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"Nature Sound of Frog's Calls on Human Stress Level: A Study at Denai Alam Recreational Park"

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ABSTRACT

Nature soundscapes are increasingly recognized for their potential to mitigate stress, especially in urban environments where noise pollution and hectic lifestyles contribute to mental health challenges. The purpose of this study is to look into how visitors' self-reported stress levels are affected by frog call soundscapes at Denai Alam Recreational Park. Before and during exposure to recorded frog calls and urban noise soundscape, participants' stress and mood levels were evaluated using a questionnaire-based methodology. The levels of stress reduction will be compared, with an emphasis on the ways in which frog calls affect emotional health and relaxation. The findings are intended to provide evidence for incorporating natural soundscapes into urban park design to increase mental health benefits. This research contributes to the growing field of environmental psychology and supports sustainable urban planning by emphasizing the restorative power of natural sounds.

Keyword: Frog Calls, Stress Reduction, Urban Parks.

INTRODUCTION

Stress is a pervasive challenge in modern urban environments, with increasing urbanization, noise pollution, and limited access to natural settings contributing to rising levels of psychological (Gupta et al., 2022). Numerous health problems, such as anxiety, depression, heart disease, and compromised immunological function, have been connected to long-term stress exposure World Health Organization (WHO). Finding non-invasive, affordable ways to reduce stress and enhance mental has become essential as the population of cities increases.

Natural settings, especially soundscapes, are essential for fostering wellbeing and relaxation. Natural sounds like rustling leaves, flowing water, and bird calls have been repeatedly demonstrated to improve mood and lower stress (Alvarsson et al., 2010; Medvedev et al., 2021). By reducing perceived stress and encouraging relaxation, these auditory stimuli have been shown to have restorative effects. Frog cries, among other natural sounds, are specifically connected to wetland settings and induce feelings of peace and nature connection (Buxton et al., 2021; Davies et al., 2020). Few studies have examined the precise impact of frog call soundscapes on human stress, despite their widespread presence in natural environments.

The purpose of this study is to determine whether frog call soundscapes can help visitors at Denai Alam Recreational Park, a natural wetland setting in Selangor, Malaysia, feel less stressed. This study aims to determine how frog calls affect mental health in comparison to urban noise, a prevalent aspect of contemporary city living, by concentrating on self-reported stress and mood swings. The results of this study will advance environmental psychology by providing proof that adding natural soundscapes to urban park designs can improve mental health. The study also supports the preservation of biodiversity and natural ecosystems to improve the quality of life in cities, which is in line with sustainable urban planning goals.

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LITERATURE REVIEW

Nature Soundscape and Stress Reduction

Nature soundscapes, encompassing natural acoustic elements like animal calls, water flows, and wind through vegetation, play a significant role in reducing stress by fostering relaxation and psychological well-being (Abbot et al., 2020; Buxton et al., 2021). By fostering a sense of peace and connectedness to nature, these soundscape—as opposed to urban noise—help people recuperate cognitively through "soft fascination" (Kaplan et al., 1995). For instance, the sound of water can reduce distractions and promote relaxation, while the gentle rustle of leaves and wind can drop pulse rates (Medvedev et al., 2021). Furthermore, animal sounds that indicate ecosystem health and harmony, such as frog cries and bird songs, help maintain emotional equilibrium (franco et al., 2019; Anderson et al., 2020).

Measuring Nature Soundscapes and Stress Levels

Field recordings and participant evaluations are combined with subjective and objective approaches to measure how nature soundscape affect stress. To measure acoustic characteristics like frequency and decibel levels, researchers use advanced audio equipment to record noises like wind, bird calls, and rustling leaves (Pijanowski et al., 2011). In addition to psychological instruments like the Perceived Stress Scale (PSS) and mood evaluation, physiological indicators like heart rate, blood pressure and cortisol levels are used to measure stress reduction (Alvarsson et al., 2010; Franco et al., 2021). Qualitative methods, such as interviews, delve deeper into individual reactions and particular aspects of the soundscape that encourage relaxation (Franco et al., 2019), elevate the mood. The benefits of combining these approaches are illustrated by studies such as (Benfield et al., 2014), which reveal that bird songs in urban parks greatly improve mood.

Applications to Stress Reduction

Soundscape of nature have been used effectively in a number of therapeutic contexts. Urban Parks designed to preserve or replicate natural soundscapes provide restorative environments that mitigate the stress-inducing effects of urbanization. It has been demonstrated that adding natural sound elements to urban green spaces—like the sound of rustling leaves or bird songs—improves visitors' psychological health and encourages relaxation (Franco et al., 2019).

Despite these results, a substantial study deficit still exists in the area of frog calls' effects on stress reduction. By investigating this little-known aspect of soundscapes, especially in a natural wetland setting like Denai Alam Recreational Park, our study seeks to close a significant gap in the literature and support urban design approaches that put biodiversity and mental health first.

Frog Call Soundscapes

Wetland ecosystems depend on frog call soundscapes, which are defined by repeating, rhythmic calls that are frequently heard at night or during rainy seasons. These soundscapes serve as indicators of ecological health and biodiversity (Both & Grant, 2020; Keck et al., 2019). However, compared to other natural sounds like bird melodies or flowing water, their potential restorative advantages for lowering human stress have not gotten much attention. This research gap emphasises the necessity of investigating their therapeutic effects, which may improve the relationship between public health and ecological preservation (Ng et al., 2017), soundscapes are frequently neglected in favour of visual aspects in urban park designs, which may be influenced by studies on frog calls. Research like that proposed for Denai Alam Recreational Park aims to address this gap by investigating the effects of frog calls on stress and promoting their integration into urban planning.

Urban Parks as Restorative Spaces

Urban parks are vital component of city environments, offering a refuge from the stress and demands of urban living. They serve as restorative spaces, promoting mental health and a sense of renewal by helping people recover from physical, emotional, or cognitive stress (Markevych et al., 2017). These spaces offer chances for

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quiet reflection, access to vegetation, and exposure to ambient sounds like frog calls and bird songs, which promote calm and drown out city noise (Medvedev et al., 2021).

For urban parks to function as restorative spaces, parks should include natural elements like plants, water features, and wildlife, along with safe, accessible pathways, proper lighting, and quiet spots for reflection. These elements align with restorative design principles and traditions like Japan's "forest bathing" (Park et al., 2010). Research shows that parks designed with these principles can improve mood, reduce stress levels, and enhance cognitive performance (Franco et al., 2019). Example of successful restorative parks include Hampstead Health in the UK, known for its meadows and serene soundscape, and Denai Alam Recreational Park in Malaysia, featuring wetlands and soothing frog calls.

Gaps in the Literature

There are also unanswered questions about certain auditory elements, such as frog calls, which are ecologically significant and may have distinct psychological impacts, despite evidence of the positive effects of natural soundscapes on mental health. Particularly in biodiverse tropical regions like Southeast Asia, research has frequently ignored the rhythmic and soothing features of frog calls in favour of boarder soundscape like bird songs and water (Ng et al., 2017). Additionally, studies frequently focus on physiological metrics while ignoring qualitative information such as emotional reactions, which could help us better understand how frog calls promote calm and a sense of connectedness to the natural world. Furthermore, because urban park design places more emphasis on aesthetics than acoustics, the therapeutic potential of frog cries is frequently overlooked (Hedblom et al., 2019). Filling in these gaps, for example by studying the effects of frog call soundscapes in Denai Alam Recreational Park, could emphasise their stress-reduction potential, encourage the preservation of wetlands, and inform more comprehensive urban park designs.

Relevance of the Study

The research on the influence of frog call soundscapes on stress levels connects sustainability, human well-being, and urban development while supporting global objectives such as the Sustainable Development Goals (SDGs) of the United Nations, particularly Goal 3 (Good Health and Well-being), 11 (Sustainable Cities and Communities), and 15 (Life on Land). This study offers potential for non-invasive, nature-based treatments by addressing the mental health issues that urbanisation has made worse in Malaysia, such as stress brought on by noise pollution and a lack of green areas. In order to enhances quality of life, it promotes the incorporation of natural soundscapes, such as frog cries, into sustainable urban design and emphasises the healing potential of urban parks. Moreover, the study link biodiversity protection to human benefits by concentrating on amphibian soundscapes as markers of wetland health, thus complementing Malaysia's National Policy on environmental preservation and urban development. The results contribute to the worldwide conversation on sustainable urban design and mental health resilience while providing practical advice for tackling mental health issues in quickly urbanising places like Kuala Lumpur.

RESEARCH METHODOLOGY

The park was divided into four zones: Zone 1 (noise from heavy traffic), Zone 2 (noise from night markets), Zone 3 (noise from maximum frog calls), and Zone 4 (minimal to no sound). The quantity of frogs in each zone and the flow patterns of pedestrians were observed to determine visitor preferences for different soundscapes.

For sound sampling, the Olympus LS-P4 audio recorder was used to capture audio recordings at night and after rain, when sound output was at its highest. This ensured that each location's soundscape was faithfully captured. The study analysed different sound characteristics in different zones, Zone 1 refers to anthropophony, a type of human-generated noise commonly found in urban environments, including traffic, vehicle engines, and honking. Zone 2 is characterized by a blend of technophony and anthropophony, characterized by the lively human activity from the night market. Zone 3 features biophony, where frogs' natural calls dominate the soundscape, offering a calming, restorative environment for animal vocalizations. Zones 4 promotes relaxation and stress alleviation by offering a peaceful setting with little to no sound, mostly

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geophony, and combining subtle noises like water and leaves. These recordings were incorporated into a survey questionnaire so that respondents could hear sound samples and express how each environment affected their mood.

The study's sample of 50 respondents was selected using recognised soundscape methodologies. Stress and mood levels will be assessed both before and after exposure to recorded soundscapes using validated measures such as the Perceived Stress Scale (Lee, 2020) and mood assessment instruments (Moser et al., 2012). By comparing the psychological reactions to frog calls, urban noise, and silence, this approach aims to explore the therapeutic advantages of natural soundscapes and evaluate their capacity to reduce urban stress.

Figure 1: Zoning Map for Sound Sample Collection at Denai Alam Recreational Park.

Table 1: Soundscape Characteristics and Sampling Details for Denai Alam Recreational Park Zones.

Zone	**Location**	**Types of Sound Sampling**	**Duration of Sound**	**Date and Time of Sampling Collection**
Zone 1: High Traffic Sound	Side facing the main road	High traffic sound	Continuous (with fluctuating intensity)	**26/11/2024** (17:00 PM - 18:00 PM)
Zone 2: Night Market	Near the night market area	Night market noise	Continuous	**25/11/2024** (20:00 PM - 21:00 PM)
Zone 3: Minimal to No Sound	Quiet nature zone, away from traffic and human activity	Minimal to no sound	Quiet with occasional subtle sounds (e.g., wind)	**27/11/2024** (17:00 PM - 18:00 PM)
Zone 4: Maximum frog calls sound	Wetland area with frog sightings	Frog call sounds	Continuous during peak calling times (after rain and at night)	**25/112024** (22:00 PM - 23:00 PM)

ANALYSIS AND DISCUSSION

Demographics Visitation Patterns and Their Current Condition and Stress Level

The demographics analysis reveals that most respondents were male (64%) and aged 21-30 (40%), followed by 31-40 (32%). Only 28% of visitors Denai Alam Recreational Park weekly, while 50% of visitors visited rarely, suggesting little interaction with the park's natural areas. Which aligned with studies by Klompmaker et al.

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(2019) people in urban area are more prone to stress, with 54% reporting occasional stress and 38% reporting constant stress. Hartig et al. (2014) and Franco et al. (2019), highlighting the advantages of natural settings and soundscape for people dealing with urban stresses. Participants' stress levels were noticeably elevated. A trend towards moderate to high stress levels was indicated in Section B, where 18% of respondents gave their present stress an 8 rating, 13% a 9, and 12% a 7, similarly 32% and 22%, respectively, reported stress levels of 8 and 9 throughout the previous week. At the same time, moods were mostly neutral or negative, with 16% rating their mood as mildly negative (3 and 4) and 26% rating their mood as neutral (5).

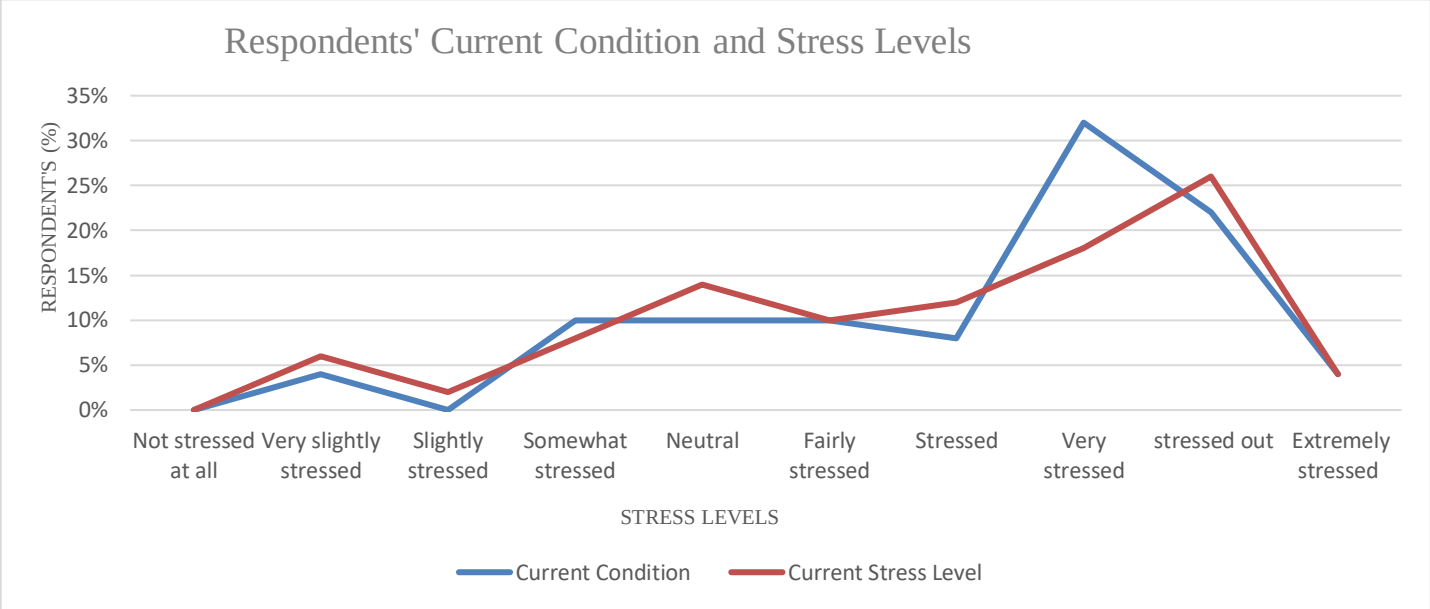

Figure 2: Respondents' Current Condition and Stress Levels

Perception of Natural and Urban Soundscapes

With preferences leaning towards water flowing (28%), frog calls (20%), and wind rustling (20%), 74% of participants perceive natural sounds, including frog calls, to be calming. Urban noise, on the other hand, was found to be the most distressing (42% for construction noise and 30% for traffic noise). According to studies on the physiological consequences of noise pollution, 62% of people who are exposed to urban noises rated their stress level as extremely high (9 or 10), demonstrating the negative effects of urban soundscapes on mental health (Basner et al., 2014).

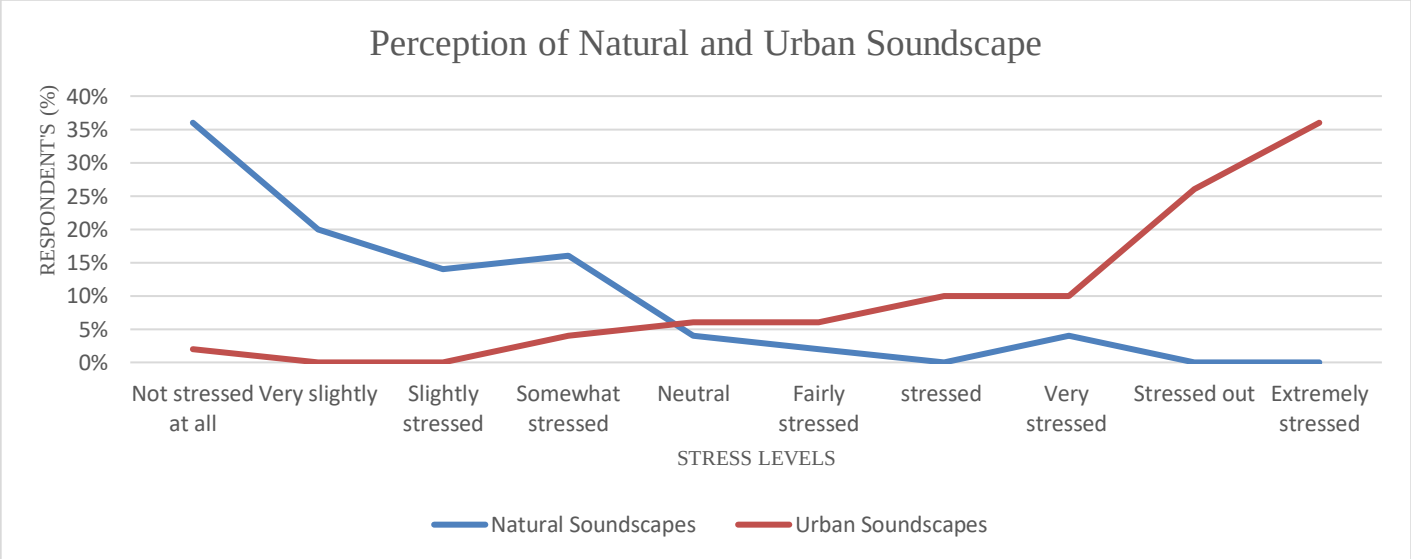

Figure 1: Perception of Natural and Urban Soundscape

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Effectiveness of Frog Call Soundscapes in Stress Reduction

Frog calls are clearly preferred by 68% of respondents as a way to unwind. Additionally, 44% of respondents said frog sounds were "absolutely effective" at lowering tension, highlighting their potential as a therapeutic tool. Which also consistent with research showing how natural soundscapes can reduce stress and anxiety (Alves-Pereira et al., 2020). Respondents further supported the idea that frog calls can enhance mental health by highlighting their connection to nature (28%) and adding variety to sound (30%) as their favourite aspects of it.

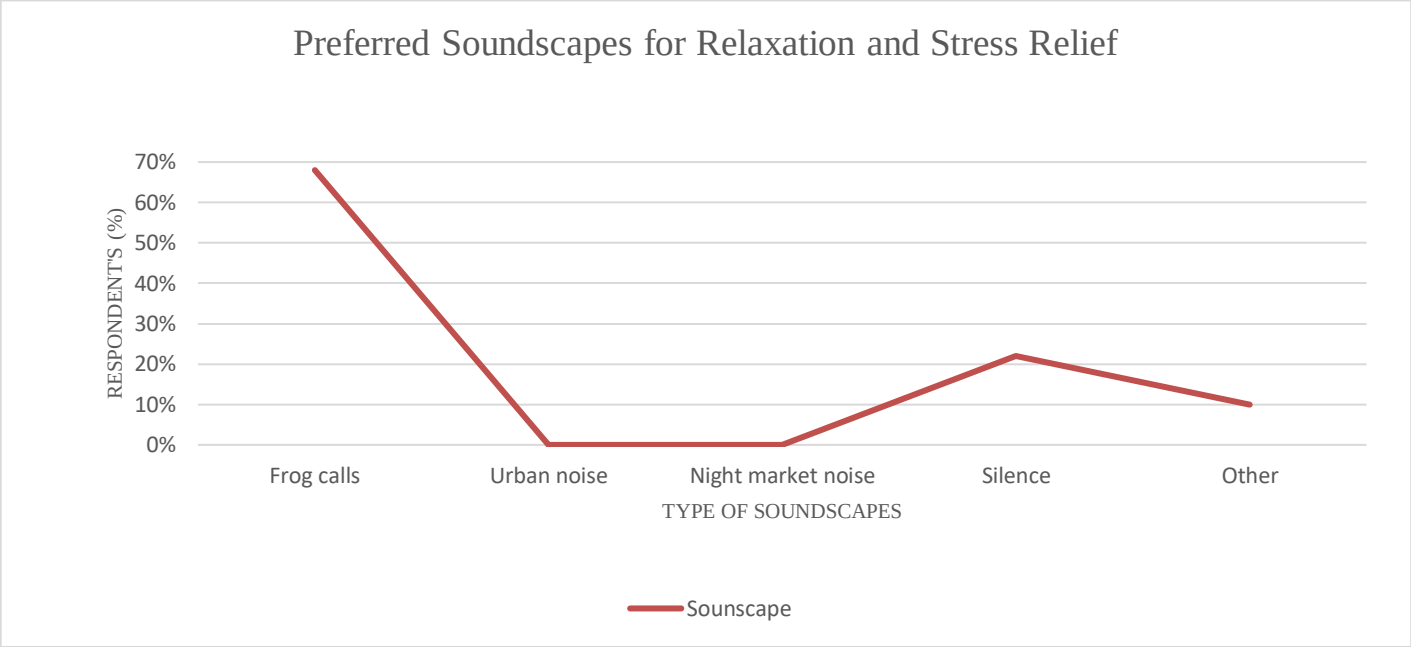

Figure 3: Preferred Soundscapes for Relaxation and Stress Relief

Limitation of Study

The data collection and analysis in this study were impacted by several of limitations. One of the main difficulties was the time limit, which limited the window for sound sample because frog calls, are most active under certain conditions, especially at night and after rain. This increased the study's time and logistical requirements by necessitating several site visits to record under ideal conditions. Also, the Denai Alam Recreational Park's poor maintenance and getting condition brought other difficulties, like accessibility problems and fewer of natural frog habitats, which might have an effect on the density and diversity of frog populations. Another issue came from the park's with poor visitor quantity, which made it harder to collect data on pedestrian flow and on-site perceptions. The findings from the research should be interpreted with consideration of these difficulties, even though every attempt was made to guarantee thorough data collection.

CONCLUSION

This study reveals the great potential of frog call soundscapes as a powerful tool for enhancing mood and lowering stress. The respondents' high levels of stress and positive perceptions of natural sounds highlight how important it is to incorporate these soundscapes into urban parks to lessen the stress that comes with city living. These findings support (Abbot et al., 2020) Stress Reduction Theory and (Kaplan's et al., 1995) Attention Restoration Theory, which emphasise the therapeutic value of nature in promoting emotional health and cognitive recovery.

The study highlights how important it is to have accessible and engaging nature-based therapies, particularly in Malaysian metropolis like Kuala Lumpur. Frog call soundscapes, which are praised for their calming effects, connection to nature, and variety of sounds, offer a sustainable way to manage stress in urban settings. Educational initiatives and sound installations could assist address the improper utilisation of parks like Denai

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Alam, promoting greater engagement with nature and ultimately improving the mental health of urban residents (Franco et al., 2019).

This study successfully achieved its aims and objectives, addressing key aspects of ecosystem protection, urban sustainability, and health in alignment with the United Nations Sustainable Development Goals (SDGs). Frog call soundscapes support SDGs 3 (Good Health and Well-Being) and 15 (Life and Land), frog call soundscapes promote good health, reduce stress, promote green spaces in urban planning, and put emphasis on habitat preservation and biodiversity. They contribute to SDG 11 (Sustainable Cities and Communities) by encouraging green spaces in urban planning. This study highlights how natural solutions like soundscapes can make urban spaces healthier and more sustainable urban spaces. It investigated the effects of frog calls on stress, compared them to urban noise, and assessed visitors' views on their relaxing benefits in urban parks.

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