

Waste Management Policy and Practices in Mountain Expeditions in Nepal: Stakeholder's Perspective on Implementation of Mountaineering Expedition Rules

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Abstract

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Purpose: This study investigates the current implementation status of the Mountaineering Expedition Rules (MER) of 2002 in Nepal, focusing on waste management practices during mountain expeditions from the stakeholder's perspective.

Methodology: The study used a descriptive research design with a mixed approach, collecting primary data through structured questionnaires and key informant interviews. Data analysis is conducted using descriptive statistics for quantitative data and content analysis for qualitative data.

Main Findings: The findings highlight the need for improvement in waste management during mountain expeditions in Nepal. While climbers demonstrate a moderate to high level of awareness and implementation of waste management practices, challenges such as limited budgets, lack of self-awareness among expeditioners, and slow decay of waste in cold weather persist. The study emphasizes the importance of proper implementation of mountaineering expedition rules, particularly in waste management.

Implications: This study contributes to the development of sustainable tourism practices in Nepal and the preservation of the mountain environment. The study recognizes the efforts made by the Nepalese government through policies and regulations to address waste management issues. The goal is to protect the fragile mountain ecosystem while facilitating the growth of sustainable mountain tourism.

Novelty: It offers practical recommendations based on stakeholder perspectives, which can inform policy formulation in Nepal and other countries with similar mountain tourism contexts.

INTRODUCTION

Nepal is renowned for its majestic mountains and challenging expeditions that attract mountaineers from all over the world. Mountaineering expeditions have played a pivotal role in the development of tourism in Nepal, attracting climbers and adventurers from around the world. Mountaineering expeditions have historically been the main source of revenue for the Nepali government.

The first ascent of Everest attracted a lot of tourists to Nepal and received a lot of media coverage throughout the world. Following that historic event, there were an increasing number of trips, which piqued the interest of the government in tourism and the financial benefits it offers. The government was moving cautiously to open mountain regions for mountaineering and similar recreational activities because Nepal had only recently (in 1951) opened its border to outsiders (Nepal, 2022).

With the rise in tourism, there has been a significant increase in the waste generated during mountain expeditions, posing a threat to the environment and ecology of the region. In response, the Government of Nepal introduced the Mountaineering Expedition Rules in 2002, which aimed to regulate mountaineering activities, promote responsible tourism and ensure environmental sustainability.

Despite the existence of policies and regulations, challenges in their implementation remain. A study by Sherpa (2022) identified its effectiveness only accounted for waste in the Mt. Everest Base Camp and ignored the increasing waste in the other camps. Furthermore, the harsh climate, remoteness, limited land availability for waste treatment and disposal, and relatively weak infrastructure in the mountain landscape are some of the factors that make waste collection and safe disposal more challenging (Jabeen et al., 2021).

Nepal's mountain tourism sector has emerged as a vital contributor to the national economy and sustainable development of the region. However, weak policies and inadequate implementation efforts have hindered the full potential of mountain tourism in the country. According to Upadhyay (2018) Nepal's tourism policies have not adequately addressed the appropriate development of mountain tourism, resulting in problems with mountaineering expeditions and trekking.

Mountain tourism is responsible tourism, which should be ecologically and culturally sensitive. Therefore, appropriate plans and policies must be in place to ensure the sustainable development of mountain tourism. According to Hardy,

[Beeton, and Pearson \(2002\)](#) the development of sustainable tourism requires an integrated approach that balances environmental conservation, economic development, and social welfare.

As mentioned by Nepal (2000), effective waste management policies must be in place to ensure the sustainable development of mountain tourism in Nepal. Therefore, this study can contribute to the development of appropriate policies and strategies for waste management in mountain expeditions, promoting sustainable mountain tourism.

The Environment Protection Act 2019 and Solid Waste Management Act 2011 have also been introduced to support the Mountaineering Expedition Rules, with specific provisions related to waste management during mountain expeditions. Despite these regulations, there have been reports of inadequate waste management practices, leading to significant pollution in the mountain regions.

The government of Nepal has introduced policies and regulations aimed at addressing the issue of waste management during mountaineering expeditions. The Ministry of Culture Tourism and Civil Aviation (MoCTCA) has made it mandatory for climbers to deposit USD 4,000 as a garbage deposit before receiving their climbing permits ([Climbing Rules, 1981](#)). The deposit is refundable upon the successful completion of the expedition and the return of all the waste generated by the climbers.

In addition, the Sagarmatha Pollution Control Committee ([SPCC](#)) has been established to manage waste in the Sagarmatha National Park, which includes Mount Everest and its surrounding areas ([SPCC, n.d.](#)). The SPCC has implemented a system of designated waste collection and disposal sites at different elevations, with regular waste collection and transportation to the lower elevations for proper disposal.

Despite huge scope, Nepal has been unable to take full benefits of mountains, due to inadequate policies and fragile implementation. The main goal of this study is to evaluate implementation of mountaineering expedition rules 2002 in Nepal. Mountain tourism's growth depends on the government's goals and policies as well as effective stakeholder collaboration. Mountain tourism has not been fully addressed by tourism policy, which has resulted in an imbalanced growth of the tourism sector.

A sufficient focus on mountain tourism is still lacking, despite the 2008 installation of a new tourism policy and Mountaineering and Expedition rules 2059, 2064. The lack of an effective driving force in tourist strategy has prevented it from adequately addressing key aspects of mountain tourism. To make mountain tourism sustainable, responsible, and sensitive—both ecologically and culturally—there is an immediate need for proper implementation of mountaineering and Expedition rules encompassing an integrated approach.

Nepal is a popular destination for mountaineering and trekking activities, but these activities also generate a considerable amount of waste, posing a significant threat to the environment. In response, the Nepalese government has implemented various policies, including the Mountaineering Expedition Rules 2002, Environment Protection Act 2019, and Solid Waste Management Act of 2011, to regulate mountaineering activities and ensure proper waste management. Despite the introduction of these regulations, there have been reports of inadequate waste management practices during mountain expeditions, leading to significant pollution in the mountain regions.

It is therefore essential to explore the perspectives of stakeholders involved in mountain expeditions to understand the challenges in implementing the Mountaineering Expedition Rules and identify potential solutions for effective waste management during mountain expeditions. This literature review aims to provide an overview of the current state of waste management during mountain expeditions in Nepal from a stakeholders' perspective and evaluate the effectiveness of these policies in promoting sustainable waste management practices.

To overcome these challenges, [Manandhar, et al., \(2010\)](#) recommends the development of waste management plans for high-altitude areas, which should include guidelines for climbers on waste management practices. The establishment of waste management facilities at base camps, such as incinerators and composting toilets, has also been recommended. In addition, waste management education should be included in mountaineering training programs to raise awareness among climbers ([Asian Development Bank, 2013](#)).

While policies and regulations aimed at addressing the issue of waste management during mountaineering expeditions in Nepal do exist, challenges in their effective implementation remain. The development of comprehensive waste management plans for high-altitude areas and the inclusion of waste management education in mountaineering training programs are among the solutions recommended by stakeholders.

The study aims to analyze the implementation status of mountaineering expedition rules 2002 from stakeholder's perspectives, particularly in waste management during mountain expeditions. The study further aims to provide practical recommendations and guidelines for sustainable waste management practices during mountain expeditions to minimize negative impacts on the fragile mountain ecosystem and promote responsible tourism in Nepal.

OBJECTIVES OF THE STUDY

The general objective of the study is to analyze the implementation of mountaineering expedition rules 2002 in Nepal. In addition, following are the specific objectives of the study:

- To analyze the current practices and policies related to waste management during mountain expeditions.

- To examine the implementation status of Mountaineering Expedition Rules 2002 through stakeholder's perspective.
- To recommend the most effective methods for minimizing waste and promoting sustainable waste management practices in mountain expeditions.

LITERATURE REVIEW

Mountain tourism

Mountain tourism is a specific type of tourism that takes place in defined geographical spaces characterized by unique landscapes, topography, climate, biodiversity, and local communities (UNWTO, 2022). The history of mountaineering in Nepal dates back to the early 20th century when expeditions to study the country's summits began. Charles Bruce led the first successful expedition to scale Mount Everest from the north side in Tibet in 1921 (Britannica, 1921). Subsequently, the first government-approved climb occurred in 1950 when a group of Sherpa climbers ascended Mount Annapurna IV. The pivotal moment in climbing history came in 1953 when Tenzing Norgay and Sir Edmund Hillary successfully reached the summit of Mount Everest from the Nepalese side (Conefrey, 2014). These accomplishments attracted global attention, sparking interest in mountaineering, and contributing to the growth of tourism in Nepal.

The development of mountaineering expeditions in Nepal played a significant role in the country's tourist industry. Maurice Herzog's successful ascent of Mount Annapurna I in 1950 drew numerous mountaineers to Nepal (Horrell, 2016). The 1950s, also known as the "golden era" of Nepalese mountaineering, witnessed an increase in climbing activity and mountaineering-related tourism as all 8000-meter peaks were successfully scaled (Dhital, 2009). The government recognized the economic potential of mountaineering expeditions, leading to the opening of more Himalayan peaks for climbing over the years (Mt Everest Today, 2023).

Mountaineering expeditions are not without challenges, including the inherent dangers of falls, avalanches, altitude sickness, adverse weather conditions, and logistical difficulties (Ghazali & Thinaranjeneey, 2015). However, the benefits of mountaineering include enhancing resilience, mental health, physical fitness, camaraderie, and teamwork among participants (Discover Altai, n.d.). The history of mountaineering in Nepal is marked by notable achievements, such as the first American summit of Everest by Jim Whittaker in 1963 (Shnayerson, 2012) and the first ascent of the challenging south face of Annapurna I by a Japanese team in 1975 (Nepal Guide Treks & Expedition, n.d.).

Mountaineering expeditions have played a pivotal role in the development of tourism in Nepal, attracting climbers and adventurers from around the world. Despite the inherent risks, the challenges faced during these expeditions contribute to the allure and appeal of mountaineering. The history and achievements in Nepalese mountaineering serve as a testament to the indomitable human spirit and the rewards that can be gained through perseverance and exploration.

Expedition

Expedition refers to mountaineering, which involves setting up a fixed line of stocked camps on the mountains which can be accessed at one's leisure, as opposed to Alpine style where one carries all of one's food, shelter, equipment etc. as one climbs. Mountaineering Expedition are arranged to allow extreme mountaineers the freedom to explore the Himalayas for an extended period as they reach their destination. The primary objective of a mountaineering expedition is to get to the top of a high mountain which in the past has withstood all attempts to conquer it. But it should not be presumed that the expedition is a complete failure if he doesn't reach the destination. Sir. Alfred wills ascend of the Swiss Wetterhorn in 1865, is considered as the start of Mountaineering.

For the Nepali government, mountaineering expeditions have been its main source of income. Everest's initial ascent generated tremendous media attention around the world and attracted large numbers of tourists to Nepal. Following that historic occurrence, there were a growing number of excursions, which sparked government interest in tourism and the financial advantages it provides. Since Nepal had only recently (in 1951) opened its border to outsiders, the government was proceeding cautiously in opening mountain regions for mountaineering and related recreational, of the total mountains, more than 119 (36.5%) have not been completed. In 1981, only 122 Himalayan peaks were opened for expedition, and by 2008, there were 326 peaks that are permitted for climbing (Marasini, 2020).

International mountaineering standards

Safety requirements and guidelines for climbing gear and mountaineering have been established by the International Climbing and Mountaineering Federation (UIAA). The UIAA has set standards for ethical mountaineering and environmental preservation, as well as a global climbing difficulty grading system (UIAA Climbing Grades). In addition, the UIAA has created regulations for climbing trips and guidelines for competition climbing, which are followed by climbers and mountaineers worldwide. The UIAA and other organizations have also established best practices for alpine climbing, including methods for safe climbing, rope management, and glacier transit. (UIAA, 2021)

Best practices for alpine climbing have been established by the UIAA and other organizations, including methods for effective and safe climbing, rope management, and glacier transit. To ensure their safety and success in the mountains, climbers and mountaineers all around the world follow certain procedures.

History of Mountaineering Expedition in Nepal

Expeditions in mountaineering, though, are not without difficulties. The danger of harm or death represents one of the largest obstacles. Mountaineering is one of the most hazardous adventure activities, with a high rate of fatalities from falls, avalanches, and altitude sickness. Additionally, harsh weather, challenging terrain, and logistical difficulties can make the journey physically and mentally taxing for expedition members ([Karki, 2023](#)).

Mountaineering trips can have a lot of advantages despite these difficulties. Mountaineering can enhance resilience, mental health, and physical fitness. As they cooperate to accomplish a common objective, it can also promote a sense of camaraderie and teamwork among expedition participants ([Discover Altai, n.d.](#)).

A series of trips to investigate the many peaks of Nepal marked the beginning of mountaineering in the country in the early 20th century. Charles Bruce, who was in charge of one of the first successful expeditions, led his crew in 1921 when they scaled Mount Everest from the north side in Tibet, which at the time was a part of Nepal ([National Geographic, 2016](#)). Mountaineering history of Nepal has begun in the early 1920's. George Mallory and Andrew Irvine in the 1920's first attempted to climb the world's highest peak mount Everest. The official first attempt to conquer the majestic mountain was attempted by them. However, they could not return from their last adventure. But this attempt became legendary tale to mountaineers. In the 1999 body of the late George Mallory was discovered by the climbers. Despite the attempts not Everest but Annapurna I was the first climbed mountain of Nepal, and this was achieved by group of French people led by Maurice Herzog in 1950 ([Trek Nepal, 2021](#)) .

Sir Edmund Hillary and Tenzing Norgay made the first successful attempt to climb Mount Everest from the Nepalese side on May 29, 1953 ([Trek Nepal, 2021](#)). The first American expedition team made an attempt to ascend Mount Everest from the south side of Nepal in 1960. Jim Whittaker, who would go on to become the first American to climb Everest the following year, was part of the crew that was commanded by Norman Dyhrenfurth ([Shnayerson, 2012](#)).

One of the world's most challenging climbs, the south face of Annapurna I (8,091 meters), was conquered by a Japanese team led by Takashi Amemiya for the first time in 1975 ([MyPrideNepal, 2019](#)).

All things considered, mountaineering trips are a distinctive and difficult sort of adventure tourism that has enthralled people for years. Even though they have inherent risks, climbing a peak and overcoming the obstacles along the way can have tremendous benefits.

Challenges and Opportunities in Implementing Mountaineering Regulations in Nepal

More mountaineers are traveling to Nepal leading to mountaineering regulations being emerged as a critical issue. Regulations must be in place to maintain public safety and environmental sustainability, but doing so presents both enormous opportunities and obstacles.

However, Nepal has been unable to take use of the tremendous potential of mountain tourism because of poor legislation and shaky implementation efforts. The proper development of mountain tourism has not been fully addressed by tourist authorities, which has led to issues with mountaineering expeditions and trekking. Implementation is being hampered by slow, unworkable policies and tactics, a lack of vision and expertise, and strict bureaucratic rules and procedures. Political unrest is another significant element. ([Upadhyay, 2018](#))

Balancing economic interests with safety is another difficulty. Mountaineering tourism is a significant source of income for the Himalayan people since farming is limited in these locations due to the harsh weather conditions and poor cultivation, tourism plays a vital role in generating income. Mountain tourism pays villagers between 150 and 250 million Nepali rupees each year in salary and other services. It supports 917 trekking agencies with a management team of over 6000 people and a field force of around 9,000 people. ([Joshi, 2022](#))

The implementation of mountaineering restrictions, however, also offers opportunity. For instance, it might support the promotion of eco-friendly travel methods. Regulations can be utilized to limit the number of climbers, lessen negative effects on the ecosystem, and support ethical tourism activities. This can help to protect the mountains' pristine appearance and guarantee their long-term viability. ([Gautam, 2023](#))

Additionally, putting regulations into place can increase safety for both climbers and the neighborhood rules in ensuring that mountaineers have access to the right tools, guides, and support systems. This can increase community safety by lowering the likelihood of mishaps and fatalities in the mountains. ([Wall, 2021](#))

There are possibilities and challenges associated with adopting climbing laws in Nepal. Regulations can aid in promoting sustainable tourist practices and enhancing safety for climbers and local populations, even with limitations like insufficient resources and the need to balance safety with economic interests.

Government's Effort on Minimizing Waste on a Mountaineering Expedition- Literature Perspective

The Environment Protection Act 2019 provides a comprehensive legal framework for the management and protection of the environment in Nepal. The act includes provisions for the prevention and control of pollution, including waste management. It mandates that all individuals, institutions, and industries take responsibility for managing their waste in an environmentally sustainable manner.

The Solid Waste Management Act of 2011 provides a legal framework for the management of solid waste in Nepal. The act aims to promote sustainable waste management practices and establishes guidelines for the segregation, collection, transport, and disposal of waste. It also mandates the establishment of waste management facilities, including landfill sites, and promotes the reuse and recycling of waste.

The Mountaineering Expedition Rules 2002 govern mountaineering activities in Nepal, including waste management practices. The rules require mountaineers to bring back all non-biodegradable waste generated during their expeditions and dispose of it in designated areas. They also mandate the provision of adequate waste management facilities at base camps and high-altitude camps.

In the study by (Maharjan, et al., 2019) the authors found that there has been the formulation of new laws and policies, however, most of them were poorly implemented by both government as well as from the citizens of the country. Lack of involvement of citizens in the strategy and poor decision-making process has made difficult to complete, functioning waste management service to be fulfilled. An attentive implementation of the current policies and laws will rally the immediate problem of SWM. (Asian Development Bank, 2013)

In the article by (Asian Development Bank, 2013), the authors analyzed the implementation of the Solid Waste Management Act in Nepal, it was found that the act faced several challenges, including a lack of adequate resources, technical expertise, and political will. The authors recommend the establishment of a multi-stakeholder approach involving the government, private sector, and civil society to promote sustainable waste management practices.

The Nepalese government has implemented various policies, including the Mountaineering Expedition Rules 2002, Environment Protection Act 2019, and Solid Waste Management Act of 2011, to regulate mountaineering activities and promote sustainable waste management practices. However, the literature suggests that there are still challenges in the implementation of these policies due to a lack of adequate resources, technical expertise, and political will. To address these challenges, a multi-stakeholder approach involving the government, private sector, and civil society is recommended to promote sustainable waste management practices and minimize the environmental impact of mountaineering expeditions.

CONCEPTUAL FRAMEWORK

This research paper investigates the awareness and implementation of the Mountaineering Expedition Rules 2002 in Nepal, specifically focusing on waste management during mountain expeditions. The conceptual framework consists of seven dimensions: awareness of rules, planning and preparation, waste reduction, waste segregation, waste transportation, disposal, and waste storage.

The first dimension evaluates stakeholders' awareness of the rules and their perception of their importance in waste management. The second dimension assesses the incorporation of waste management strategies in expedition plans and the effectiveness of planning and preparation. The third and fourth dimensions examine waste reduction and segregation practices during expeditions. The fifth dimension explores stakeholders' perspectives on waste transportation logistics. The sixth dimension focuses on compliance with waste disposal regulations, while the seventh dimension evaluates waste storage facilities. By analysing these dimensions, this research aims to provide insights into stakeholders' perspectives and identify areas for improvement in the implementation of waste management rules during mountain expeditions in Nepal.

METHODS

Research Design

The aim of the study is to examine the implementation of mountaineering expedition rules in Nepal. Therefore, the study has used descriptive research design using mixed (quantitative and qualitative) approach. The rationale of using descriptive research design is that the study tries to describe and connect to the role of mountaineering and expedition policy in betterment of the mountain expedition and the upliftment of people involved within it. In the study the primary data collection source has been used and descriptive data analysis techniques are implemented for the data analysis.

Population and Sampling

All the people who have completed mountain expedition in Nepal at least once and the people who are involved with Nepal Mountaineering Institute (NMA) were the universe of the study. For the study non-probability sampling method has been used. Under the non-probability sampling method, the study used purposive sampling method from which only 23 climbers who have completed the mountain expedition at least once, higher level officers from NMA and DOT had been selected as the sample to collect the primary data.

Respondents Profile

In the study, most of the sample were male (87%), and the rest were female (13%). In terms of age, most of the sample fell within the range of 20-30 years (82.6%), while only a small portion of the sample were aged between 31-40 years (17.4%). The majority of the respondents were Hindu (73.9%), followed by Buddhist (13.0%), Islam (8.7%) and others (4.3%). Regarding marital status, most of the respondents were single (65.2%), while 30.4% were married and 4.3% chose other options. In terms of education, more than half of the respondents had a master's degree (52.2%), while 34.8% had a bachelor's degree and 13.0% had completed Higher Secondary education. Regarding income, most respondents did not

disclose their income (34.8%), while the rest fell within the range of 15001-25000 (21.7%), 25001-35000 (8.7%), 35001-45000 (21.7%) and 45000 and above (13.0%).

Table 1: Demographics of the sample

Variables	Category	N	Percentage
Gender	Male	20	87
	Female	3	13
Age	20-30	19	82.6
	31-40	4	17.4
Religion	Hindu	17	73.9
	Buddhist	3	13
	Islam	2	8.7
	Others	1	4.3
Marital Status	Married	7	30.4
	Single	15	65.2
	others	1	4.3
Education	Higher Secondary	3	13
	Bachelors	8	34.8
	Masters	12	52.2
Income	15001-25000	5	21.7
	25001-35000	2	8.7
	35001-45000	5	21.7
	45000 and above	3	13
	Rather not say	8	34.8
Total		23	100

Source: Survey 2023

Instrumentation

The instruments used in this study include a structured questionnaire for the mountain expeditors and a checklist for the key informant interviews. The questionnaire used a five-point Likert scale to collect quantitative data, the five-point Likert Scale had ranges from unaware to aware for awareness of rules were unaware was rated 1 and aware was rated as 5. Likewise, never to always for other dimensions, where never was stated as 1 and always was stated as 5. Checklist was used as a guide for in-depth interviews with higher level officers of NMA, DOT; MoCTCA.

Table 2: Reliability Analysis

Dimension	Cronbach's Alpha	Number of items(Likert Scale)
Mountain Expedition Rules	0.886	20

Source: Descriptive statistics of the survey data 2023

The assessment of instrument reliability in mountain expedition research is crucial for ensuring accurate data collection and valid research outcomes. Since Cronbach's Alpha score is 0.886, we can conclude that the instruments used for the study were reliable.

RESULT ANALYSIS

The data collected through the instruments were arranged, coded, and presented in tabular form, then descriptive statistics were used. Excel 2016 and SPSS-26 were used for the analysis of quantitative data, and the qualitative data were summarized through content analysis.

POLICY ANALYSIS

Environment Protection Act 2019

The Environment Protection Act, 2076 (2019) (the "Act") was passed by Parliament on July 19, 2019. The previous Environment Protection Act, 2053 (1997) (referred to as the "1997 Act") is now repealed.

The EPA 2019 of Nepal has set out a waste management policy framework that covers all aspects of waste management, including collection, transportation, disposal, and recycling. (Rai, Nepal, Khadayat, & Bhardwaj, 2019) The policy emphasizes the need for an integrated approach to waste management that involves all stakeholders, including the government, private sector, and civil society. The EPA 2019 also mandates the creation of an Integrated Solid Waste Management (ISWM) plan, which outlines the strategies and actions required to manage waste in a sustainable manner.

One of the key strengths of the waste management policy of the EPA 2019 is its focus on the 3R principle of waste management: reduce, reuse, and recycle (Kedar & Adhikari, 2015). The policy recognizes that waste reduction is the most effective way of managing waste and promotes the use of eco-friendly products and practices. The policy also encourages the reuse of waste materials and promotes the recycling of waste materials, particularly plastics, which are a significant environmental challenge in Nepal.

However, there are some challenges with the implementation of the waste management policy of the EPA 2019. One of the primary challenges is the lack of infrastructure and resources for waste management (Rai, Nepal, Khadayat, & Bhardwaj, 2019). Nepal faces significant challenges in waste collection and transportation due to the rugged terrain, inadequate road networks, and limited resources. There is also a lack of awareness and education among the general public on the importance of proper waste management practices.

To address these challenges, the EPA 2019 needs to be supplemented with additional policies and regulations that provide for the allocation of resources and infrastructure development. Additionally, the government needs to invest in public education and awareness campaigns to promote proper waste management practices.

In conclusion, the waste management policy of the EPA 2019 of Nepal is a step in the right direction towards sustainable waste management (Kedar & Adhikari, 2015). The policy's emphasis on the 3R principle and the creation of an ISWM plan is commendable. However, more needs to be done to address the challenges facing waste management in Nepal, including the lack of infrastructure and resources and the need for public awareness and education.

The Solid Waste Management Act 2011

The Solid Waste Management Act of 2011 was passed by the Nepali government and went into force on June 15, 2011. The Solid Waste Management Act 2011 is a legislation passed by the Government of Nepal to provide a legal framework for the management of solid waste in the country. The act aims to promote sustainable solid waste management practices and reduce the negative impact of solid waste on public health and the environment (Government of Nepal, 2011).

The act defines solid waste as any garbage, refuse, sludge, or other discarded material, including solid, semisolid, and liquid waste generated from domestic, commercial, industrial, or other sources. It mandates the segregation of solid waste at the source, collection and transportation of segregated waste, processing, and disposal of waste in an environmentally sound manner.

In the context of mountain expeditions, the Solid Waste Management Act 2011 is relevant in ensuring the proper management of solid waste generated by climbers, trekkers, and other expedition members. The act requires that solid waste generated in the mountains should be segregated at the source, and measures should be taken to minimize waste generation.

Additionally, the act mandates the establishment of facilities for the treatment and disposal of solid waste generated in the mountains. It requires that the facilities be in an environmentally sound manner and be operated in compliance with the regulations prescribed by the government. The act also imposes penalties for non-compliance, which include fines and imprisonment. Therefore, the Solid Waste Management Act 2011 is an essential legislation that provides a legal framework for the management of solid waste in Nepal, including in the context of mountain expeditions.

Mountain Expedition Rules 2002

The Mountain Expedition Rules 2002 is a set of regulations that govern the management of mountain expeditions in Nepal. These rules were enacted to ensure the safety and well-being of climbers and to protect the environment of the mountain regions.

In terms of waste management during expeditions, the Mountain Expedition Rules 2002 mandate that all expedition groups must carry their waste and garbage from base camp to the final destination. The rules require climbers to segregate their waste into biodegradable and non-biodegradable categories and dispose of them in an environmentally friendly manner. The rules also require climbers to bring back all non-biodegradable waste with them from the mountain.

Furthermore, the Mountain Expedition Rules 2002 mandate that all expeditions must have a designated waste management officer who is responsible for ensuring the proper disposal of waste generated by the expedition. This officer is required to maintain a record of all waste generated and disposed of by the expedition.

Proper waste management during mountain expeditions is crucial for preserving the environment and protecting the health of climbers and the local community. Inadequate waste management can lead to pollution, water contamination, and other environmental problems. Therefore, it is essential to follow the rules and regulations set out by the Nepali government to ensure the proper management of waste during mountain expeditions.

According to research conducted by (Nyaupane, Musa, Higham, & Thompson-Carr, 2015) proper waste management practices during mountain expeditions are critical for the preservation of the environment and the protection of the climbers and local communities. The researchers noted that inadequate waste management practices can lead to environmental pollution, degradation of natural resources, and increase the accidents.

Similarly, the study conducted by Kuniyal (2005) highlighted the importance of effective waste management practices during mountain expeditions. A person in a civilized society needs to work very closely together to manage waste. The

district administration, non-governmental organizations, research institutions, and all law-abiding tourists and villagers will need to take proactive measures to manage their garbage in a coordinated manner.

In conclusion, the Mountain Expedition Rules 2002 of Nepal are essential regulations that aim to ensure the safety and well-being of climbers and protect the environment of the mountain regions. Proper waste management practices during mountain expeditions are critical for the preservation of the environment and the protection of the health of climbers and local communities. It is crucial to follow the rules and regulations set out by the Nepali government to ensure the proper management of waste during mountain expeditions.

In terms of garbage management, all three of these regulations emphasize the importance of proper waste management practices to protect the environment. The Mountain Expedition Rules 2002 and the Solid Waste Management Act 2011 specifically require the segregation, storage, transportation, and disposal of waste to prevent pollution and protect the environment. The Environment Protection Act 2019 aims to regulate the discharge of pollutants and other harmful substances into the environment and to promote sustainable development practices. Mountain Expedition Rules 2002, Solid Waste Management Act 2011, and Environment Protection Act 2019 all have provisions and policies related to waste management during mountain expeditions in Nepal.

Mountain Expedition Rules 2002 mandate that mountaineers must bring back all non-biodegradable waste, including oxygen cylinders, plastics, and metals. They also require that mountaineers use portable toilets and bring back all human waste. The rules specify that expedition organizers must obtain a permit and provide insurance for the climbers.

Solid Waste Management Act 2011 aims to promote proper waste management practices across Nepal, including in mountainous regions. The act requires waste segregation, collection, transportation, and disposal in an environmentally friendly manner. The act also encourages the use of waste reduction and recycling techniques.

Environment Protection Act 2019 establishes a legal framework for environmental protection in Nepal. The act aims to conserve and manage natural resources, including mountains and their surroundings. It prohibits any activity that causes environmental degradation, including improper waste disposal.

Overall, these laws have provisions and policies that focus on promoting waste management practices during mountain expeditions in Nepal. These regulations emphasize the need for responsible waste management practices to protect the environment and promote sustainable development. They highlight the importance of reducing waste, segregating waste, and disposing of waste properly to minimize the impact of human activities on the environment.

Quantitative Analysis

Awareness and Implementation of Mountain Expedition Rules: a climbers' overview

All the respondents on the survey were asked with a set of structured questionnaires regarding the awareness and implementation of Mountain Expedition Rules 2002 to understand their understanding about the waste management policy in mountain expedition and to know the implementation status of the waste management policy of mountain expedition rules. The questions were developed on various dimensions like Awareness of Rules, Planning and Preparation, Waste Reduction, Waste Segregation, Waste Transportation, Disposal, Waste Storage of which the question was developed on a five-point Likert scale of unaware to aware for awareness of rules and never to always for other dimensions. The result of the survey is given below on table 2.

Table 2: Descriptive analysis of awareness and Implementation of Mountain Expedition Rules

Dimensions of implementations	Mean	Std. Deviation
Awareness of Rules	3.94	0.858
Planning and Preparation	3.85	0.872
Waste Reduction	4.33	0.717
Waste Segregation	4.01	0.721
Waste Transportation	3.43	0.802
Disposal	3.91	0.913
Waste Storage	3.74	1.054
Mountain Expedition Rules	3.88	0.598

Source: Survey 2023

Awareness of Rules: On average, respondents had a moderate to high level of awareness regarding the rules related to waste management during a mountain expedition. The mean score of 3.94 (SD=0.858) of awareness of rules indicates that climbers are mainly aware about the potential risks on mountain expeditions and the environmental impact caused by waste on mountain expeditions. However, it shows that some climbers may still be unaware of some rules, which could lead to improper waste management and negative environmental impacts. The result shows that the climbers are unaware about the 3R principle of waste management which is one of the key components of MER.

Planning and Preparation: On average, respondents had a moderate to high level of planning and preparation related to waste management during a mountain expedition. The mean score of 3.85 (SD= 0.872) of planning and preparation shows that climbers do not use appropriate equipment and do not determine the possible waste before going for mountain

expeditions which suggests that they may still not be fully prepared or may lack proper planning, which could lead to ineffective waste management and negative environmental impacts.

Waste Reduction: On average, respondents were quite successful in reducing waste during a mountain expedition. The result shows the mean score of 4.33 (SD= 0.717) of waste reduction suggests that climbers mostly reduce the amount of packaging of products and also use recyclable items while going for mountain expeditions. It also suggests that some respondents may still be generating significant amounts of waste, which could lead to negative environmental impacts.

Waste Segregation: On average, respondents were quite successful in segregating waste during a mountain expedition. The result shows the mean score of 4.01 (SD= 0.721) of waste segregation which suggests that the climbers use separate disposal technique and use separate bins for waste disposals. However, climbers are found to be lacking of training on segregation technique of waste, also due to lack of training some climbers may still be improperly segregating waste, which could lead to negative environmental impacts.

Waste Transportation: On average, respondents were somewhat unsuccessful in transporting waste during a mountain expedition. The mean score 3.43 (SD= 0.802) of waste transportation shows that improper waste transportation could lead to littering or other negative environmental impacts. The result of survey shows that the climbers carry down all the waste back from expedition as much as possible however, the unavailability of facilities like helicopter to carry down waste makes it very difficult for the climbers to bring down waste making them to leave wastes behind on mountains.

Disposal: On average, respondents were moderately successful in disposing of waste during a mountain expedition. It is found that the climbers successfully follow 3R (reduce, reuse and recycle) principle while on mountain expedition. The mean score 3.91 (SD= 0.913) of Disposal suggests that, though they follow 3R principle, it is also found that it is difficult for climbers to recycle waste and compost it as they have to carry all the waste back by themselves. The potential negative of it is that improper waste disposal could lead to negative environmental impacts, such as soil or water pollution.

Waste Storage: The respondents were moderately successful in storing waste during a mountain expedition as they are less likely to set up trash bins on different places on route for expedition. The mean score 3.74 (SD= 1.054) of waste storage suggests that the potential negative of improper storage of waste during expedition is that it may cause the thrown-out waste to be covered under ice during the time of them climbing up and returning leading to the prevention of decomposition of the waste. The improper waste storage could also lead to littering or other negative environmental impacts.

The overall result of the study suggests that climbers have a moderate to high level of awareness and implementation of the Mountain Expedition Rules (MER) related to waste management during a mountain expedition. While climbers are mostly aware of potential risks and environmental impacts caused by waste, some climbers may still lack knowledge about certain rules, such as the 3R principle of waste management.

In terms of planning and preparation, climbers have a moderate to high level of planning and preparation related to waste management during a mountain expedition. However, some climbers may still lack knowledge about proper planning and equipment, which could lead to ineffective waste management and negative environmental impacts.

Regarding waste management, climbers were quite successful in reducing waste and segregating waste during a mountain expedition. However, waste transportation and disposal are areas where climbers need to improve, as improper waste transportation and disposal could lead to littering or other negative environmental impacts.

Overall, climbers have a moderate to high level of awareness and implementation of MER related to waste management during a mountain expedition. However, there is still room for improvement, particularly in waste transportation and disposal. Proper trash management is critical for environmental preservation, while inappropriate waste management can result in negative environmental impacts such as littering, pollution, and other risks. As a result, it is critical to educate and teach respondents on the best waste management procedures for mountain adventures in order to reduce negative environmental impact and promote sustainable tourism.

Content Analysis

Adequacy of directives on Mountain Expedition Rules 2002

The responses provided present a range of viewpoints regarding the sufficiency and safety of waste management directives outlined in the Mountaineering Expedition Rules 2059. Some respondents acknowledge the adequacy of the directives but raise concerns about non-compliance among companies. They propose that training programs specifically focused on waste management could be a viable solution to enhance adherence.

"It's inadequate needs much more amendments"- Informant-7

"Yes, a lot of climbers are aware, and waste are being managed by the climbers themselves"-Informant-16

"Yes, it is adequate but all of it needs to be implemented strictly"- Informant-18

Others emphasize the importance of strict compliance with government-issued directives and the establishment of robust policies to address waste management during mountain expeditions.

They suggest that the formulation and implementation of stringent rules and policies, along with training and seminars for responsible individuals, would be effective measures. However, one respondent argues that the existing directives may be inadequate and require revision by experts to align with changing times and technological advancements.

In summary, these responses highlight the significance of compliance, education, robust policies, and regular review and modification of rules to ensure effective waste management during mountain expeditions. While one contributor proposes the need for expert modification of the current guidelines to accommodate modern technologies and evolving social norms. Overall, these insights underscore the importance of compliance, education, rigorous standards, and periodic rule review and amendment to ensure efficient waste management during mountain trips.

Education on use of specialized equipment's

The respondents expressed concerns about the insufficient education and awareness pertaining to specialized equipment and responsible waste management practices. They emphasized the importance of reducing waste generation and minimizing environmental impact by promoting the use of recyclable materials and adopting a lightweight approach to mountain expeditions.

"Pre-expedition briefing and regular training"- Informant- 13

"We must be honest, and we follow mountain rules and discipline and respect"- Informant- 1

Furthermore, they recommended leveraging local resources and establishing waste management facilities operated by local staff. The respondents suggested implementing policies that encompass the construction of waste disposal facilities, strategic placement of trash receptacles along hiking trails, and the initiation of composting and recycling programs. They also advocated for the imposition of restrictions on the number of climbers and the enforcement of strict regulations for expedition businesses to ensure responsible mountain trips.

Suggestions on improving existing directives on Mountaineering Expedition Rules 2002 by climbers

As stated by the climbers, several improvements need to be made to the policies outlined in the Mountaineering Expedition Rules 2002. These changes need to address various concerns, such as the proper disposal of trash by requiring it to be returned to Kathmandu and the prevention of digging and destruction in mountainous areas.

"More inclined to environmental aspects, safety, and health of Sherpas."- Informant-14

"The policy is up to the mark, but it is necessary to follow in a proper and respective manner."- Informant-23

To ensure well-prepared expedition teams, the respondents recommended implementing more comprehensive management practices, including providing teams with prior training. Additionally, the importance of prioritizing the environment, safety, and well-being of Sherpas was emphasized.

A specific policy change proposed was the modification of Rule 4, Sub-rule 2, to grant teams more flexibility in their explorations. The respondents also suggested that the Nepalese government invest in new, specialized equipment for trash disposal and establish effective monitoring methods to oversee expedition teams following their summit attempts. Lastly, they called for the implementation of stringent rules and legislation applicable to all groups engaging in mountaineering adventures.

Future improvements that can be made to improve responsible waste management practices in mountain expeditions

To promote ethical waste management practices among mountaineering expeditions, several measures can be implemented. Firstly, it is essential to establish a robust waste management system and enforce regulations for waste disposal. The provision of adequate trash cans and dustbins at strategic locations along the expedition routes is crucial.

"Installation of bins and trash collectors. One set trash bin in every 4 hours of hike."- Informant-11

"Nepal government should purchase new latest specialized equipment for waste management, and there should be proper checkback systems after summiting the expenditure teams. Strict laws and regulations should be implemented for all the teams who goes to expeditions."- Informant-23

Additionally, conducting educational programs on waste management techniques and raising awareness among expedition participants is imperative, as education plays a pivotal role in fostering responsible practices. Moreover, the formulation and implementation of laws and regulations specifically targeting environmental contamination in mountainous regions are essential. Governments, such as the Nepalese government, should allocate investments towards acquiring specialized waste management equipment and establish monitoring processes to ensure proper waste disposal following expeditions.

Policy Makers perspective towards Mountaineering Expedition Rules 2002

The major theme of the question was the implementation of tourism policies in Nepal, particularly regarding solid waste management in the mountains. According to the Informant from Nepal Mountaineering Association (NMA), it has implemented policies to encourage climbers and expedition operators to bring back their garbage and manage it properly. However, the implementation of these policies faces several challenges, such as the difficulty in monitoring climbers and the accumulation of waste in established camps.

One major positive aspect of the policies is that they promote responsible tourism and environmental conservation in the mountainous regions of Nepal. By requiring climbers and expedition operators to manage their waste properly, the policies help protect the fragile ecosystems and prevent pollution. Additionally, the policies encourage collaboration between the government, NGOs, and private sector to address environmental issues.

On the other hand, some of the challenges faced in implementing these policies can be seen as negative aspects. For example, the difficulty in monitoring climbers and the accumulation of waste in established camps shows that the policies may not be fully effective in their current form. Additionally, the fact that the Nepali Army has taken over some of the NMA's responsibilities for mountain cleaning shows that there may be issues with the NMA's capacity or resources to implement the policies.

Overall, the implementation of tourism policies in Nepal regarding solid waste management in the mountains has both positive and negative aspects. While the policies promote responsible tourism and environmental conservation, challenges in their implementation suggest the need for continued efforts to improve their effectiveness.

Likewise, Informants from Department of Tourism (DOT), Ministry of Culture, Tourism and Civil Aviation (MOCTCA) added that lack of Budget, lack of self-awareness and self-discipline of expeditors, and the cost to remove waste from mountains especially human bodies of people who died during expedition are some of the major problems causing waste on mountains.

Nepal Army bringing out tender for cleaning campaign every year and them conducting it have been found to be unsatisfactory in case of NMA and DOT.

Some of the major problems as highlighted by the key informants were:

"The existing policies on Mountaineering Expedition are not practical and needs an amendment" – Key Informant- 1

"There is an unhealthy competition between different expediting agencies for organizing cleaning campaigns" - Key Informant- 2

"NMA and NTB should be able to run the cleaning campaigns and not Nepal Army as they have proper information, knowledge and Expertise about the mountain" -Key Informant- 3

"Public Awareness program conducted by Sagarmatha Pollution Control Committee (SPCC) is only adequate for the Everest region and it should be conducted on other peaks as well"- Key Informant- 4

According to key informant from NMA, only 10% of the income obtained from the garbage deposit fee is provided to the Environment Committee of NMA for organizing cleaning campaign which is not a huge budget to organize the campaign. Also, it is found from the interview that NMA in coordination with other stakeholders is planning to organize plantation campaigns in the mountainous regions of Nepal, to highlight the importance of the afforestation in mountainous region.

"To save mountain, we have to do plantation and preserve habitats of animals which can survive in the region which would benefit on saving the environment and mountain"- Key Informant -4

According to most of the informants, the waste, especially non-degradable waste on mountains takes approximately 5 hundred years to decay because of the cold weather and even one banana peel takes 6 months to decay. NMA in 2019 collected 65,000 tons of plastics and 5 dead bodies from Everest. But the informants have dissatisfaction on government providing tender of cleaning campaign of Everest to Nepal Army for 3 years in a row despite of having various agencies to organizing cleaning campaigns and they are bidding their tenders as well. They further added that creating awareness among the tourists especially Asian is very necessary because they are found to be more reluctant and contributing more to pollution in comparison.

According to the informants from DOT they are planning to establish funds to set up to operate tender for organizing cleaning campaigns on other mountains as well under its jurisdiction. Likewise, they are planning on establishing other departments like SPCC in every mountain.

DISCUSSION

The study found that the existing policies on waste management during the mountain expeditions are considered impractical and challenging to implement. The stakeholders need to propose a rotational approach for the cleaning campaign, where different agencies take turns to participate and involve in the cleaning efforts.

It is found that climbers and expedition teams should be educated about the hazards of waste in the mountains and be held accountable for bringing back the trash they generate. Several studies and literature support the arguments and provide insights into waste management on mountain expeditions. For example, a study by (Esfahani, 2014) highlights the importance of education and awareness among climbers regarding the impacts of waste in mountain environments. It emphasizes the need for climbers to take responsibility for their waste and adopt practices that minimize their environmental footprint.

Furthermore, the findings emphasize the need for increased government involvement and allocation of adequate budget for the cleaning campaigns, as it is found the current level of support is insufficient. The stakeholders also advocate for implementing a limit on the number of climbers per season. Research by (Byers, Gustafsson, Shrestha, & Chhetri, 2020)

emphasizes the significance of effective governance and policy implementation in waste management on mountains. It underscores the need for dedicated monitoring teams, proper enforcement of regulations, and adequate government support to ensure successful waste management initiatives.

Despite mountaineering being a significant contributor to the country's economy, the support provided by the government to mountaineering agencies is inadequate, and the allocated budget for cleaning campaigns falls short. As a result, cleaning campaigns are primarily conducted on popular mountains like Mt Everest and Annapurna, while other mountains are neglected. It is evident that climbers and guides must cultivate a sense of responsibility during expeditions and make a concerted effort to bring back as much garbage as possible, leaving no waste behind.

Study reveals that although expedition teams are aware of the waste management policies, there is a lack of proper enforcement. There is no dedicated team for monitoring waste management and ensuring policy compliance on the mountains. While teams are required to prepare checklists and deposit a certain amount of garbage before embarking on the expedition, there seems to be an imbalance between the goods brought in and the garbage brought back. Additionally, due to snow covering the waste left behind, it becomes difficult to locate and clean up the garbage effectively.

The study found that increasing self-awareness, mobilizing available funds, conducting regular cleaning campaigns, and ensuring proper use of human waste bags by climbers and expedition teams can contribute to addressing waste management challenges in mountain expeditions. Amendments should be made to existing policies, and the funds collected through garbage deposits ought to be effectively utilized and allocated for cleaning campaigns.

CONCLUSION

The study found that waste management on mountains in Nepal during expeditions requires improvement. While climbers have a moderate to high level of awareness and implementation of waste management practices, challenges such as budget constraints, lack of self-awareness among expeditioners, and the long decay time of waste in cold weather persist.

The relevancy of the study findings lies in their potential to inform policy decisions and interventions to address waste management challenges on mountains in Nepal. The importance of effective policy implementation in this area cannot be overstated, as poor waste management can have significant environmental and public health implications. Possible suggestions to mitigate the problem may include amending policies, reducing competition among expedition agencies, increasing public awareness, and involving relevant organizations in organizing cleaning campaigns.

IMPLICATIONS

The study suggests that there is a need for greater attention to waste management policies and practices in mountain expeditions in Nepal. The study identified several challenges and obstacles to policy implementation, including the lack of budget, lack of self-discipline among expeditioners, and the cost of waste removal, among others. Despite these challenges, the study found that climbers generally have a moderate to high level of awareness and implementation of proper waste management practices.

POLICY RECOMMENDATIONS

To effectively manage waste in mountain expeditions, a comprehensive approach is needed that involves strengthening existing policies, increasing public awareness, improving waste transportation and disposal, involving relevant authorities in cleaning campaigns, and establishing a waste management fund. The Nepal Mountaineering Association's policies on responsible tourism and environmental conservation should be further strengthened, and mechanisms for monitoring compliance should be put in place.

Public awareness campaigns targeting expeditioners, mountaineers, and local communities should be implemented. Measures should be taken to improve waste transportation and disposal facilities in mountain regions, and expedition agencies should be required to properly dispose of their waste. The Nepal Mountaineering Association and Nepal Tourism Board should take the lead in organizing cleaning campaigns and involve local communities and relevant authorities. The Department of Tourism should establish a waste management fund to support waste management initiatives in mountain regions, which could be used to operate tenders for organizing cleaning campaigns and establishing Solid Waste Management departments in every mountain.

Overcoming obstacles such as budget constraints, lack of coordination among relevant authorities, and the need for effective monitoring and enforcement mechanisms will be necessary for the successful implementation of these policies. However, the benefits of implementing these policies would be significant, including improved environmental conservation, increased public awareness of responsible tourism, and a safer and more enjoyable experience for expeditioners and mountaineers.

MECHANICS OF IMPLEMENTATION

To effectively manage waste in mountain expeditions, a synchronized approach is needed. One important step is the establishment of a task force comprising representatives from the Nepal Mountaineering Association, Nepal Tourism Board, and relevant government agencies. The task force should develop an action plan that identifies specific targets, timelines, and responsibilities for implementing waste management policies.

Adequate funding should also be allocated by the Department of Tourism for waste management initiatives in mountain regions. This funding could support the establishment of waste management facilities and infrastructure, public awareness campaigns, and cleaning campaigns. To ensure compliance with waste management policies, monitoring and enforcement mechanisms should be established, such as on-site inspections, fines, and permit revocation for repeat offenders. By following these steps, waste management in mountain expeditions can be effectively implemented and monitored.

Overall, the implementation of these policy recommendations would require a collaborative effort from all stakeholders, including the government, Nepal Mountaineering Association, Nepal Tourism Board, expedition agencies, mountaineers, and local communities. The benefits of implementing these policies, however, would be significant, including improved environmental conservation and a safer and more enjoyable experience for all involved in mountain expeditions. The research provides insights into the existing challenges and areas for improvement on the current implementation status of the Mountaineering Expedition Rules (MER) of 2002 in Nepal. By highlighting the challenges, the research helps stakeholders and policymakers understand the specific issues that need to be addressed to enhance waste management practices effectively. By recognizing the need for adherence to regulations and policies, the research underlines the role of governance in promoting sustainable tourism practices and preserving the fragile mountain ecosystem. The research contributes to the development of sustainable tourism practices in Nepal. By providing insights into waste management practices, it offers recommendations that can inform policy formulation and decision-making processes related to mountain tourism. This contribution is essential in ensuring the long-term sustainability of tourism activities and minimizing the negative environmental impact. The findings and suggestions can be valuable for policymakers and organizations involved in mountain expeditions, enabling them to create effective waste management policies and practices.

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The authors confirm contribution to the paper as follows: study conception and design: Biswakarma, G.; data collection: All authors; analysis and interpretation of results: All authors; draft manuscript preparation: Biswakarma, G and Rijal, U.; All authors reviewed the results and approved the final version of the manuscript.

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