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# Assessment and Analysis of Noise Levels During Festivals in Guwahati City of Assam, India

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***Abstract*** **- Indian festivals are vibrant expressions of cultural unity and spiritual tradition; however, they also lead to a significant rise in environmental issues, particularly noise pollution. This study investigates ambient noise levels during two major festivals-Durga Puja (2019–2023) and Deepawali (2023)-across selected urban locations in Guwahati City, Assam, namely Ganeshguri, Bharalumukh, Pandu, Panbazar, and Ulubari. The research is based entirely on secondary data sourced from the open-access records of the Pollution Control Board Assam (PCBA) and analyzed using descriptive statistical methods in Microsoft Excel. The findings indicate that noise levels consistently exceeded the permissible limits set by the Central Pollution Control Board (CPCB), especially during festival nights. Ganeshguri and Panbazar recorded the highest noise levels, with $L_{max}$ values during Deepawali reaching up to 121.9 dB(A), posing serious health hazards. Even quieter areas such as Pandu experienced a substantial rise in noise levels during festivals. The study highlights that sustained exposure to high-decibel noise can lead to hearing loss, cardiovascular problems, sleep disturbances, and psychological stress, particularly among vulnerable populations such as children, the elderly, and patients.**
***Keywords:*** **Ambient Noise Levels, Cultural Events, Sound Level Assessment, Event-Based Pollution**

## I. INTRODUCTION

The introduction should provide a comprehensive background. Indian festivals are a source of celebration for the entire society, uniting people with a collective sense of reverence, emotion, and culture. They essentially serve as mirrors that reflect the ancient traditions and spiritual beliefs of the country, and they play an important role in fostering social bonding and community harmony. In every state, festivals are marked by unique customs and rituals, making them an essential part of community life. Assam, located in the northeastern part of India, is no exception. Guwahati, a major city in Assam located at 26°10″ north latitude and 92°49″ east longitude, faces significant environmental challenges, including traffic congestion, flash floods, and air and water pollution [1,2]. As the largest urban center in the state and a cultural hub, Guwahati witnesses' large-scale celebrations during festivals such as Durga Puja, Diwali, Bihu, Eid, Christmas, and other regional events. These festivals often involve processions, music, dance, street performances, decorative lighting, and public gatherings that add to the festive spirit of the city. However, alongside these celebrations, a less visible yet critical issue emerges-environmental pollution [3].

One major problem during such periods of celebration is the rise in noise pollution. Loudspeakers blaring devotional songs, religious sermons, public announcements, musical performances, and the bursting of firecrackers are common sights and sounds during these times [4]. Other aggravating factors include vehicles moving through already congested roads as people shop for groceries, visit relatives, and attend cultural events, thereby contributing to elevated ambient noise levels [5]. In cities like Guwahati, where population density is increasing and urban spaces are becoming increasingly saturated, the cumulative effect of these noise sources creates an uncomfortable and sometimes hazardous sound environment.

Noise pollution remains an underrated environmental threat, despite its growing impact on urban public health and quality of life. Prolonged exposure to high-decibel sounds can lead to a wide range of physical and psychological health problems, including stress and anxiety, hypertension, hearing impairment, sleep disorders, and, in the long term, cardiovascular ailments. Vulnerable groups such as children, the elderly, hospital patients, and individuals with pre-existing health conditions are particularly affected by excessive noise exposure [6,7]. The situation is further aggravated by the fact that festivals, though temporary, cause repetitive and intense surges in noise, which are more difficult for the human body to adapt to than steady background noise [8].

TABLE I THE AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE GIVEN BY CPCB

| Area | Category of Area/Zone | Limits in dB(A) | |
|---|---|---|---|
| | | Day Time | Night Time |
| A | Industrial Area | 75 | 70 |
| B | Commercial Area | 65 | 55 |
| C | Residential Area | 55 | 45 |
| D | Silence Zone | 50 | 40 |

At the national and international levels, several regulatory frameworks have been established to reduce the adverse effects of noise pollution. To protect public health, the

World Health Organization (WHO) recommends specific noise exposure thresholds for daytime and nighttime periods. In India, permissible noise levels for residential, commercial, industrial, and quiet zones (such as hospitals and schools) have been established by the Central Pollution Control Board (CPCB) and the corresponding State Pollution Control Boards, including that of Assam. Unfortunately, during festivals, these prescribed limits are often exceeded, particularly in urban residential areas, resulting in violations that frequently go unchecked or are underreported [9,10]. Several studies have highlighted the adverse effects of noise pollution generated during festivals and public celebrations. Festival-related activities, particularly the use of firecrackers and loudspeakers, significantly increase ambient noise levels, often exceeding the permissible limits set by regulatory bodies. An assessment of traffic noise at selected locations in Delhi indicates that most areas are exposed to elevated noise levels ranging between 60–80 dB, which exceed the prescribed standards [11]. Among all zones, residential areas are the most affected, followed by commercial, silent, and industrial zones. Bhoi *et al*. (2022) demonstrated that noise pollution increases significantly during festive celebrations, often exceeding permissible limits and adversely affecting human and animal health. Machine learning models such as Decision Tree and Random Forest have been successfully employed to predict noise levels in urban areas, achieving high accuracy. The study also highlights the need for continuous monitoring and the adoption of advanced technologies, including IoT and deep learning, to effectively manage and mitigate noise pollution during such events [12].

## II. METHODOLOGY

This research work is based on secondary data sources available online on the portal of the Pollution Control Board Assam (PCBA). A total of three major locations in Guwahati city were considered to study noise levels during Durga Puja from 2019 to 2023, namely Ganeshguri, Bharalumukh, and Pandu. Additionally, three major locations in Guwahati city were considered to study noise levels during Deepawali in 2023. The noise level data were processed, tabulated using Microsoft Excel, and analyzed.

## III. SIGNIFICANCE OF THE STUDY

By studying noise pollution, we can understand its impact on the lives of human beings as well as animals and trees in the surrounding environment, and how it greatly affects their livelihoods. The present study attempts to explore different facets of noise pollution in Guwahati city, Assam, and provides insight into how the environment and other aspects of life can be protected from damage or adverse effects caused by human activities. Excessive noise pollution adversely affects humans, especially the elderly and patients with mental illnesses. It also harms other living beings, such as birds and animals. After assessing noise level data from various locations in the selected city, it is evident that significant health hazards exist. These problems can be minimized in the future through increased public awareness and the implementation of remedial measures by local governments and NGOs.

## IV. RESULTS AND DISCUSSION

This section presents the findings of the study based on data collected from different locations and time periods. It discusses variations in ambient noise levels during major festivals such as Durga Puja and Deepawali, comparing values recorded before, during, and after the events. The results are analyzed to identify fluctuations in noise levels.

### *A. Ambient Noise Level Before, During and After Durga Puja*

TABLE II AMBIENT NOISE LEVEL BEFORE, DURING AND AFTER DURGA PUJA

| Year | Location | Ambient Noise Level $L_{eq}$ (in DBA) | | |
|---|---|---|---|---|
| | | Before Puja | During Puja | After Puja |
| 2019 | Ganeshguri | 76.4 | 80.1 | 79.2 |
| | Bharalumukh | 74.7 | 79.2 | 77.3 |
| | Pandu | 63 | 67 | 67 |
| 2020 | Ganeshguri | 75.1 | 74.3 | 72.8 |
| | Bharalumukh | 73.2 | 73.1 | 72.8 |
| | Pandu | 64.8 | 67.2 | 67.5 |
| 2021 | Ganeshguri | 69.7 | 73.6 | 74.4 |
| | Bharalumukh | 59 | 74.8 | 71.1 |
| | Pandu | 66.7 | 72.4 | 74.7 |
| 2022 | Ganeshguri | 69.4 | 66 | 60.6 |
| | Bharalumukh | 56 | 78.6 | 60.9 |
| | Pandu | 53.2 | 70.1 | 62.9 |
| 2023 | Ganeshguri | 69.2 | 73.2 | 62 |
| | Bharalumukh | 58.9 | 76.3 | 62.3 |
| | Pandu | 55.8 | 72.8 | 62.5 |

Ganeshguri has consistently recorded the highest noise levels, especially during Durga Puja, peaking at 80.1 dB(A) in 2019. Although a slight downward trend is observed by 2023 (73.2 dB), the levels remain significantly higher than the CPCB residential night limit of 55 dB(A). The pre- and post-Puja noise levels also remained elevated, indicating prolonged exposure to noise. In Bharalumukh, noise levels during Puja fluctuated but rose again to 76.3 dB in 2023, showing a rebound after a low of 70.1 dB in 2022. The sharp increase during 2021–2023 could be attributed to the return of full-scale festivities following the pandemic.

Pandu, although relatively quieter than the other two locations, experienced a notable increase in 2023, with $L_{eq}$ reaching 72.8 dB(A) during Puja, up from 66 dB(A) in 2022. This indicates a growing noise impact in previously quieter zones. Across all years, the “during Puja” values were consistently higher than the “before” and “after” values, confirming that festival activities significantly affect the urban soundscape. The data call for better regulation, increased public awareness, and environmentally friendly celebration practices.

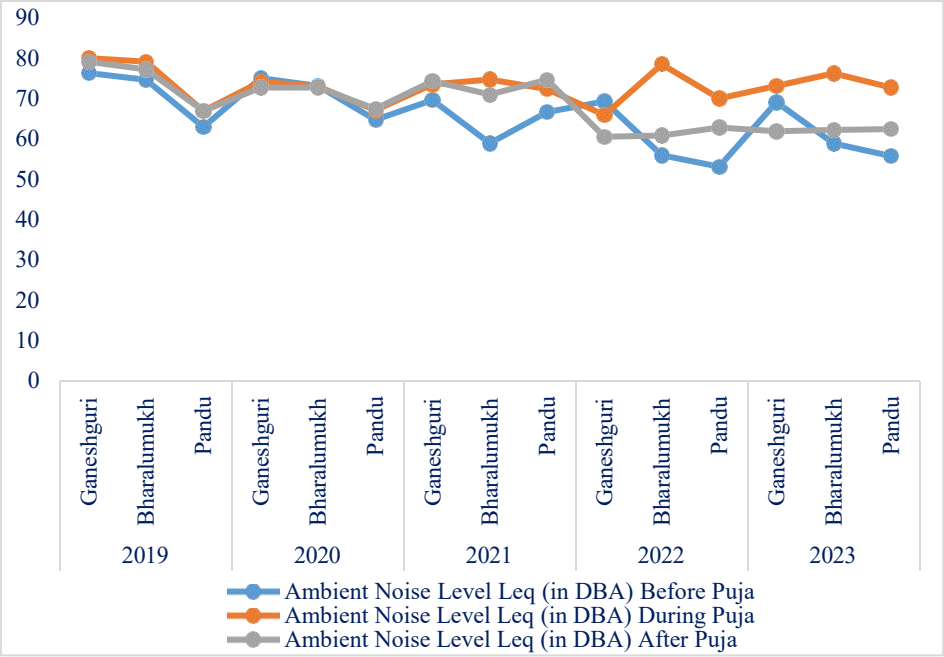


Fig.1 Comparative Study of Noise Indices $L_{eq}$ Before, During and After Durga Puja

### *B. Ambient Noise level during Deepawali-2023*

TABLE III AMBIENT NOISE LEVEL DURING DEEPAWALI AT ULUBARI AREA AS PER PCBA REPORTS

| Location | Time | 06.11.23 (Before Deepawali) | | | 12.11.23 (During Deepawali) | | |
|---|---|---|---|---|---|---|---|
| | | $L_{min}$ | $L_{max}$ | $L_{eq}$ | $L_{min}$ | $L_{max}$ | $L_{eq}$ |
| Ulubari | 6 PM-7 PM | 58.7 | 84.7 | 70.7 | 61.3 | 72.7 | 65.3 |
| | 7 PM-8 PM | 56.5 | 85.3 | 66.1 | 56.1 | 101 | 72.9 |
| | 8 PM-9 PM | 55.8 | 81.3 | 66.5 | 58.9 | 105.4 | 74.6 |
| | 9 PM-10 PM | 53.2 | 83.9 | 64.3 | 57 | 105.1 | 79.6 |
| | 10 PM-11 PM | 53.8 | 87.5 | 65.4 | 56.2 | 96.2 | 73.1 |
| | 11 PM-12 PM | 52.6 | 82.3 | 62.7 | 55.5 | 81.2 | 66.3 |
| Ganeshguri | 6 PM-7 PM | 58.9 | 95.6 | 70.6 | 58 | 96.8 | 69.7 |
| | 7 PM-8 PM | 58 | 89.8 | 69.6 | 57.6 | 114.5 | 75.9 |
| | 8 PM-9 PM | 57.5 | 94.6 | 68 | 59 | 100.7 | 71.4 |
| | 9 PM-10 PM | 56.3 | 87.7 | 67.1 | 56.1 | 100.8 | 72 |
| | 10 PM-11 PM | 55.1 | 87.1 | 65.2 | 56.7 | 102.3 | 70.9 |
| | 11 PM-12 PM | 48.7 | 65 | 64.8 | 54.5 | 101.1 | 70.1 |
| Panbazar | 6 PM-7 PM | 45.9 | 77.6 | 59.1 | 48.1 | 100.6 | 74.8 |
| | 7 PM-8 PM | 45 | 79.2 | 62.2 | 47.2 | 121.9 | 87.9 |
| | 8 PM-9 PM | 44.9 | 81.8 | 58 | 46.7 | 102.9 | 76.4 |
| | 9 PM-10 PM | 40.6 | 79.6 | 57 | 45.2 | 109.8 | 79.7 |
| | 10 PM-11 PM | 39.1 | 84.1 | 57.2 | 44.7 | 112.1 | 81.8 |
| | 11 PM-12 PM | 38.8 | 72.6 | 53.4 | 37.8 | 100.2 | 72.5 |

Ulubari showed a moderate increase in average $L_{eq}$ from 66 dB(A) to 72 dB(A) during Deepawali. Although lower than Panbazar, the noise levels still exceeded the permissible limits across all time slots. Lmax reached 105.4 dB between 8–9 PM, indicating significant firecracker activity. Interestingly, the rise in Leq was relatively uniform at this location, with all evening time slots remaining between 65.3 and 79.6 dB. This suggests persistent medium-to-high noise levels throughout the evening. Even the $L_{min}$ values remained above 55 dB, indicating a lack of quiet periods. Compared to the other two locations, Ulubari presents a controlled yet consistently elevated noise pattern, implying the need for regulation, though with relatively less urgency than Panbazar.

At Ganeshguri, the ambient noise level showed a noticeable rise during Deepawali. The average $L_{eq}$ increased from 66 dB(A) before Deepawali to 71.7 dB(A) during the festival. The sharpest increase occurred between 7–8 PM, when $L_{max}$ surged from 89.8 dB to 114.5 dB, indicating the peak of firecracker activity. Notably, all time slots during Deepawali exceeded the CPCB residential night noise limit of 55 dB(A). Even the lowest Lmin values remained close to or above 54 dB. This suggests sustained high noise levels, potentially causing discomfort and health risks. The consistent elevation of $L_{eq}$ across all evening hours indicates prolonged noise exposure in this commercial area, emphasizing the need for improved festival-time regulation and public awareness.

Panbazar experienced a drastic increase in average $L_{eq}$ from 57.8 dB(A) before Deepawali to 78.9 dB(A) during Deepawali, the highest among the three locations. Between 7–8 PM, $L_{max}$ spiked to an alarming 121.9 dB, the peak value in the dataset, indicating excessive bursting of high-decibel firecrackers. Even during the 11 PM–12 AM time slot, Lmax reached 100.2 dB, which is highly concerning given the prescribed nighttime limits. Such extreme values suggest severe noise pollution with potential impacts on human health, particularly sleep disturbance, anxiety, and stress. The data indicate that Panbazar, as a densely populated urban zone, is highly vulnerable to festival-related noise pollution and requires immediate attention through policy enforcement, public sensitization, and time-bound restrictions on fireworks.

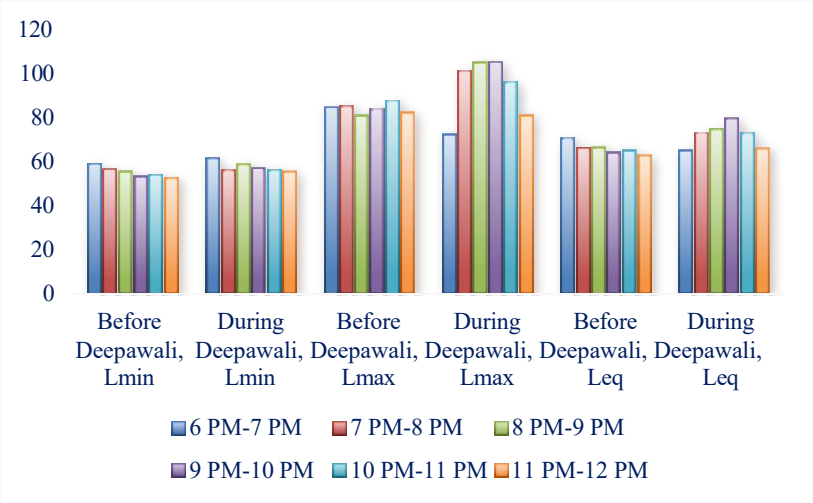


Fig.2 Comparative Study of Noise Indices $L_{min}$, $L_{max}$ and $L_{eq}$ for Ulubari Area

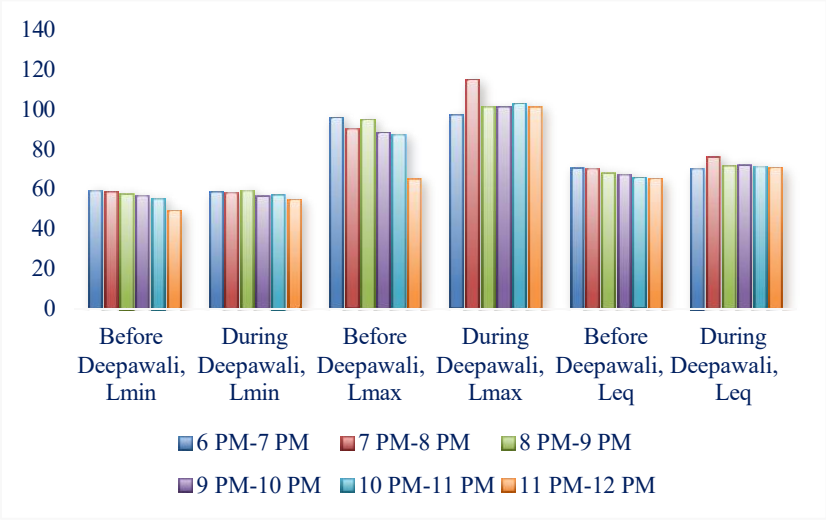


Fig.3 Comparative Study of Noise Indices $L_{min}$, $L_{max}$ and $L_{eq}$ for Ganeshguri Area

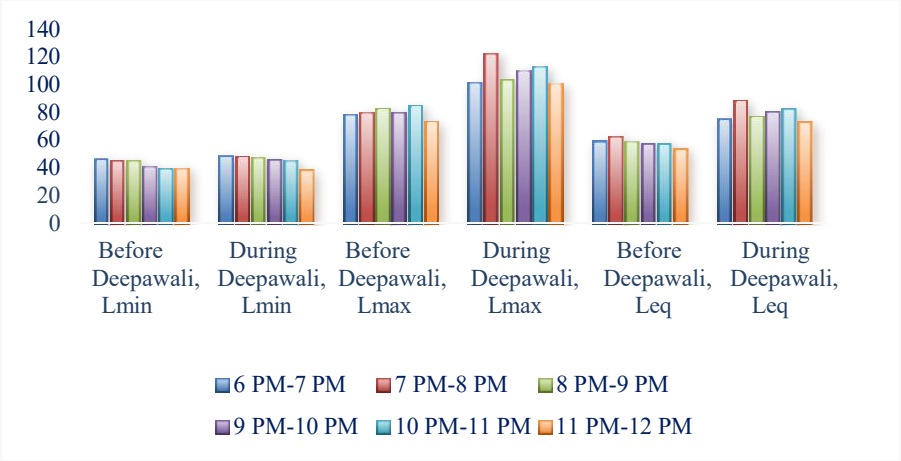


Fig.4 Comparative Study of Noise Indices $L_{min}$, $L_{max}$ and $L_{eq}$ for Panbazar Area

### *C. Comparison of Noise Levels with CPCB Limits*

All the observed locations exceeded the CPCB's permissible noise levels. Among the surveyed sites, Panbazar recorded the highest noise level, approximately 80 dB, which significantly surpasses the permissible limit of 55 dB. Ulubari and Ganeshguri both exhibited noise levels around 70 dB, again exceeding their respective thresholds. Overall, the data clearly indicate that noise pollution in Guwahati during Diwali reaches hazardous levels, breaching environmental safety norms across all area types. This pattern reflects a broader disregard for noise regulations during festivals and emphasizes the urgent need for public awareness campaigns, stricter regulatory enforcement, and alternative celebration methods to reduce the impact of festive noise on human health and the environment.

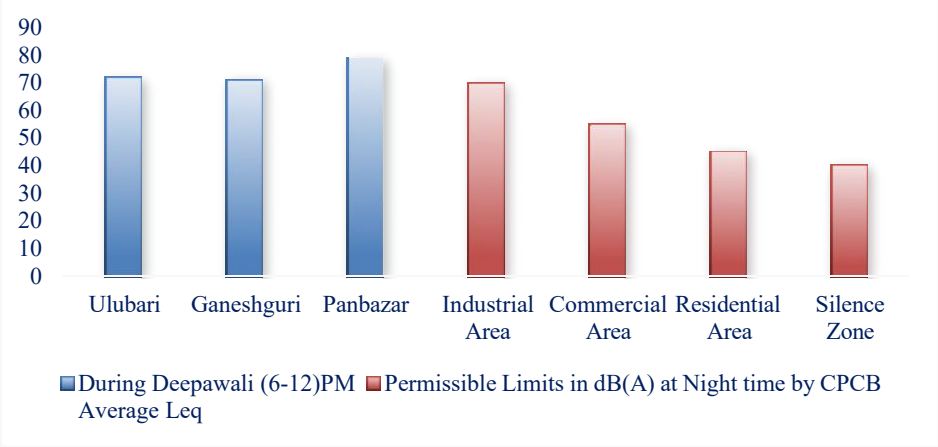


Fig.5 Comparative Study of $L_{eq}$ During Deepawali with Permissible Limits by CPCB, India

## V. HEALTH IMPACTS

Excessive noise levels, especially during festivals such as Diwali, pose a serious threat to public health. Prolonged or sudden exposure to high-intensity sound can lead to a range of physical and psychological health issues [13]. According to health experts, sustained exposure to sounds above 70 decibels can be harmful, while levels beyond 85 decibels may cause permanent hearing damage [14]. One of the most immediate effects of high noise levels is hearing impairment. Continuous exposure to loud firecrackers or loudspeakers can result in noise-induced hearing loss, tinnitus (ringing in the ears), and, in some cases, irreversible damage to the eardrums [15]. This is particularly concerning for children and the elderly, who are more vulnerable to auditory stress. Sleep disturbance is another significant impact of noise pollution. Loud noises during nighttime celebrations often disrupt sleep cycles, leading to insomnia, irritability, and reduced concentration the following day [16]. Over time, poor sleep is associated with a weakened immune system and various chronic health problems [17].

Noise pollution also affects the cardiovascular system. Studies show that persistent exposure to high decibel levels can lead to elevated blood pressure, increased heart rate, and a higher risk of heart disease and stroke. The body's stress response to noise triggers the release of cortisol and adrenaline, which contribute to long-term health deterioration. From a psychological perspective, high noise levels can cause increased stress, anxiety, and mental

fatigue [18]. These effects may reduce productivity, cause mood swings, and negatively affect overall emotional well-being. In children, chronic noise exposure can impair cognitive development, reduce attention spans, and impact learning outcomes. For pregnant women, constant exposure to loud sounds may increase the risk of preterm delivery and low birth weight in infants [19]. Overall, noise pollution has severe impacts on individual health and community life, highlighting the need for stricter regulation, greater public awareness, and responsible celebration practices.

## VI. CONCLUSION

The analysis of ambient noise levels across various locations in Guwahati during major festivals such as Deepawali and Durga Puja reveals a consistent and significant rise in noise pollution during festive periods. Across sites including Ganeshguri, Panbazar, Ulubari, Bharalumukh, and Pandu, the $L_{eq}$ values recorded during festivals consistently exceeded the CPCB's permissible limits, particularly the nighttime limit of 55 dB(A). Among all locations, Panbazar and Ganeshguri experienced the highest noise levels, with $L_{max}$ values during Deepawali reaching up to 121.9 dB(A), a level hazardous to human health. Even quieter zones such as Pandu and Bharalumukh recorded a sharp increase in Leq during Durga Puja in 2023, suggesting that noise pollution is spreading beyond commercial centers. The data also indicate that festive noise is not confined to short durations but persists well into late-night hours. Ganeshguri consistently showed the highest average $L_{eq}$ across multiple years, marking it as a noise pollution hotspot. This trend reflects a growing challenge driven by the widespread use of high-decibel firecrackers, loudspeakers, and increased human activity during festivals. Such persistently elevated noise levels call for urgent regulatory intervention, including strict enforcement of noise limits, public awareness campaigns, and the promotion of eco-friendly celebrations. Without timely action, Guwahati's urban population will continue to face increasing health risks such as stress, sleep disorders, and hearing issues linked to prolonged exposure to high noise levels.

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The authors confirm that no AI-assisted technologies were used in the preparation or writing of the manuscript, and no images were altered using AI.

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