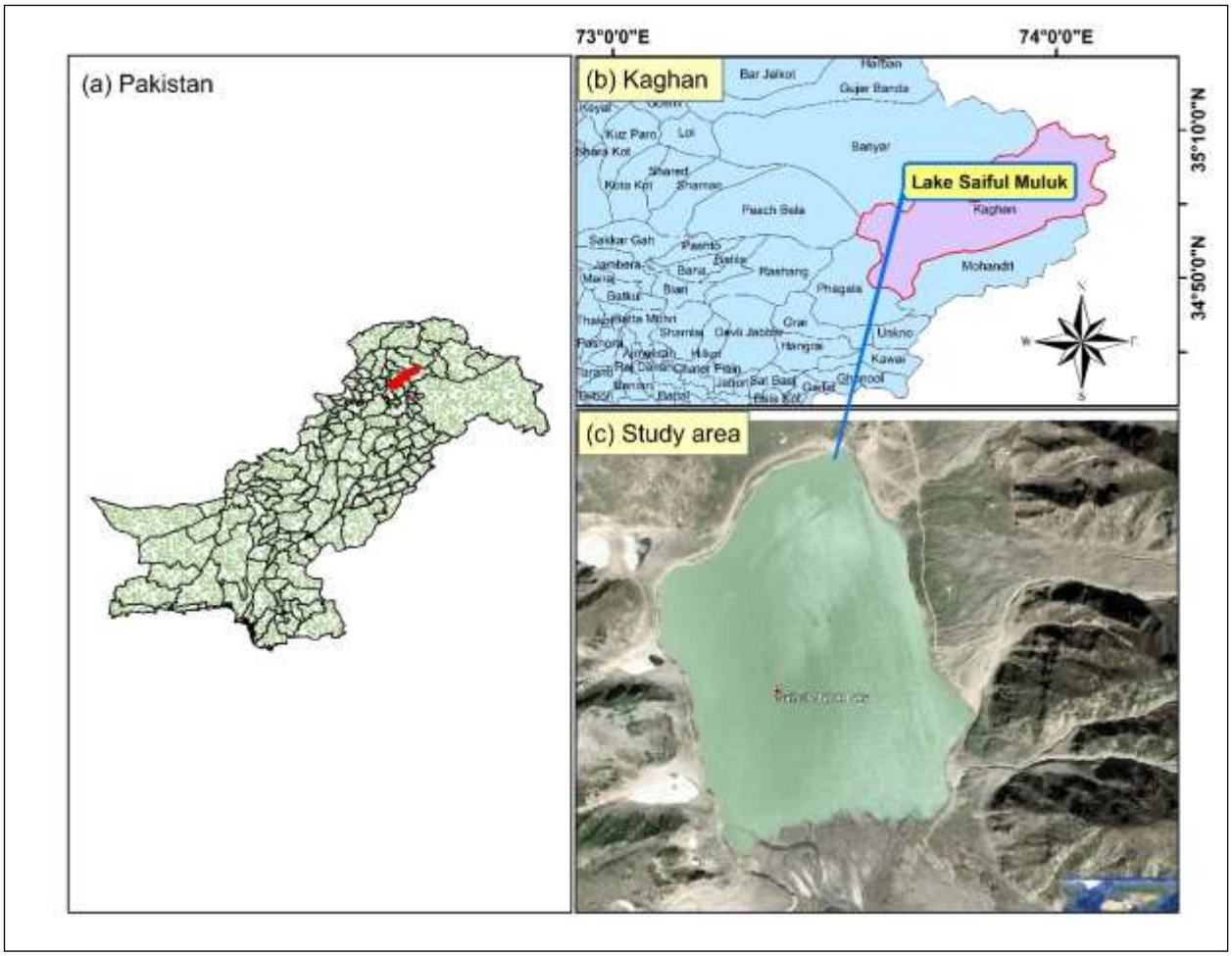

Figure 1. (a) Location Map of Pakistan (b) Union Council Kaghan is located in the District Mansehra KP Pakistan (c) Map of Study area Lake Saiful Muluk which is located in the national park of Kagahn Valley

2.2 Methodology

Primary data were collected using questionnaire surveys, interviews, and field trips. In addition to conducting firsthand observations, field trips included discussions with tourist groups, wildlife authorities, and rag pickers. In June, July, and October of 2018, there were two visits to SMNP. A survey using questionnaires was distributed to visitors, proprietors of hotels and shops, and representatives of wildlife agencies. A total of 350 tourists completed the questionnaire survey. Secondary data were gathered via the internet, books, and earlier study publications, among other sources. Using descriptive statistics, such as maximum, minimum, mean, frequency, and percentages, SPSS and Geographic Information System (GIS) were used to examine the final data that were gathered.

3. Results

3.1. Characteristics and status of tourism in the SMNP

For locals residing in SMNP, tourism is the main source of income. The total number of visitors to the SMNP during the busiest travel months (May through September) during the last five years is displayed in Figure 2. It was discovered that the number of tourists visiting the SMNP gradually increased from 2015 to 2017. **Error! Reference source not found.** and **Error! Reference source not found.** show the maximum, minimum, mean, and total number of tourists/ year in the peak season.

Table 1. Tourist Flow in peak season/year (2014-2018) in SWNP

Peak Season Tourists Flow/Year						
Months	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
May	203,324	200,938	243,183	288,032	226,789	1162266
June	185,220	179,035	223,331	201,023	170,209	958818
July	165,800	236881	222,194	237,006	189,343	1051224
August	249,800	205,241	241,952	230,765	144,311	1072069
September	313	249	201	121	28	912
Total	**804,457**	**822,344**	**930,861**	**956,947**	**730,680**	**4,245,289**

Table 2. Maximum, minimum, and total number of tourists in SWNP

Descriptive Statistics per year (Peak Season)						
	N	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Error**
Year_2014	5	313	249800	804457	160891.40	42489.212
Year_2015	5	249	236881	822344	164468.80	42081.004
Year_2016	5	201	243183	930861	186172.20	46703.989
Year_2017	5	121	288032	956947	191389.40	49823.444
Year_2018	5	28	226789	730680	146136.00	38924.375
Valid N (listwise)	5					

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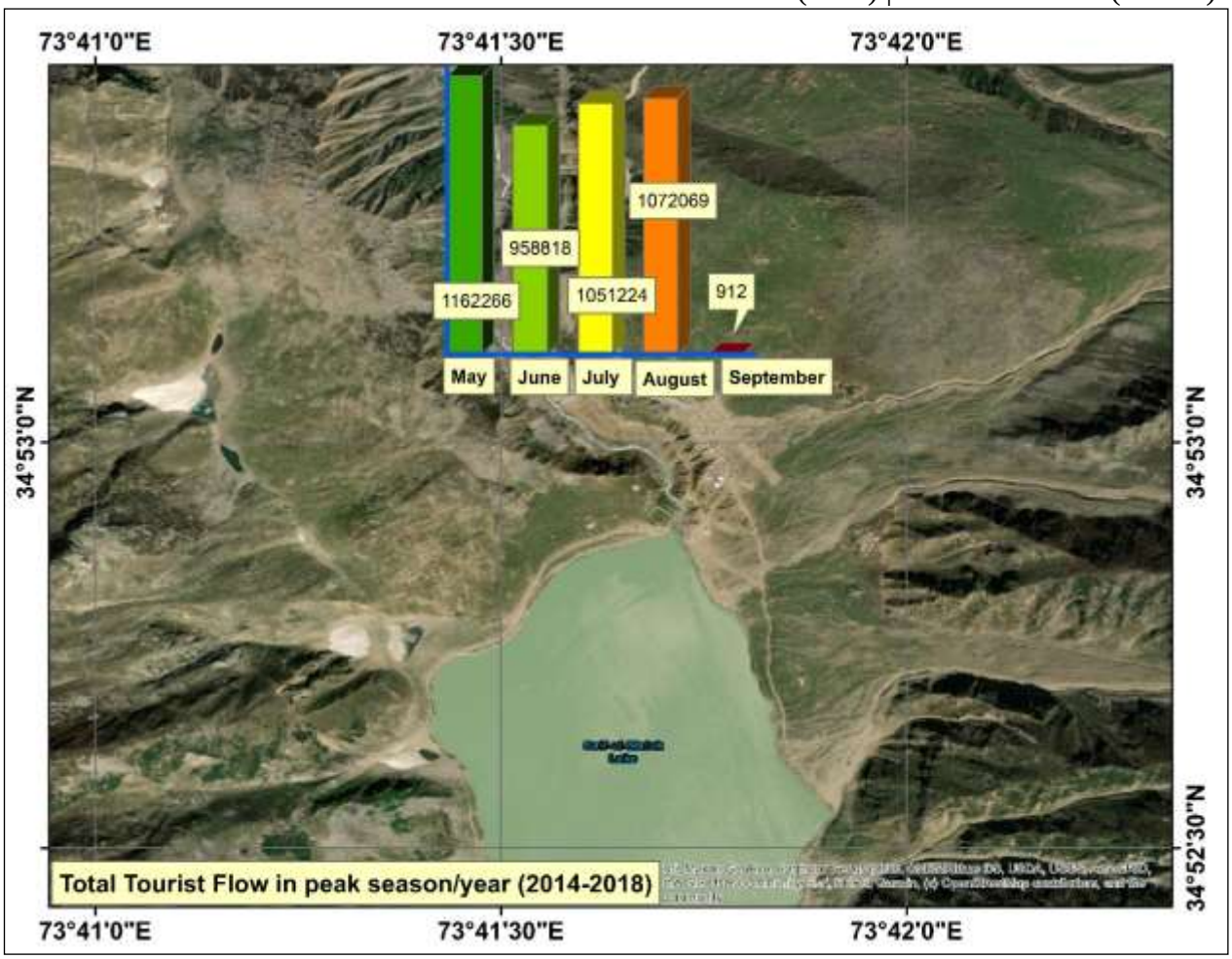

Figure 2. Tourists flow to Narran and Saif-Ul-Malook National Parks (SMNP) during peak season in the months of May, June, July, August, and September (2014-2018). (Source: Wildlife Department, 2018.)

3.2. Total number of respondents

A total of 350 questionnaires were given out to visitors in order to assess the quality of solid waste management methods at SMNP. A total of 296 individuals of various ages took part in the poll, yielding an 84.5% response rate. A portion of the incomplete surveys and non-operational responses were eliminated from the examination. According to this poll, visitors from all across the nation, representing a range of age groups, come to the national park each year. Records were readjusted, and distinct age and gender sets were formed. Of the 296 respondents, 41.2% were between the ages of 20 and 30 (F = 122), 42.6% were between the ages of 35 and 45 (F = 126), and 16.2% were above 50 (F = 48). The total number of male and female visitors, together with their age groupings, is displayed in Table 3.

Table 3. Total number of male and female tourists and age groups

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	167	56.4	56.4	56.4
	Female	129	43.6	43.6	100.0
	Total	296	100.0	100.0	
Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20_30	122	41.2	41.2	41.2
	35_45	126	42.6	42.6	83.8
	Above_50	48	16.2	16.2	100.0
	Total	296	100.0	100.0	

3.3. Categories of solid waste generated by tourist activities

The outcome of the questionnaire circulated among tourists showed that packaging material is produced more than the other waste in SMNP. Figure 3. shows the maximum and minimum values of solid waste generated by tourists in the national park.

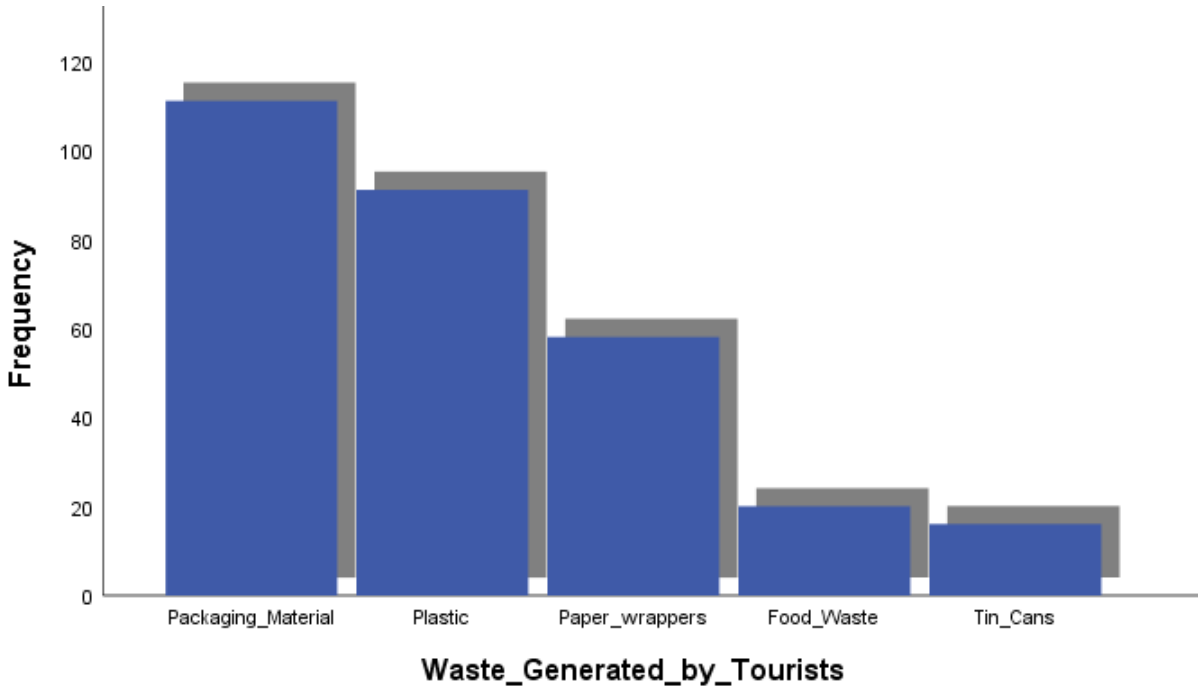

Figure 3. Maximum and minimum number of waste generated by tourists in the study area. (a) Frequency of various trash kinds such as packaging materials, plastic, paper wrappers, food waste, and tin cans

3.4. Current environmental conditions and waste management practices in SMNP

The current environmental quality of SMNP is depicted in Figure 4. The quality of the present SMNP environmental circumstances was compared to the environment five years ago, and respondents were questioned about it. The environmental circumstances of SMNP are much worse now than they were five years ago, according to the majority of respondents (33.1%) with F=98; however, 17.9% with F=53 thought they were somewhat worse then and 23% with F=68 thought they were the same.

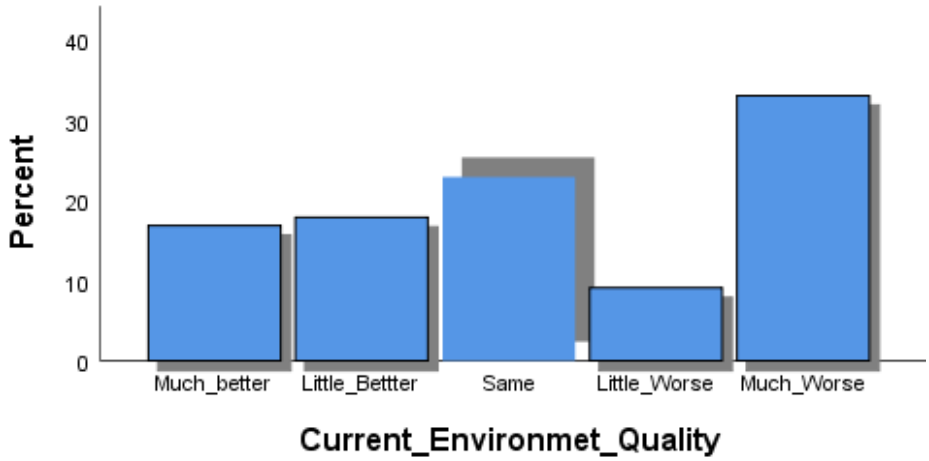

Figure 4. The current environmental quality of Narran and Saif-Ul-Malook National Parks (SMNP). (a) A comparison of current environmental quality to five years ago. (a) Environmental qualities are classified into five categories (much better, little better, same little worse, and much worse).

3.5. Responses of tourists to recycling program and open burning of solid waste

Error! Reference source not found. shows the frequency of different responses from tourists. During their visit, tourists were questioned about the open burning of solid waste in the parking area. Most (80.7%) tourists answered No, and 19.3% answered Yes. In contrast, if a recycling program were set up, they were asked if they would be willing to dump different materials into separate bins.

Table 4. Responses of tourists on the solid waste recycling program

If a recycling program is setup, would you be willing to dump separate materials into separate bins

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	138	46.6	46.6	46.6

No	75	25.3	25.3	72.0
Don't Know	83	28.0	28.0	100.0
Total	296	100.0	100.0	

3.6. Availability and condition of public bins in the national park

According to the question about the availability of public bins in the national park, 56.4% (F=167) of tourists' responses showed the availability of public bins, and 43.6% (F=129) showed no availability of public bins. Moreover, respondents were asked how they could describe the state of public bins in the national park. 22.9% said not in good condition, 30.7% answered in good condition, 16.8% said rusting and 30.7% did not know about the condition of the bin. **Error! Reference source not found.** and 6 shows the different responses of tourists.

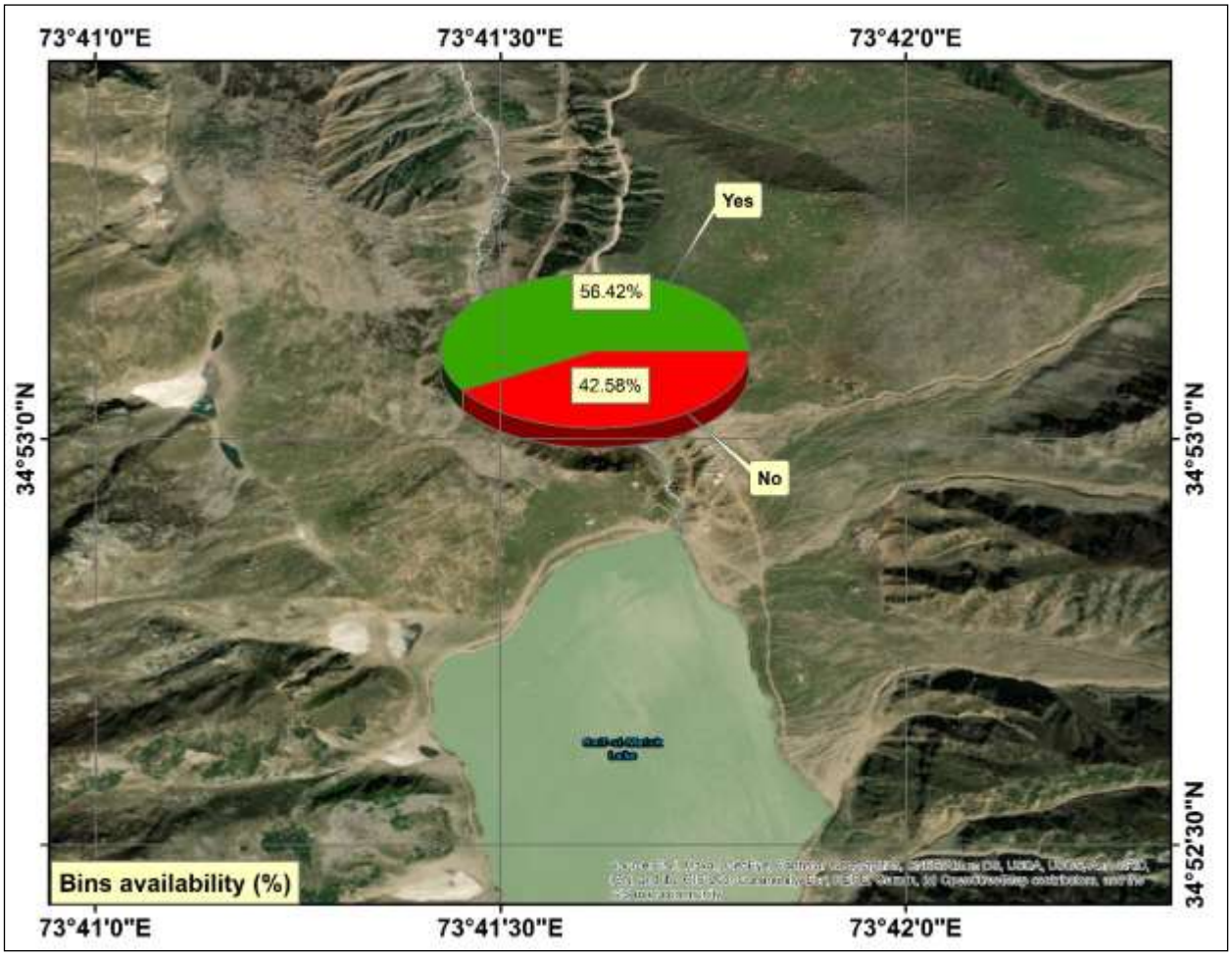

Figure 2. The availability of public bins in the study area, as well as tourist responses. (a) Providing useful information for lawmakers, environmentalists, urban planners, and the general public interested in environmental sustainability and trash management.

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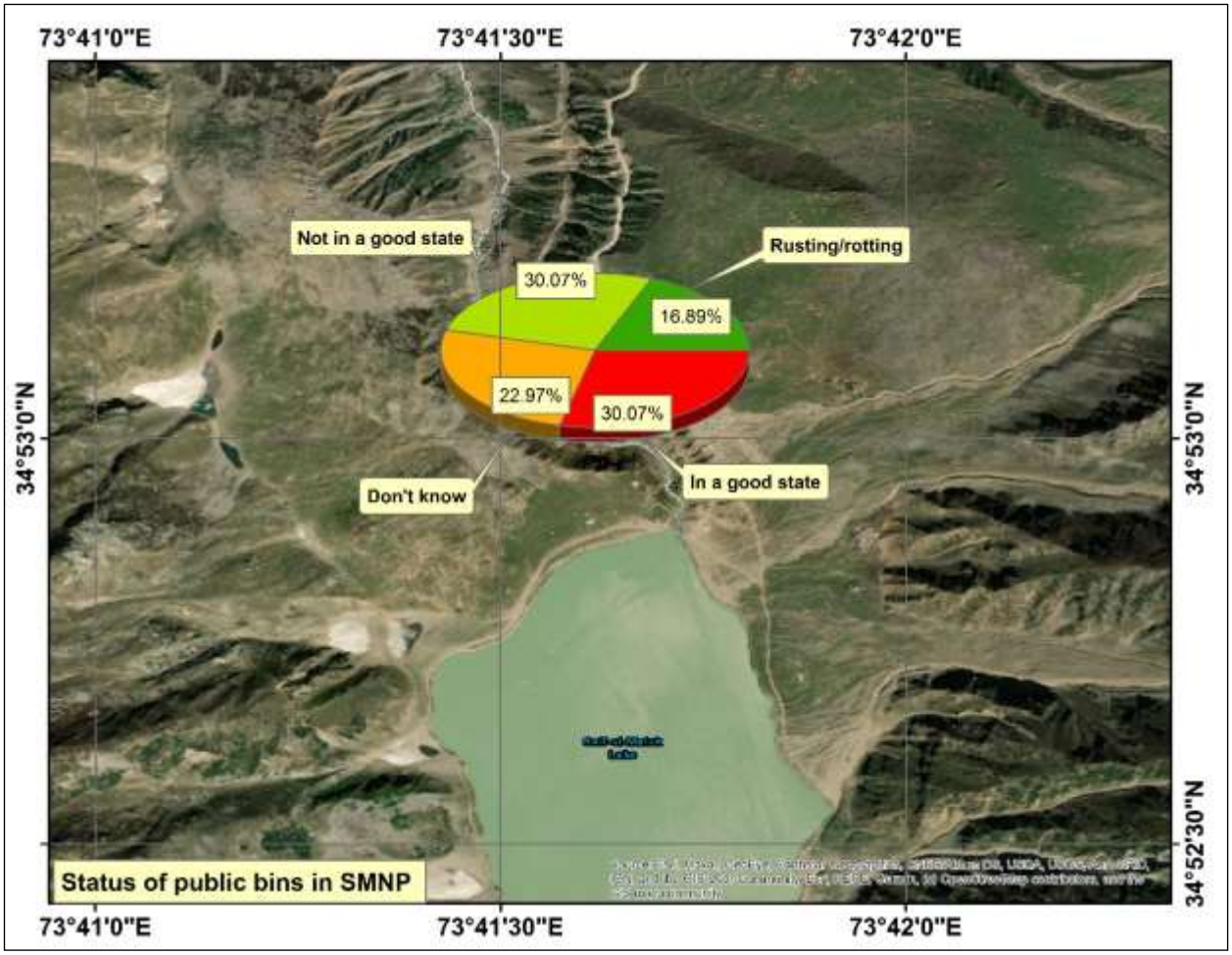

Figure 3. Status of public bins in SMNP. (a) Classifying the condition of bins in the study region into four categories: not in excellent condition, good condition, rusting, and not knowing the condition of the bin.

3.7. Willingness to pay tourists

Findings indicate that most visitors are willing to pay for solid waste collection and management in order to preserve the SMNP ecology. A study that inquired for several sums revealed that 27% (F=80) would be ready to donate Rs. 100, 43.6% (F=129) would give more than Rs. 100, and 29.4% (F=87) would give additional amounts. The percentage of visitors who are willing to pay to lessen the solid waste problem is displayed in Figure. 7.

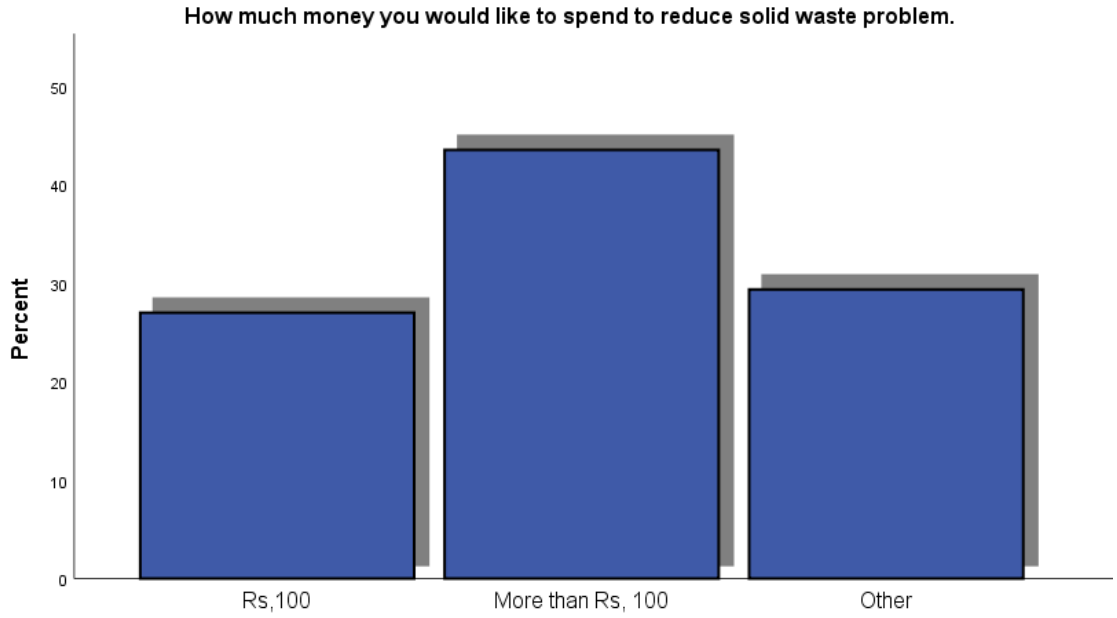

Figure 4. The percentage of willingness to pay of tourists. (a) The percentage of travelers who are willing to pay offers insightful data divided in two three categories (Rs. 100, more than Rs, 100, and others) for destination management, marketing, product development, and sustainability initiatives in the travel and tourism sector. It supports decision-making by stakeholders that is advantageous to visitors and the spot itself.

4. Discussion

The SMNP's solid waste management situation is currently underdeveloped; waste is dumped in the national park area without proper management due to a lack of resources and ability. The government workers' only method of disposing of the waste is by open burning, where waste is burned without treatment (as observed personally during field visits) as illustrated in Fig. 8.

Next to the water reservoir, the Kaghan Development Authority (KDA) has an unhygienic dumping site. They also openly burn rubbish, which harms both locals and visitors in addition to polluting the environment (Fig. 9). Six hundred to seven hundred cattle (sheep, goats, etc.) graze freely inside the national park, which is home to around thirty boats and three hundred riding horses. Grassland degradation is a result of horseback riding and livestock grazing in the open. The present disposal location, as seen in Fig. 10, is close to the national park by Lake Saif-Ul-Malook, causing degradation and pollution of the lake water.

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Figure 8. Open burning of Solid Waste at a dumping site near Chattakallan, Kaghan (a) During fieldwork this photo was taken in the study area

Figure 9. Open burning near the water reservoir (a) The graphic depicts how open burning in the research region might affect the air, soil, and water.

Figure 10. Dumping site near Lake Saif-ul-Malook (Peak-Season) (a) Waste conditions throughout peak season (May, June, July, August, and September)

Tourism-related garbage is one of the main obstacles to environmental sustainability in isolated alpine areas and protected areas. Effective solid waste management is challenging in mountainous regions like SMNP which see a lot of visitors. The national park's appeal is diminished by the increasing quantity of solid waste and litter produced by tourists, local businesses, and hotel operators. In addition, there is a serious risk to human health, the environment, and the ecosystem. In the SMNP, it pollutes the land, the air, and the water.

Littering, rubbish disposal, and driving on undesignated roads are all strongly prohibited by the Preservation, Protection, Conservation, and Management Act of 1975. Nevertheless, visitor jeeps clog the serene and scenic Saif-Ul-Malook Lake, the focal point of the national park, making conditions unpleasant there. There were wildflowers in the area twenty or thirty years ago, but soil deterioration has caused them to vanish. Due to open dumping of solid waste, horse and jeep riding, and grazing, grasslands and open pastures are deteriorating every day. In addition to causing soil degradation, horseback riding generates animal excrement.

The fragile environment of the SMNP, where the ecosystem is slowly deteriorating because visitors, locals, and management agencies are not aware of proper solid waste management, is seriously threatened by the solid waste left behind by travelers and the improper transfer of solid waste by lodging establishments (Shah *et al*., 2013). Conversely, open dumping and sanitary landfilling are the most often recommended techniques for disposing of solid waste (Dhokhikah *et al*., 2012). The concentration and variety of solid waste types generated subsequently lead to the degradation of the ecosystem. In addition, improper disposal of solid wastes contaminates soil, ground, and surface waters through leachate formation, pollutes the air through open burning of solid waste, and disperses diseases and odors in landfills (Ngoc *et al*., 2009). People who live in the Narran and SMNP primarily make their living from tourism. Ninety percent of visitors to Kaghan/ Narran valley are required to see the lake within the national park itself. Visitors and tourists come at Lake Saif-Ul-Malook by vehicle from Narran, as it is not possible to reach the national park on foot. 200–300 jeeps a day, carrying five people each, may land in the national park during the busiest months of June through August. There are 60–90 fewer jeeps operating daily to transport the same amount of tourists during the off-season (September–October). The months of May through August are the most commonly known times to visit the national park. On August 14, Pakistan Independence Day, most celebrations, including the Naran festival, are observed. The months of May through August are the most commonly known times to visit the national park. According to earlier research, 4,245,289 visitors—140 of them were foreign visitors—visited the SMNP during the busiest months (May through September) over the previous

five years (Tariq *et al*., 2019). Different parts of the nation are home to tourists. The amount of visitors that visited the SMNP between 2015 and 2017 was shown to have risen gradually. Tourists often stay in the national park for two to four hours and in the Naran valley for three to four days. The most frequented location in the National Park is Lake Saif-ul-Malook, which has grown to be a major tourist destination. A variety of waste products from visitors and hotel activities are provided. The purpose of the inquiry was to determine the proportion of different types of solid trash generated by the tourists. According to the study's findings, the highest percentage of solid trash generated by visitors is 19.6% with F=58 of paper waste in both seasons, 5.4% with F=16 of tin cans and glass, 30.7% with F=91 of plastic (bags/bottles), and 37.5% of packing material. Travelers tend to like drinking tea in cold weather, hence some wastes, like tetra packs, are created more during the winter. The vast majority of participants concurred that the government has to maintain oversight over the open disposal of rubbish in national parks since it pollutes the ecosystem. According to recent studies, trophy hunting and mass tourism in the KNP account for 80% of the park's revenue, but they also pollute the ecosystem and negatively affect biodiversity (Wajid *et al*., 2020). As a result of inadequate measurement and limited resources, the SMNP's existing waste management situation leads to inappropriate management. When asked whether visitors had ever seen sanitary workers picking up trash in the national park, 57.8% of all respondents (F=171) stated they had not seen any, and solid waste items are frequently disposed of in open landfill sites, posing a real risk to both the environment and human health (Fig.8). Air pollution, soil pollution, and contamination of groundwater and surface waters are some of the potentially harmful effects of inadequate waste removal procedures. SMNP lacks appropriate solid waste management procedures. In the national park region, waste is freely deposited. As seen in Figure 8, the only method of trash disposal used by government and wildlife sanitary professionals is open burning.

According to the study's findings, the following recommendations were made: To protect the SMNP ecology, visitors must pay an admission charge. The Zero Litter Initiative (ZLI), a new initiative to minimize tourism waste creation on climbing routes in China, was recently established by Chinese research. It requires climbers to carry their rubbish down the mountain (Huan *et al*., 2018). To collect the garbage created by visitors, the wildlife department and park administration have to adopt a proactive approach by offering biodegradable bags. To lessen the detrimental effects of tourists and preserve the delicate environment of Saif-ul-Malook National Park, the government must create an appropriate waste management and disposal strategy for SMNP. The installation of waste treatment plants may also be funded by the money received from SMNP.

Through workshops and seminars, tourists should be made aware of the issues caused by solid trash and how to work with the government and wildlife department to reduce the generation of solidwaste. Parking is not permitted for Jeeps or other vehicles inside the national park. When visitors openly dump solid garbage, they should be fined. When it came to how much they were willing to spend on solid waste management, respondents were questioned. For the protection of SMNP, most of them believe that solid waste collection and management are crucial. It was observed that the greatest number of visitors appeared to be environmentally conscious and willing to pay for solid waste management; nonetheless, the national park's solid waste management situation might be improved by offering more details about the ecosystem and environmental preservation.

5. Conclusions

This study found that the main source of income for the locals in the Narran and SMNP is tourism and that the number of visitors to these areas rises year, from 804457 to 956947. Roughly ninety percent of visitors to Kaghan/Naran Valley are required to see the lake within the national park. Visitors/tourists come to Lake Saif-Ul-Malook from Narran using jeeps and horses as it is not possible to reach the national park on foot. Every day, as many as 200–300 jeeps might arrive in the national park during the busiest months of June through August. Ninety to sixty jeeps a day, accommodating five passengers each, are available during the off-season (September to October). An increase in the number of tourists was noticed from 2015 to 2017 in SMNP. A total of 296 tourists participated in the questionnaire survey conducted from June, July to October 2018, out of which 56.4% were male, and 43.6% were female. In response to a questionnaire, tourists indicated that 33.1% thought the SMNP's environmental quality was significantly worse than it had been in the past, 72.6% thought solid waste was a major problem currently affecting the SMNP, 46.6% wanted to recycle solid waste, and 43.6% were willing to pay more than Rs. 100 for waste management. Effective solid waste management is a challenge in mountainous locations like SMNP because of the high pace of tourism growth. Growing tourism is correlated with a rise in solid waste management issues. As a result, mountainous regions like SMNP with a high tourist concentration find it challenging to handle solid waste adequately. In the end, 37.5% of the garbage comes from packaging, 30.7% is made up of plastic (bottles and bags), and 19.6% is paper waste from both local hotels and restaurants as well as visitors. Tourists in the SMNP were asked about the availability of public bins in the national park; 56.4% (F=167) answered that they were available, and 43.6% (F=129) showed no public bins. Moreover, 22.9% of respondents described

the state of public bins are not in good condition, 30.7% answered that they were in good condition, 16.8% said rusting, and 30.7% did not know about the condition of the bins.

Author's Contribution

The primary concept was proposed by Noureen Orakzai, who also assisted with the drafting and write-up of the manuscript. Saeeda Yousaf supervised the entire research and manuscript project, while Rubina Noor and Muhammad Arif supplied the necessary equipment for the field trips and collected primary data. Anis Safir, on the other hand, collected secondary data. The paper was critically corrected by Taqweem Ul Haq to remove any significant intellectual material, and Waheed Ullah and Mahwish Ahmed Alvi reviewed and approved the final version.

Conflict of interest

None of the writers had any competing interests.

Acknowledgment

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