Perceptions of Flood Risks among Users of Hells Gate National Park, Nakuru County, Kenya for Enhanced Disaster Preparedness and Management

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ABSTRACT

Flooding is a significant natural hazard, particularly in regions like Hell's Gate National Park in Nakuru County, Kenya, where the park's steep gorges and proximity to water bodies heighten flood risks during rainy seasons. This study investigates the perceptions of flood risk among park users, emphasizing the importance of awareness and preparedness in flood management strategies. Utilizing a descriptive research design, data were collected from 125 respondents, including 112 park users and key informants from relevant institutions. The results indicate that while 98.2% of park users are aware of flooding, only 20.5% have directly experienced a flood event within the park. The study reveals significant preparedness gaps, with only 36.6% of respondents aware of evacuation routes and 59.8% knowledgeable about designated safe areas. Furthermore, 74.1% of participants expressed concerns about the reliability of current warning systems. The study emphasizes the importance of targeted educational campaigns to address these gaps, focusing on the severe consequences of flooding, such as potential loss of life and environmental damage, to enhance risk perception and motivate proactive behaviour. The findings suggest that improving communication systems, increasing awareness of evacuation procedures, and fostering community engagement are crucial steps toward bolstering flood preparedness and resilience among park users. The research contributes valuable insights into the broader understanding of disaster management in recreational areas, with implications for similar settings globally.

Keywords: Flood Risk Perception, Perception of Flood Preparedness Gaps, Park User Awareness, Perceptions of Flood Management Strategies

INTRODUCTION

Flood risk perception is a critical component in the management of natural disasters globally. As climate change intensifies, the frequency and severity of floods have risen, necessitating a comprehensive understanding of how individuals and communities perceive these risks (Bhatti, Rana, and Routray, 2023). The significance of flood perception is not limited to local or national contexts but extends internationally, where varying socio-economic and environmental factors shape responses to flood hazards (Onyango *et al.*, 2024). Hell's Gate National Park in Kenya offers a unique case study for examining these perceptions at international, regional, and local levels, especially given its susceptibility to flooding and the diverse demographic of park visitors. Hell's Gate National Park attracts numerous tourists and outdoor enthusiasts due to its unique geological features, abundant wildlife, and opportunities for activities like hiking, rock climbing, and sightseeing. However, the park's topography, characterised by steep gorges and proximity to water bodies, makes it particularly vulnerable to flooding during the rainy seasons. Understanding how park users perceive flood risks is essential for developing effective preparedness and response strategies.

Globally, flood events have been increasing in both frequency and severity, a trend well-documented in various

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studies (Meteorological Office, 2024). For instance, research conducted in Germany and other parts of Europe shows a significant rise in flood occurrences over recent decades, largely attributed to climate change and shifts in atmospheric patterns such as the North Atlantic Oscillation and the Atlantic Multidecadal Oscillation. Similar trends have been observed in regions like North America and Africa, where changes in precipitation patterns have led to more frequent and intense flood events (Delworth *et al*., 2016). This global uptick in flood events has necessitated a deeper exploration of how people perceive and respond to these risks. Understanding global trends is crucial as they provide a framework within which regional and local flood risk perceptions are shaped (Lechowska, 2022).

International studies underscore the importance of integrating flood risk perception into disaster management strategies. For example, in Europe and North America, flood risk management has increasingly incorporated public perceptions to enhance preparedness and response strategies (Lechowska, 2018; Chelli, 2023). These approaches emphasize the need for public awareness campaigns, education, and community engagement to align perceptions with actual risks, thereby reducing vulnerability and improving resilience (Lechowska, 2018). The international discourse on flood perception also highlights the role of socio-economic factors, such as education and access to information, in shaping how individuals perceive flood risks and their willingness to adopt precautionary measures (Chelli, 2023; Ahadzie et al., 2016).

In Africa, flood risk perception is influenced by a combination of climatic variability, socio-economic challenges, and historical flood experiences (Adelekan and Asiyanbi, 2016; Olanrewaju and Chitakira, 2023). The continent has witnessed a significant increase in flood events, particularly in regions such as West and East Africa (Okaka and Odhiambo, 2019). For instance, studies in Nigeria and other West African countries have documented a rise in flood occurrences, correlating with changing rainfall patterns and land use practices. In East Africa, including Kenya, similar trends have been observed, with floods becoming more frequent and severe due to intensified rainfall and inadequate infrastructure to manage water flow (Lucas, 2020).

The perception of flood risks in Africa is often shaped by the immediate and tangible impacts of these events, such as loss of life, property damage, and disruptions to livelihoods (Adelekan and Asiyanbi, 2016). However, there is also a significant gap in awareness and preparedness, particularly in rural and marginalized communities (Olanrewaju and Chitakira, 2023). This gap is partly due to limited access to early warning systems and educational resources that could inform communities about flood risks and mitigation strategies (Okaka and Odhiambo, 2019). Moreover, the reliance on traditional knowledge and coping mechanisms, while valuable, may not be sufficient to address the increasing complexity and unpredictability of flood events in the region (Salami, Giggins, and Von Meding, 2017).

Multiple studies have explored how park users perceive flood risks to improve emergency response and preparedness measures. Research indicates that risk perception is shaped by both rationalist and constructivist factors, including cognitive models and social, political, cultural, and historical contexts (Lechowska, 2022). These studies emphasized incorporating local and regional conditions into flood risk management to enhance public awareness and preparedness (Lechowska, 2018). Additionally, empirical studies have shown that factors such as worry, awareness, and preparedness play a significant role in how individuals perceive and respond to flood risks (Chelli, 2023). By understanding these perceptions, authorities can craft more effective communication strategies and encourage park users to adopt proactive measures to reduce flood risks (Ge, Yang, Wang, Dou, Lu, and Mao, 2021).

Drawing on these insights, this study examines the awareness, preparedness, and attitudes of park users toward flood risks, offering a comprehensive analysis of how to enhance emergency response and preparedness in Hell’s Gate National Park.

STUDY AREA

Hell's Gate National Park is located in Naivasha Sub County in Hell's Gate ward and has a population of 44,297 people with a growth rate of 3.05% (Nakuru County Government, 2018). The area of study was situated south of Lake Naivasha and northwest of Nairobi.

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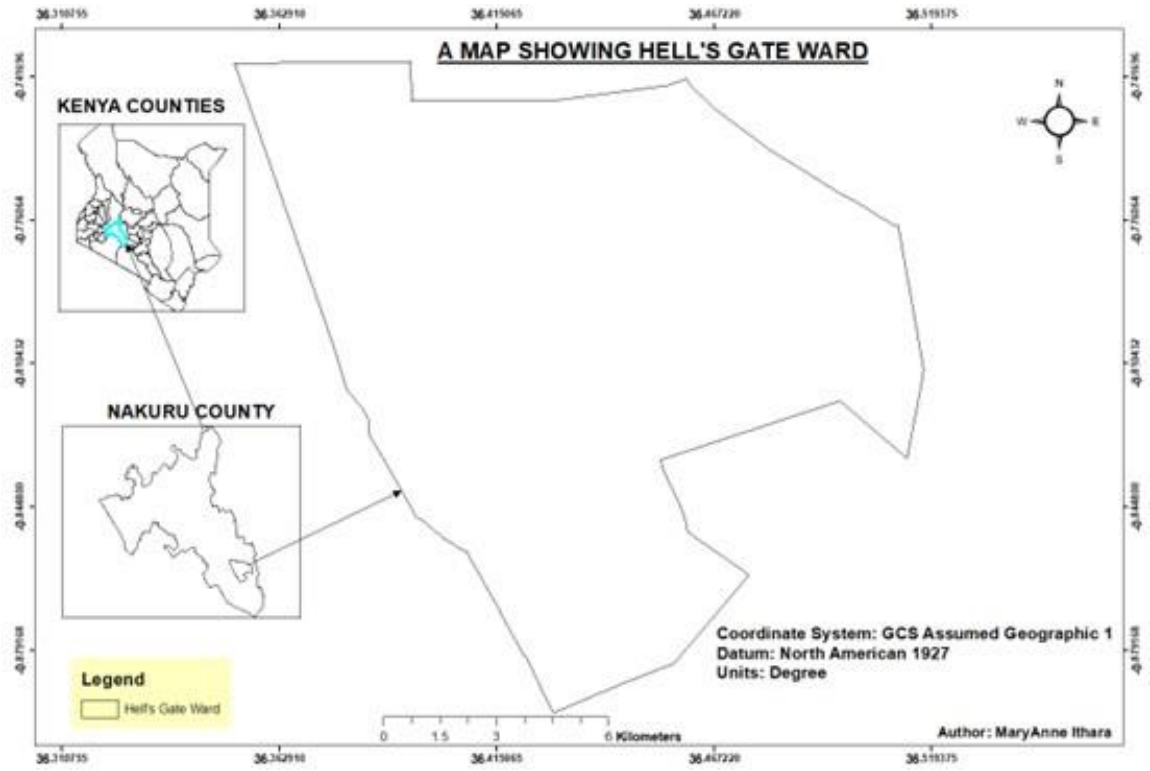

Figure 1: Hell's Gate Location Map

The climatic condition of the study area is influenced by the Lake Naivasha basin (Onywere, 2005). The rainfall pattern is bi-modal with the long rain season occurring between April- June and the short rain season occurring between October-November. The area receives rainfall of approximately 600mm annually. The highest temperature is recorded in March while the coldest temperature is recorded in July (KWS, 2010). Tourism is the main economic activity in the study area (Scoon, 2020). Hell's Gate National Park attracts tourists both locally and internationally due to its proximity to Nairobi, many hotels, and campsites, the extent of the birds and wildlife, and the area's beauty. Vegetation in the park ranges from rocky to swampy but is dominated by shrubs and short trees which include euphorbia and acacia. The vegetation is as a result of the topography (Onywere, 2005).

METHODOLOGY

This study adopted a descriptive cross-sectional design to analyze and describe the existing phenomena concerning flood awareness and preparedness in Hell's Gate National Park. Descriptive research was selected because it allowed for the collection of both qualitative and quantitative data to assess park users' perceptions and Kenya Wildlife Services's preparedness for flood hazards. According to Dannels (2018), this method provides an accurate depiction of the situation by collecting data from a defined population. The sample size was calculated using Creative Research Systems (CRS) tools (2009), suitable for research without prior admission data or census records of park users. The formula utilized to determine the sample size is:

$S = (Z^2 * p (1-p)) / c^2$

Where S= sample size, Z= Z value (1.96 for 95% confidence level) p= percentage picking a choice, expressed as decimal 0.5 and c= confidence interval expressed as decimal (0.09). The number of park users is, therefore.

$(1.96^2 * 0.5(1- 0.5))/ 0.09^2 = 118$ park users.

This calculation produced a sample size of 118 park users. Additionally, 7 key informants, including 3 Kenya Wildlife Service (KWS) officers, 2 Kenya Red Cross personnel, and 2 KenGen officers, were purposively sampled for interviews. Therefore, the total sample size was 125. Simple random sampling was employed for park users, ensuring that each participant had an equal chance of selection.

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Data were gathered using multiple methods: interview schedules, observation checklists, Focus Group Discussions (FGDs), and questionnaires. Park users' perceptions of flood risk and preparedness levels were captured through questionnaires, focusing on statements from the park users. FGDs, comprising KWS, Kenya Red Cross, and KenGen officers, were held to obtain deeper insights into institutional responses and preparedness levels. An observation checklist was used to assess the flood management facilities and techniques within the park. Secondary data was sourced from academic publications, Kenya Meteorological Department records, government reports, and media documentaries.

Quantitative data from park users were analyzed using descriptive statistics, including frequency distribution tables and cross-tabulations, to examine the relationships between independent variables (e.g., user characteristics) and dependent variables (e.g., preparedness levels). Chi-square tests were conducted to explore associations between these variables, and response mechanisms were analyzed through frequency analysis. Qualitative data from interviews and FGDs were subjected to content analysis. To ensure the reliability and validity of the data collection instruments, pre-testing of questionnaires was conducted with 10 representative respondents. Adjustments were made based on pilot results. Ethical approval was obtained from the relevant government agencies and Kenyatta University's ethical review board. Respondents were briefed on their right to anonymity and voluntary participation before each interview or discussion session.

RESULTS

Respondents' characteristics

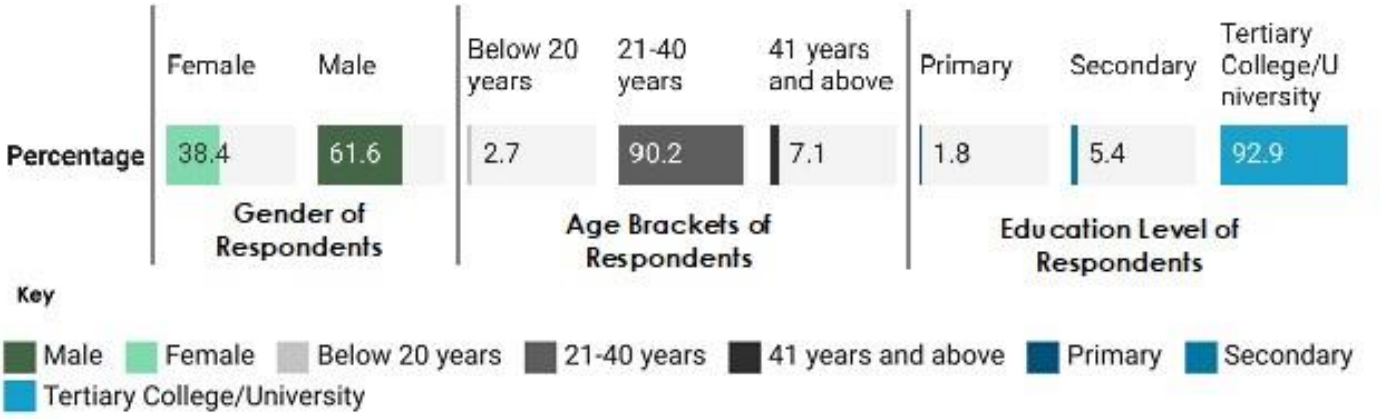

Figure 2: Respondents' General Information (Source: Author, 2024)

The study surveyed 112 park users, revealing that 61.6% were male and 38.4% were female. This imbalance suggests the importance of ensuring that when questionnaires are distributed to park users to determine their perceptions of floods and preparedness levels, efforts should be made to capture diverse responses. To understand the perceptions and preparedness levels holistically, it is essential to achieve a balance in gender representation. This will ensure the feedback is inclusive and represents the views and experiences of all park users, leading to more accurate and actionable insights. Most respondents (90.2%) were between the ages of 21 and 40, indicating a younger demographic that is actively involved in park activities. These results imply that flood preparedness and response strategies in Hell's Gate National Park may be heavily influenced by the experiences and needs of the 21-40 age group. While this could mean that the park's flood management strategies are well-suited for the physically active and possibly tech-savvy majority, it also raises concerns about the adequacy of these strategies for older and younger visitors, who are significantly underrepresented. The current measures might not account for the specific vulnerabilities or needs of these minority age groups, thereby compromising the overall effectiveness of the park's flood management efforts. Additionally, 92.9% of respondents had a tertiary education, reflecting a highly educated user base. These results imply that current flood preparedness and response measures in Hell's Gate National Park may be inadvertently tailored to a highly educated audience, capable of quickly understanding and responding to complex emergency instructions. While this might make dissemination of information and execution of emergency plans efficient for the majority, it also risks alienating those with lower educational levels, who may require more straightforward communication

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and guidance. Therefore, the park's flood management efforts should consider diversifying their communication and educational approaches to be inclusive of all educational backgrounds.

These results are consistent with other studies that have explored flood risk perceptions among park users to improve emergency response and preparedness. Research suggests that younger, educated individuals are more likely to be aware of and concerned about environmental risks, such as flooding (Lechowska, 2022). Higher educational attainment in this demographic often correlates with greater access to information and a better understanding of risk management practices (Lechowska, 2018). Additionally, studies have highlighted that awareness, concern, and preparedness are crucial factors influencing how people perceive and respond to flood risks (Chelli, 2023). By understanding these perceptions, authorities can develop targeted communication strategies that effectively engage this demographic, ultimately enhancing preparedness and response efforts. By applying these insights, this study offers a comprehensive view of how to improve emergency response and preparedness strategies in Hell's Gate National Park.

Flood Awareness and Experiences among Hell's Gate National Park Users

Table 1: Perceptions/beliefs regarding flooding and disaster management (Source: Author, 2024)

Statements	Strongly agree	Agree	Not sure	Disagree	Strongly disagree	Mean	Std. deviation
Floods are natural phenomena	70.80%	17.90%	4.70%	3.80%	2.80%	2.94	1.19
Flooding is inevitable and cannot be prevented	15.70%	14.80%	16.70%	35.20%	17.60%	1.50	0.96
Park users maintain an emergency contact list in case of the flood event	30.80%	23.40%	30.80%	11.20%	3.70%	3.24	1.34
Flood preventive measures are more important than emergency relief and rehabilitation work.	66.4%	13.1%	9.3%	4.7%	6.5%	2.34	1.14
There are advocacy activities to strengthen disasters awareness in the park	20.4%	25.0%	41.7%	8.3%	4.6%	1.97	1.21
The area development planning recognizes contingency programmes such as flood recovery, disaster funding provisions, search and rescue missions	18.2%	31.7%	28.5%	11.8%	9.8%	2.05	1.17
Park users are provided with a contingency plan to apply during a disaster	15.7%	36.1%	28.7%	10.2%	9.3%	1.75	1.16
There are supplies (such as blankets, battery powered radio) provided by agencies/organizations in-readiness for disasters	14.8%	18.5%	34.3%	22.2%	10.2%	1.72	1.21
There is an evacuation and rescue manpower in-line with area contingency plan	17.0%	29.2%	34.0%	10.4%	9.4%	2.52	1.05
There are installed "flood warning" posts with colored indicators to measure floodwater level	20.2%	25.7%	34.9%	12.8%	6.4%	2.61	1.15
Flood hazard could be reduced by man-made structures	20.6%	21.5%	26.2%	21.5%	10.3%	2.60	1.14

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People are capable of controlling the occurrence of floods	20.4%	24.1%	24.1%	18.5%	13.0%	2.29	1.16
The state should establish financial reserves to help flood victims	56.9%	28.4%	4.6%	2.8%	7.3%	2.01	1.14
Modern technology is the best way to solve flooding problems.	42.10%	29.00%	16.80%	6.50%	5.60%	2.26	1.02
Average						2.27	1.15

Source field work 2023

The study found that most park users were familiar with the concept of flooding, with 98.2% of respondents indicating they understood what flooding is. However, only 20.5% of respondents had experienced a flood event within the park, while 79.5% had not.

These findings are crucial when considering how park users perceive flood risk. Research suggests that simply being aware of flooding does not necessarily lead to accurate risk perception or preparedness, particularly when direct experience is lacking (Lechowska, 2018; Chelli, 2023). For example, studies have shown that individuals who have experienced flooding firsthand are more likely to perceive higher risks and take proactive steps to prepare (Lechowska, 2018). On the other hand, those without such experience may underestimate the risk and be less prepared (Chelli, 2023). These studies are backed by psychological research which indicates that individuals who haven't experienced disasters often have an optimism bias which mostly results in complacency or inadequate preparation (Paton, 2003).

Given that most park users have not experienced flooding, there may be disconnect between perceived risk and actual preparedness. This underscores the need for targeted educational campaigns and emergency response strategies that stress the importance of being prepared, even for those who have not directly faced flooding ((Lechowska, 2018; Chelli, 2023). Additionally, these educational campaigns should also include drills and simulations to help park users understand the levels of risks involved in cases of emergencies (Paton, 2003; Becker et al., 2012). By addressing this gap, emergency response efforts can be better tailored to improve community resilience and mitigate the impacts of potential flood events (Ng, 2022).

Perceived Impact of Flooding

Respondents identified the potential loss of life as the most significant consequence of flooding, with 68.8% citing it as their primary concern. Other concerns included damage to physical structures (11.6%) and the destruction of wildlife habitats (17.9%), highlighting an awareness of both human and environmental risks associated with flooding.

These findings align with broader research on the perceived impact of flooding among park users, underscoring the strong correlation between the perceived severity of consequences and individuals' risk awareness and preparedness behaviours. Research shows that when people perceive severe consequences, such as the potential loss of life, they are more likely to develop heightened risk awareness and engage in proactive flood management measures (Lechowska, 2018; Chelli, 2023). For instance, a study on flood risk perception found that individuals who recognize high personal and environmental risks are more inclined to support and participate in flood preparedness initiatives (Lechowska, 2018). Additionally, the awareness of environmental impacts, such as the destruction of wildlife habitats, not only raises concern for ecological preservation but also motivates community-level actions to reduce flood risks (Chelli, 2023). Thus, the respondents' concern for both human and environmental consequences in Hell's Gate National Park may indicate a broader readiness to support and engage in effective flood risk mitigation strategies (Cutter *et al.*, 2012; Twigg, 2009). Furthermore, these insights into these perceptions amongst park users can help develop emergency response and preparedness strategies that can be customized to address the specific concerns of park users. Highlighting the potential loss of life and environmental damage in educational campaigns can improve the effectiveness of these strategies, ultimately leading to greater community resilience and preparedness.

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Perceptions of Flood Preparedness Gaps in Hell's Gate National Park

The study revealed significant gaps in preparedness among park users, with only 36.6% aware of evacuation routes and 59.8% knowledgeable about designated safe areas for shelter during floods. This indicates that a substantial portion of visitors may not be adequately informed about how to respond during a flood event. Furthermore, 74.1% of respondents felt that the current warning systems were insufficient, and 70.6% doubted the reliability of the park's communication system for disseminating flood warnings.

These findings are consistent with broader research on preparedness gaps in disaster management within parks, highlighting how insufficient awareness and lack of confidence in emergency systems can severely undermine disaster response efforts. Studies have shown that inadequate knowledge transfer and weak communication infrastructure lead to poor preparedness and ineffective response measures. For example, research on disaster knowledge gaps indicates that when people are not well-informed about evacuation routes and safe areas, they are less likely to respond effectively in an emergency (Soshino, 2024). Additionally, if warning systems are perceived as unreliable, it can diminish trust in these systems and reduce compliance with emergency protocols, further exacerbating the risk during a disaster (Albris, Lauta, and Raju, 2020).

Addressing these preparedness gaps requires targeted efforts to enhance communication infrastructure and improve public awareness within the park. By focusing on better dissemination of information regarding evacuation routes and safe areas, and ensuring the reliability and trustworthiness of warning systems, parks can significantly improve visitor preparedness for flood events (Alexander, 2015). This approach not only enhances emergency response effectiveness but also contributes to greater community resilience in the face of potential disasters (Soshino, 2024; Albris, Lauta, and Raju, 2020).

Perceptions and Beliefs on Flooding and Disaster Management

The study's findings, as reflected in Table 1, provide valuable insights into the perceptions and beliefs of respondents regarding various statements related to flooding and disaster management within the park. Most respondents (70.80%) strongly agree that floods are natural phenomena, demonstrating a fundamental understanding of the natural aspect of floods among the surveyed individuals. Only a small percentage express uncertainty (4.70%), while even fewer disagree (3.80%) or strongly disagree (2.80%). The mean value of 2.94 indicates a high level of agreement, and the relatively low standard deviation of 1.19 suggests a high level of consensus among respondents. The strong consensus that floods are natural phenomena indicates that educational efforts on the natural causes of flooding have been successful. This understanding is essential for developing disaster management strategies that focus on the natural patterns and behaviours of floods (Awah *et al.,* 2024).

Opinions vary on whether flooding is inevitable and cannot be prevented. A notable portion (35.20%) strongly disagrees with this statement, indicating a belief in the potential for flood prevention. In contrast, 14.80% agree, 16.70% are uncertain, and 17.60% strongly disagree. The statement's mean value of 1.50 reflects this divergence in opinions, and the standard deviation of 0.96 suggests variability in respondents' beliefs. The mixed responses regarding the preventability of floods underscore the need for targeted communication and education on flood prevention measures. While some individuals believe in the potential for prevention, others may require more information or reassurance about the effectiveness of such measures. Engaging park users in disaster preparedness activities and planning can help bridge this gap in understanding and foster a more unified approach to flood management (Jerome, 2021). The participatory approach could also strengthen policy development, since an informed populace can be used to inform data-driven decisions, such as increasing the investments in infrastructure and technology aimed at mitigating flood risks (Albris, Lauta, and Raju, 2020). Additionally, collaboration with experts in flood risk management can lead to the creation of comprehensive and integrated disaster management plans that account for both natural and human factors based on data collected from park users (Khan *et al.,* 2023).

The views on whether park users maintain an emergency contact list are mixed. Approximately 55% agree, 31% are uncertain, whereas about 15% disagree, with the maintenance of an emergency contact list among park users. This reflects diverse opinions, with a mean value of 3.24 suggesting a moderate level of agreement, and a

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standard deviation of 1.34 indicating variability in responses. The varied opinions on keeping an emergency contact list emphasize the need for greater awareness and education on the importance of emergency preparedness amongst park users. Helping Park users recognize the significance of having an emergency contact list can improve overall disaster readiness levels within the park.

A substantial majority (66.4%) either strongly agree or agree that flood preventive measures are more important than emergency relief and rehabilitation efforts. Only 13.1% express uncertainty, while 9.3% disagree and 6.5% strongly disagree. This indicates a consensus on prioritizing proactive flood risk reduction strategies. The mean value of 2.34 reflects this high level of agreement, and the standard deviation of 1.14 suggests a certain degree of uniformity in respondents' opinions. The widespread agreement on prioritizing flood preventive measures over emergency relief indicates that policymakers should emphasize proactive strategies. This approach should involve investing in infrastructure improvements, enhancing early warning systems, and implementing community education programs to reduce flood risks (Porter *et al.,* 2019). Bangladesh has a history of devastating cyclones, but the Cyclone Preparedness Program (CPP) has significantly improved disaster preparedness and response. The program includes early warning systems, cyclone shelters, and community-based preparedness training. The preventive measures and the simplicity of the CPP have significantly lowered the death toll and damage caused by cyclones, highlighting the advantages of proactive disaster management. (Habib, Shahidullah, and Ahmed, 2012).

The perception of advocacy activities to enhance disaster awareness in the park is mixed. 41.7% are uncertain about their existence, while 20.4% strongly agree, 25.0% agree, 8.3% disagree, and 4.6% strongly disagree. The mean value of 1.97 indicates a leaning towards agreement among those with an opinion, but the standard deviation of 1.21 suggests significant variability in responses. There is uncertainty regarding the recognition of contingency programs in area development planning, with 28.5% expressing uncertainty. Meanwhile, 18.2% strongly agree, 31.7% agree, 11.8% disagree, and 9.8% strongly disagree. The mean value of 2.05 indicates a moderate level of agreement among informed respondents, but the standard deviation of 1.17 suggests a range of perspectives. In the context of flooding and disaster management in national parks, these findings suggest that while there is some awareness of advocacy and contingency programs, there is also significant uncertainty and variability in perceptions. This could be due to inconsistent communication or implementation of these programs. Research shows that Natural Flood Management (NFM) techniques, such as increasing soil infiltration and slowing water flow, can significantly reduce flood risks in national parks (Demyk, 2021). For instance, a study in the Yorkshire Dales National Park demonstrated that simple flood management measures could slow water flow during high rainfall events by up to 12% (Yorkshire Dales National Park, 2024). Similarly, Scottish National Parks have incorporated NFM into their strategies, focusing on woodland restoration and catchment management to mitigate flood risks (Kempe, 2019). The Flood Green Guide by USAID further supports this approach by offering a framework for integrating nature-based solutions with traditional engineering to effectively manage flood risks (WWF, 2016).

The data reflects a range of opinions on disaster management in national parks, particularly concerning contingency plans, disaster readiness supplies, evacuation manpower, and flood warning posts. Regarding Contingency Plans for Park Users, the opinions are mixed: 15.7% strongly agree, 36.1% agree, 28.7% are uncertain, 10.2% disagree, and 9.3% strongly disagree. This shows a moderate level of agreement (mean value of 1.75) with some variability in responses (standard deviation of 1.16). Broader research suggests that effective disaster management in national parks typically involves detailed contingency plans that include coordination with local agencies and clear communication strategies (Simpson, 2010). The differences in opinions might indicate varying levels of awareness and trust in these plans.

In terms of Supplies for Disaster Readiness, 34.3% of respondents are uncertain about the supplies provided by agencies or organizations. Among those who expressed an opinion, 14.8% strongly agree, 18.5% agree, 22.2% disagree, and 10.2% strongly disagree. The mean value of 1.72 points to a moderately positive perception, while the standard deviation of 1.21 suggests a diversity of views. Research emphasizes that the provision of well-stocked emergency supplies is critical for enhancing disaster response and recovery efforts (Yorkshire Dales National Park, 2024). The uncertainty in the data may reflect a lack of visibility or communication regarding these supplies.

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For Evacuation and Rescue Manpower, 34.0% of respondents are uncertain about its adequacy, while 46.2% either agree or strongly agree that it is sufficient. The standard deviation of 1.05 suggests some level of agreement. Broader research underscores the necessity of having adequate manpower for evacuation and rescue, as well as clear protocols (WWF, 2016). The uncertainty observed in the data may indicate gaps in communication or training regarding these resources.

Regarding Flood Warning Posts, 34.9% of respondents are unaware of their existence, although among those who are informed, 46.0% either agree or strongly agree with their presence. The mean value of 2.61 suggests a relatively high level of agreement, with a standard deviation of 1.15 indicating some consensus. Research highlights the importance of flood warning systems for early disaster response, as they can significantly mitigate the impact of floods by providing timely information (Schottland, 2022). The lack of awareness shown in the data suggests a need for improved communication and education about these systems.

Uncertainty is present regarding the belief that flood hazards could be reduced by man-made structures, with 26.2% expressing uncertainty. Among those with an opinion, 42.1% either agree or strongly agree, indicating a moderate level of support for this idea. The standard deviation of 1.14 suggests variability in respondents' views. The statement about people's capability to control the occurrence of floods reveals varying opinions, with 24.1% expressing uncertainty. However, 44.5% either agree or strongly agree, indicating some level of belief in people's capability. The standard deviation of 1.16 suggests a range of perspectives. In addition, support for the state establishing financial reserves to help flood victims is strong, with 85.3% either agreeing or strongly agreeing. Only a small percentage (4.6%) is uncertain about this proposition. The mean value of 2.01 reflects a high level of agreement, and the standard deviation of 1.14 indicates a certain degree of uniformity in respondents' opinions. The belief in modern technology as the best way to solve flooding problems is met with uncertainty, with 42.10% strongly agreeing, 29.00% agreeing, and 16.80% not sure, 6.50% disagreeing, and 5.60% strongly disagreeing. The mean value of 2.26 suggests a high level of agreement. These findings underscore the diversity of opinions and beliefs among park users regarding various aspects of flooding and disaster management. They also highlight the importance of education, communication, and community engagement to enhance disaster preparedness and resilience within the park.

The data reflects a range of opinions on flood management strategies in national parks. Effective disaster management requires a combination of structural measures, community preparedness, financial support, and modern technology. The variability in responses underscores the need for ongoing education, communication, and community engagement to enhance disaster preparedness and resilience.

CONCLUSION

The study of park users at Hell’s Gate National Park highlights significant awareness of flood risks but reveals critical gaps in practical preparedness and confidence in existing warning systems. Despite high levels of education and awareness, many park users lack essential knowledge about evacuation routes and safe shelter areas, and the current flood warning systems are perceived as inadequate. There is a clear preference for proactive flood prevention measures and government-backed financial preparedness, underscoring the need for improved communication infrastructure, targeted educational campaigns and participatory disaster planning to enhance community resilience and safety against flood events.

RECOMMENDATIONS

Based on the study's findings, several perception-based recommendations can enhance flood preparedness among park users, they are as follows:

1. First, it is crucial to develop and implement targeted educational campaigns that address the gap between awareness and preparedness. These campaigns should emphasize the severe consequences of flooding, such as potential loss of life and environmental damage, to heighten perceived risk and encourage proactive behaviour. Utilizing various media—such as brochures, workshops, drills, simulations, and online resources—can effectively disseminate essential information about evacuation routes and safe

shelter areas.

2. Improving communication systems is another critical recommendation. The current flood warning systems should be upgraded to address concerns about their reliability. Ensuring that these systems are robust and trustworthy is essential for maintaining public confidence. Regular testing and updates to the communication infrastructure, along with transparent information about system functionality, can help build trust and encourage compliance.

3. Addressing perceived preparedness gaps is also important. Efforts should be focused on increasing awareness of evacuation routes and safe areas among park users. Since many visitors are unaware of these critical details, improving signage, providing clear maps, and conducting informational sessions can bridge this gap. Ensuring that this information is readily accessible and easily understood will help users feel more prepared and confident in their ability to respond to flood events.

4. Leveraging the strong concern for severe consequences, such as loss of life and environmental damage, can drive flood preparedness initiatives. Tailoring educational materials and emergency plans to highlight these perceived risks can resonate more effectively with park users. By emphasizing the personal and ecological impacts of flooding, authorities can foster greater engagement and support for preparedness measures.

5. Fostering community engagement is another key recommendation. Active participation in flood preparedness programs should be encouraged. Given the high levels of concern among park users, involving them in planning and response activities can enhance their commitment to preparedness. Community forums, volunteer opportunities, and collaborative drills can build a stronger sense of collective responsibility and readiness.

6. Finally, monitoring perception changes over time is essential. Regular surveys and feedback mechanisms can provide valuable insights into evolving attitudes and identify areas where additional education or resources are needed. Adapting strategies based on ongoing feedback will help maintain and improve preparedness levels, ensuring that flood preparedness efforts remain effective and relevant.

By focusing on these perception-based recommendations, authorities can better align their flood preparedness efforts with the concerns and understanding of park users, ultimately leading to more effective risk management and improved community resilience.

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