ASSESSING ACOUSTIC COMFORT AND USER PREFERENCES IN URBAN PARKS: A COMPARATIVE STUDY OF SOUNDWALK AND QUESTIONNAIRE SURVEY DATA

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ABSTRACT
This study investigates visitors' perceptions of Lindenwood Park, an urban park located by the riverside of the Red River in Fargo, ND. The study uses data from an online park user survey and a field-recorded sound walk survey to analyze and compare visitor preferences within the park. It employed a mixed-methods approach, including an objective sound walk survey recorded by the authors and 234 unique park visitor responses from ages 18 to 65 to an online questionnaire survey. Objective sound measurements were taken at 53 survey spots on four different days, two in the morning and two in the afternoon, corresponding to the questionnaire. The findings show that in addition to the visual comfort evaluation of the landscape, the assessment of acoustic comfort also significantly influences users' acceptance of the urban park environment. The soundwalk survey collected visitors' perceptions and evaluations of the urban park soundscape and provided a baseline threshold for visitor tolerances.

In contrast, the qualitative questionnaire survey explored visitors' experiences and preferences regarding the soundscape for acoustic comfort and their preferred locations to visit inside the park. The study revealed the locations within the park where visitors perceived the most and least positive acoustic comfort in the urban park soundscape. Visitors preferred natural sounds, such as bird songs and water sounds, over human-made sounds, such as traffic and construction noise, as they found the former to be more soothing and pleasant. The study also found that visitors had varying preferences for the intensity and complexity of the soundscape, with some preferring a quiet and straightforward soundscape. In contrast, others enjoyed a more diverse and complex soundscape. The results suggest that urban park designers should prioritize the soundscape as a critical consideration. They should carefully plan for programming group elements where masking of anthropogenic sound is difficult and extensively buffering mechanical sound in areas where groups are unlikely to gather, and individuals prefer to visit. The study finds that group activities are comfortable with decibel levels up to 72dB and that individuals seeking solo activities have a threshold preference of up to 60dB when analyzing the 234 park visitor responses for location programming and comparing them to the readings of the soundwalk survey.

Keywords
soundwalk survey, urban park, soundscape perception, acoustic comfort, urban soundscape evaluation.

1 INTRODUCTION

1.1 How soundscapes in urban parks are perceived

Urban parks substantially benefit both the ecological environment and the public community. However, rapid socioeconomic growth and urbanization have distanced urban citizens from nature. High-intensity work, stressful lives, and changes in living environments have indirectly impacted urban residents' physical and mental health (Karasek et al., 2012; Park et al., 2012; Tyssen et al., 2000). Compared to other urban spaces, urban parks feature more planted green spaces and designed landscapes, which can locally reduce air pollution (Laurent et al., 2019) and block some urban noise (Ow & Ghosh, 2017). Ulrich's stress recovery theory (Ulrich et al., 1991) suggests that exposure to nature or urban greenery can relieve mental stress as an "immediate, subconscious stress response." The visual aesthetic quality of landscapes, especially the beauty and exuberance of vegetation, has always been a primary focus in park designs (Smardon, 1988). Evidence recently suggests that soundscape quality enhances visitor experiences in parks (Nilsson, 2006). Natural sounds like birdsong and flowing water are preferred, while mechanical sounds from road traffic are not welcomed (Nilsson, 2006; Yu & Kang, 2010). Natural environments are more effective in promoting stress recovery than urban environments (Herzog et al., n.d.; Karmanov & Hamel, 2008). Soundscapes are key elements of restorative landscape design, offering recreational value and enhancing human experience through sound perception (Aletta et al., 2018). Annerstedt et al. (2013) demonstrated that birdsong and water flow sounds have better stress-relieving effects than no sound exposure. The restorative nature of urban parks has been recognized as a foundational aspect of late 19th Century "landscape gardening" and soon after "landscape architecture." This is evident in the work of H.W.S. Cleveland, who created public parks throughout the Midwest of the United States, including Klaus Memorial Park in Jamestown, ND, circa 1884, and advocated for and planned the Grand Rounds park system in Minneapolis and St. Paul, MN (Tischler, 2000). The dual purpose of landscapes for visual and psychological enrichment is documented in Cleveland's historical writings on aesthetic and profound influence from the transcendentalist movement's celebrated writers (Nadenicek, 1993).

1.2 What are soundscapes and soundwalks?

As described at the 10th Convention of the European Acoustics Association in 2023, "the definition of the soundscape was codified in an ISO standard for the first time. This definition drew from Schafer and Southworth's work, which focused squarely on human perception in context" (Mitchell et al., 2023). The term "soundscape" has been used by various disciplines to describe the relationship between a landscape and the composition of its sounds. The key differentiator is the perceptive construct of the soundscape. Sound in outdoor environments has traditionally been considered in negative terms as both intrusive and undesirable (Jennings & Cain, 2013). However, sound may provide positive effects, such as enhancing a person's mood, triggering a pleasant memory of a prior experience, or encouraging a person to relax and recover (Payne, 2013). Thus, the soundscape framework proposes a positive approach, which claims not only to reduce sound exposure but also to preserve, conserve, or even encourage certain sounds that may be of great interest to the population.

The sound walk survey is an academic method for evaluating soundscape quality, typically in locations designed to be restorative and quiet. The soundwalk survey was conducted by the authors to objectively record the characteristics and levels of sound in the park, which informed the map quadrants included in the questionnaire surveys. According to author Jiang Liu, "there are major differences between soundscape information derived from sound walks and from the experience of the general public." (Liu et.al. 2014). This study aimed to balance the differences by completing the soundwalk first and using the baseline information to create the park quadrants for survey participants to reference.

1.3 Soundscape literature on urban parks

Urban parks' function to improve the urban environment's soundscape through noise reduction may be limited by their size and location (Watts et al., 2010). However, recent studies have shown that soundscape perception is not explicitly associated with decibel levels but rather with the soundscape type, individual preference, individual sensitivity, and soundscape-related demographics (Hong et al., 2020; Van Renterghem, 2020). Age and gender have been shown to influence the perception of soundscapes (Alves et al., 2015; KANG, 2017; Ode Sang et al., 2016; Van Kempen et al., 2014); cultural background can also influence perceptions and assessments of the environment (Hunter, 2001; Muratet et al., 2015; Van

Kempen et al., 2014). Moreover, four vital elements are sound, space, people, and environment. The interrelationships among them have been highly prioritized in the soundscape studies of urban parks and other open spaces (Coles & Bussey, 2000.; Zhang & Kang, 2007); however, this study approach includes an additional measurement of the preferred geolocation for each visitor that completed a survey.

1.4 Study location and context

This study chose an urban riverside park with mainly a residential context and Interstate Highway 94 at its southern border. Lindenwood Park in Fargo, ND was selected as the study site. Various residential buildings and houses of worship border the park on the North and West boundary. The Red River and a busy interstate highway with a 2021 FM metropolitan council of governments average daily traffic (ADT) traffic count of nearly 73,000 cars per day. Taking it as the research object of the acoustic environment study is closer to the daily life and activities of nearby residents. Lindenwood Park is the most extensive multi-use park in Fargo, with five picnic shelters, a natively landscaped campground, bike & kayak rentals, restrooms, and two playgrounds for children, including a fully adaptive playground for people of all abilities. There is a pedestrian bridge connected to Moorhead's Gooseberry Park. The park location and surrounding environment are shown in Figure 1. The primary reasons for selecting this park as the test site were the various activity types along the river, the highway, recreational uses, and proximity to the interstate highway without any sound constructed sound barriers save the riparian tree canopy of primarily oak and elm species.

Figure 1. Lindenwood Park location. Diagram by the authors.

1.5 Research objective

The primary objective of this study was to determine the park's sound level conditions at different times of the day and to answer two primary questions: 1) How do soundscape qualities and decibel levels influence the preferences of where park users choose to visit, and 2) What are the tolerance thresholds for park visitors in a riverside park so designers can consider the level sound abatement needed for new park designs.

The sound environment of urban parks consists of different sources of sound, and their level of intensity has some correlation with individual perceptions of sound source types. This study mainly focused on developing an online survey questionnaire to understand visitors' experience in different soundscape zones of Lindenwood Park and to compare their awareness of natural, human, and mechanical sound effects for comfort and preference. This study used Lindenwood Park, Fargo, North Dakota, as a study site, representing an urban park environment with typical features discussed in section 1.5. The gradation of soundscape perception of the sample site is accessed with the help of the soundscape perception evaluation questionnaire.

2 METHODOLOGY

The two methods used in this study are a soundwalk survey with data recorded by the authors and a Qualtrics-based online survey completed by self-identified visitors to Lindenwood Park. The online questionnaire survey was used to collect and sort data on users' perception and evaluation of the park's qualitative acoustic environment characteristics and to examine how acoustic comfort evaluation relates to the acceptability of the environment and preference to stay within a park due to soundscape quality.

Lindenwood Park and Fargo, North Dakota, are selected as study sites. It was chosen because traffic noise was expected to be the significant sound source within the park areas. Also, they were expected to possess similar landscape features and to be equipped with sports and recreational facilities (Cheng et al., 2022.) Park users were asked to answer questions on an online survey about the sound quality of this park and suggestions to improve it. To capture the sound intensity, a sound walk survey was administered in both mornings and afternoons during weekends and holidays. Sound recordings and the measurements of the sound levels were carried out at 53 designated spots within the park. These physical sound measurements were carried out using a sound analyzer app that was as close to the target road segment as possible and in a direction facing the nearest road. The sound analyzer app gave the equivalent sound pressure levels. The buildings around the park are mainly residential areas, which belong to Class 1 sound environment functional area according to sound environment quality standard GB3096-2008, with a daytime ambient noise limit value of 55 dB (A). The Sound Environment Quality Standard GB3096-2008 is a set of regulations established by the People's Republic of China to manage and assess environmental noise levels. Class 1 Sound Environment Functional Area typically refers to a designated space classified based on its sound environment for specific functional purposes. The "functional area" aspect indicates that the space is designed or intended to support particular activities that benefit from a controlled sound environment: class 1 Areas that require a quiet environment are typically residential areas and public parks, of which Lindenwood Park is a functional fit as shown in Table 1. The sound measurement and the questionnaire survey enabled an analysis of the visitors' perceptions of the park's soundscape.

Table 1. Levels of influence per type for several sensitive functions.

Area (m^2)	92 acres
Location	A residential district near a busy highway
Sports facilities	
Swimming pool	No
Football fields	No
Multipurpose field	Yes
Playground (age 2 - 5)	Yes
Playground (age 5 - 12)	Yes
Basketball courts	No
Jogging path	Yes
Extreme games	Yes
Tennis	No
Bicycle tracks	Yes
Landscape features	
Square	No
Campground	Yes
Shelter	Yes
Restroom	Yes
Garden	No
Recreational trails	Yes
Pond	No
River	Yes
No. of measurement spots	53

3 SOUND MEASUREMENT AND QUESTIONNAIRE SURVEY

This study chose an urban park with mainly commercial land use as the study site. Lindenwood Park was selected as the study site. It is in Fargo, North Dakota state. Various residential buildings, the Red River, and busy highways surround the park site. Taking it as the research object of the acoustic environment study is closer to the daily life and activities of nearby residents. Lindenwood Park is the largest multi-use park in Fargo, with five picnic shelters, a beautifully landscaped campground, bike & kayak rentals, restrooms, and two playgrounds, including a fully adaptive playground for people of all abilities. There is a pedestrian bridge connected to Moorhead's Gooseberry Park. The park location and surrounding environment are shown in Figure 1.

3.1 Sound measurement data collection using Decibel X

To understand the sound intensity of Lindenwood Park, 53 points were selected to measure the sound level of the park, including Gooseberry Park. The 53 points were selected in an overlapping grid spacing to cover the entire park and crossings. The data were collected on four (04) different days, two days in the morning and the other two in the afternoon. All the days were weekends because this park is more active on weekends than weekdays. A sound level measurement app Decibel X with a 30–130 dB(A) measurement range was used. The current sound pressure level of the park was collected on September 30th, 2023, and October 1st, 2023, from 8:00–11:30 a.m. in the morning and October 7th, 2023, and October 15th, 2023, between 4:00–6:00 p.m. in the afternoon, and the height of the measuring point was 1.5 m from the ground.

Based on the range of sound measurement points, it was decided to focus solely within the limits of Lindenwood Park, which was divided into 9 segments corresponding to the soundwalk measurements and common areas for park activity (see Figure 2.). The questionnaire survey asked which part of the park visitors most prefer to stay. While taking sound level data it was taken note about the activity of this segment during that time and the nature of this sound such as human, natural or mechanical sound. The activities of different segments are listed in Table 2.

Table 2. Park activities in different segments

Segment Number	Description	Sound Source
1	Natural trail and less active place	Natural
2	Parking lot and open space without any facilities	Mechanical and natural
3	Small picnic shade and parking facility	Human, mechanical, natural
4	Open space and parking lot	Mechanical and natural
5	Main picnic shelter with a parking lot, children's play area, and RV parking	Human, mechanical, natural
6	Fishing deck, boat landing, and parking lot	Mechanical and natural
7	Entry point of the park and small parking lot	Mechanical and natural
8	Natural trail and less active place	Natural
9	RV parking with a natural setting	Human, mechanical, natural

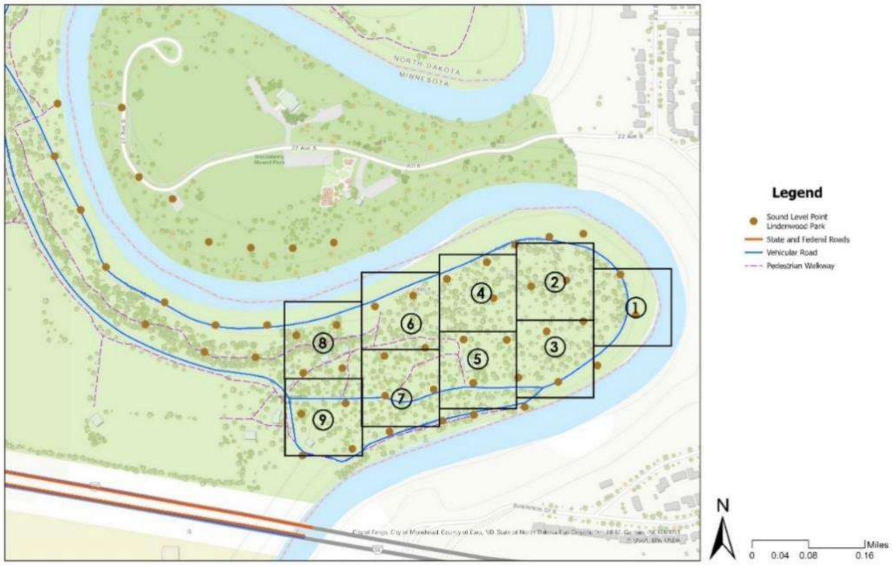

Figure 2. Park segment according to activity. Diagram by the authors.

3.2 Sound measurement datasheet

The sound pressure level research measurement point data information is shown in Figure 3, where we compared the morning and afternoon sound level intensity to understand the overall range and quality of sound in Lindenwood Park. This figure represents continuous data, and the unit of this measurement is decibels. The data was extracted from the sound measurement app and transformed into a table form to get a generalized idea of which point of the park has a more intense sound level and which time of the day reflects more sound and which category of sound. The data table reflects that afternoon is more intense than morning, and the points closer to the highway and parking have higher decibels. There are some points that are near highways but show lower sound levels because trees enclose those locations. The data was imported into Arc GIS Pro, and morning and afternoon maximum, minimum, and average sound level maps were prepared to understand the park's sound level. The maximum sound level in the morning was found in two sound measurement points (02) with a range of 71 - 85 dB(A), while ten (10) sound measurement points reflect the minimum sound level ranging from 51 - 55 dB(A). In contrast, there are ten (10) sound measurement points that reflect the maximum sound level in the afternoon with the range of 71 - 85 dB(A), and the minimum sound level is shown in one (01) point with 56 – 60 dB(A). See Figure 4 for morning and afternoon maximum sound level data along with morning minimum sound level data analysis.

These two data analyses show that the maximum sound level in the morning and afternoon is on the park's south side, which is close to the highway, parking area, and main picnic shelter. On the other hand, there are some sound measurement points on the park's south side, which is also close to highways but does not indicate high sound intensity because those areas are mostly enclosed with large trees and act as a sound screen. From this sound walk data analysis, we divided the park into nine (9) segments and added the map with a questionnaire survey to determine visitors preferred location for relaxation.

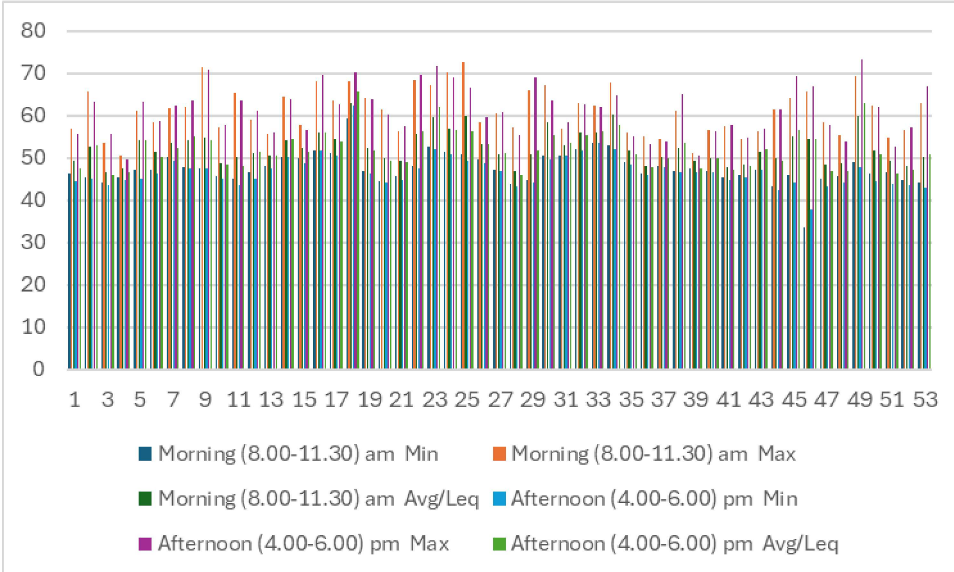

Figure 3. Sound intensity level research measurement point data

3.3 Questionnaire survey

An IRB protocol was created and approved for an online survey created by the authors and disseminated via local email listservs and social media. A total of 234 respondents completed the online questionnaire survey under-informed conditions, of which males completed 35.27%, 62.95% were female, and 1.79% had their identities not listed. 19.64% of the participants were 18-25 years old, 12.95% were 26–30 years old, 20.09% were 31–40 years old, 42.86% were over 41-65 years old, 4.02% were above 65 years old and 0.45% were not willing to answer this question.

The questionnaire comprises five main sections. The first section was sociodemographic characteristics and aimed to extract respondents' gender, age, level of education (primary school, secondary education, higher education- university, master's degree, Ph.D.), how big city they are from in consideration of the population of the city (metropolitan city, big city, medium city, large town, town, village/ rural area). In this section, they also asked how often they visit the urban park (daily, weekly, monthly, rarely) and how long (minutes) they stay in the park (less than 30, 30 - 59, 60 - 89, 90 - 119 or more than 120).

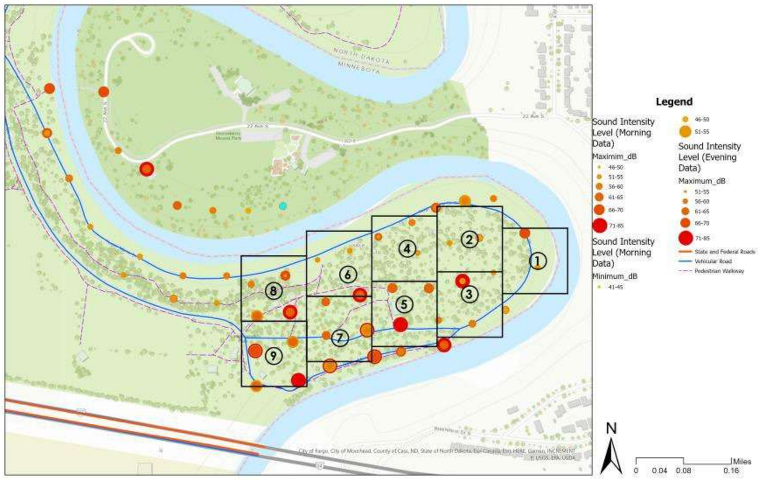

Figure 4. A sound level analysis for the morning and afternoon, maximum, minimum, and mean sound levels recorded in 53 locations— GIS diagram by the authors.

The second section asked questions about visitors' auditory capability and their soundscape perception of urban parks. Respondents were asked to rate their auditory capability (1– 5 scale, "very poor," "poor," "average," "good," very good"). They were also asked to rate their overall soundscape perception of the urban park (1- 5 scale, "very negative," "negative," "neutral," "positive," very positive"). What are the most common sounds they hear in the park? These were asked in this section (bird song, traffic noise, flowing water, wind rusting through trees, children playing, music playing, and others).

The structure of the third section is like that of the second section, but its focus is on activity and sound preference. Respondents were asked which sound they found most enjoyable in the park by ranking 1- 5 (bird song, traffic noise, flowing water, wind rusting through trees, children playing, and music playing). They were also asked if there was any specific sound they liked to hear in the park and which sound they found unpleasant and disruptive. They were then asked on a scale of 1- 5, how important is a tranquil and quiet soundscape of the park ("not important," "less important," "neutral," "important," or very important")? The respondents were asked what activities they typically engage in while visiting the urban park (e.g., walking, picnicking, relaxing) and whether the park's soundscape impacts the choice of activity. The last question of this section is how respondent want to scale unpleasant sounds during their activity in the park (1- 5 scale, "very unacceptable," "unacceptable," "neutral," "acceptable," very acceptable") and do they prefer to stay in the park for the bad soundscape quality ("leave right away," "consider leaving," "neutral," "consider staying," continue to stay").

In the fourth section of this questionnaire survey, respondents were asked about the soundscape quality of Lindenwood Park, Fargo, ND. Do they visit this park, and how often do they visit there? Respondents were asked how they rate the noise level of Lindenwood Park (1- 5 scale, "very quiet," "quiet," "moderate," "noisy," very noisy") and which part of this park they prefer to stay and enjoy by selecting the area from a map of the park, where the park was divided into nine (09) section considering sound level data analysis (see Figure 2). They were also asked to rate the sound level of this park and what level of disruption caused by the unwelcoming sound they experienced here (1- 5 scale, "very unacceptable," "unacceptable," "neutral," "acceptable," very acceptable,") and source of disturbance affect their experience.

The final section collects information on individuals' personal suggestions to enhance the urban park's soundscape and whether there are any specific hours or days they believe the soundscape in parks is more enjoyable or disruptive. Respondents were also asked to share their experiences in the urban park.

4 RESULTS

4.1 Respondents' characteristics

234 respondents were successfully anonymized and collected online from December 6th, 2023, to December 30th, 2023. The average duration for completing an interview was around 10 to 15 minutes. The sound pressure level of the park was collected from 8:00–11:30 a.m. in the morning and between 4:00–6:00 p.m., and the height of the measuring point was 1.5m from the ground. The maximum sound level in the morning and afternoon was 56.05 and 60.96 dB(A), respectively, while the minimum sound level was 46.43 and 47.52 dB(A), respectively, in the morning and afternoon. Table 3 shows a summary of statistics on the respondents' personal characteristics.

Table 3. A summary statistic of the personal characteristics of the respondents

Gender	%
Male	35.27
Female	62.95
An identity not listed	1.79
Age (yr)	
18–25	19.64
26–30	12.95
31–40	20.09
41–65	42.86
Over 65	4.02
Do not want to answer	0.45
Highest level of education	
None	0.45
Primary school (elementary)	0.00
Secondary Education	8.52
Higher Education (University)	49.33
Master's Degree	31.84
PhD	9.42
I do not want to answer	0.45
Frequency of visiting the park	
Daily	3.57
Weekly	23.21
Monthly	45.54
Rarely	27.68
Purpose of visiting the park	
Walking or jogging	34.23
Exercising	4.56
Picnicking	12.24
Relaxing	28.01
Playing with children	14.11
Others	6.85
Duration of stay (min)	
Less than 30	17.04
30–59	54.26
60–89	20.18
90–119	5.38
More than 120	3.14
Place of residents	
Metropolis (More than 1 million inhabitants)	0.90
Big City (between 300.000-1.000.000 inhabitants)	4.04
Medium City (Between 100.000-300.000 inhabitants)	71.30
Large Town (between 10.000-100.000 inhabitants)	15.70
Town (less than 10.000 inhabitants)	4.93
Village/Rural Area (less than 2.500 inhabitants)	3.14
Self-rated auditory capability	
Very poor	1.44
Poor	1.92
Average	20.19
Good	39.42
Very good	37.02

4.2 Acoustic comfort assessment

The objectives are to identify the overall acoustic perception and factors that affect visitors of urban parks and their preference for staying there. The acoustic comfort assessment was rated on a five-point verbal scale with “low acoustic comfort assessment” or “high acoustic comfort assessment”. This assessment's question was how respondents wanted to describe any unpleasant sound during their activity in an urban park. High acoustic comfort assessment refers to a rated response of acceptable or very acceptable but excludes a neutral response. Low acoustic comfort assessment refers to a rated response of very unacceptable, unacceptable, or neutral. As a result, the total numbers of responses falling into two groups are comparable (11.89% for high acoustic comfort evaluation and 88.12% for low acoustic comfort evaluation).

4.3 Park sound and preference

From the questionnaire survey, we found that the most frequently heard sounds in the park were birdsong, flowing water, and wind rusting through trees. 25.77% of the respondents in the park listened to the wind rustling through trees, 20.75% heard bird songs, and 8.91% heard flowing water from the fountains and steam. The respondents also heard different types of anthropogenic and mechanical sounds. Sounds from children playing were heard by 21.72% of respondents, 18.80% of the respondents also mentioned that they heard vehicular noise, and 1,94% noticed music playing.

The respondents were asked which sound they found most and least enjoyable in the park, with the rank of 1 to 5, where 1 was least enjoyable, and 5 was most enjoyable. According to this, most respondents preferred birdsong, and flowing water was the most enjoyable sound. Conversely, traffic noise was the least enjoyable sound (see Figure 5 for respondents who preferred sound). They were also asked about the unpleasant sounds in the park and how tranquil and quiet soundscapes are important for urban parks, with a scale of 1 to 5, where 1 is not important and 5 is very important. The response shows that construction and traffic noise are the primary disruptive sounds, and most respondents prefer quiet soundscape as an important consideration during their activity in the park.

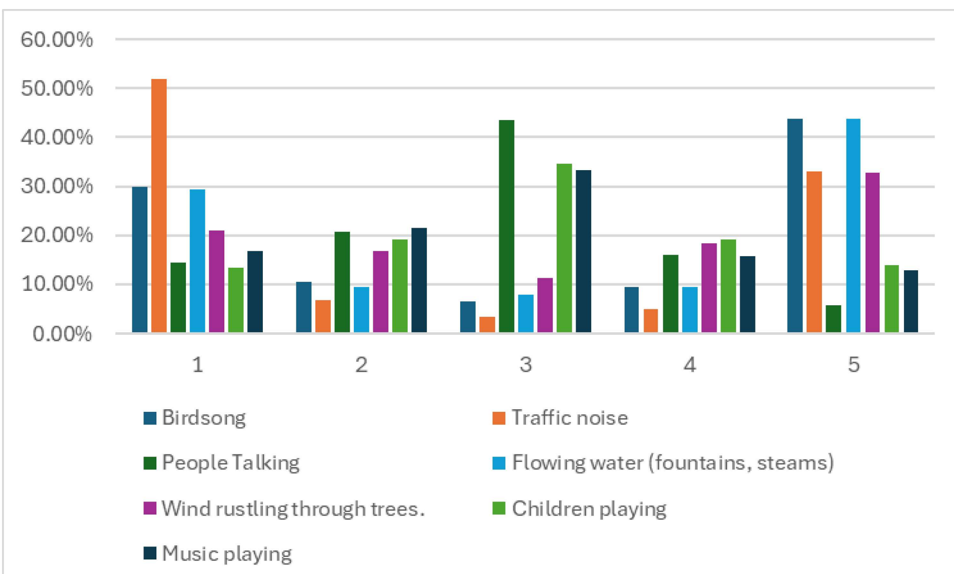

Figure 5. Visitor preference of the park sound. Diagram by the authors.

4.4 Soundscape quality and preference of Lindenwood Park

Out of 234 respondents, 180 mentioned that they have visited Lindenwood Park, Fargo, ND, where 1.13% of respondents visit there daily, 7.34% visit weekly, 37.29% visit monthly, and 54.24% visit rarely. According to the respondent’s evaluation, most found that Lindenwood Park's noise level is moderate. Respondents were also asked to mention their preferred location in Lindenwood Park, where they want to stay and enjoy according to the visitor's preferred location segment map. It was found that most respondents want to stay and enjoy themselves in segments 5, 6, 1, and 8 (see Table 4 and Figure 6).

Table 4. Visitor-preferred location of Lindenwood Park

Lindenwood Park segment	%
1	12.64
2	6.32
3	9.77
4	8.62
5	15.52
6	13.79
7	5.75
8	10.92
9	9.20

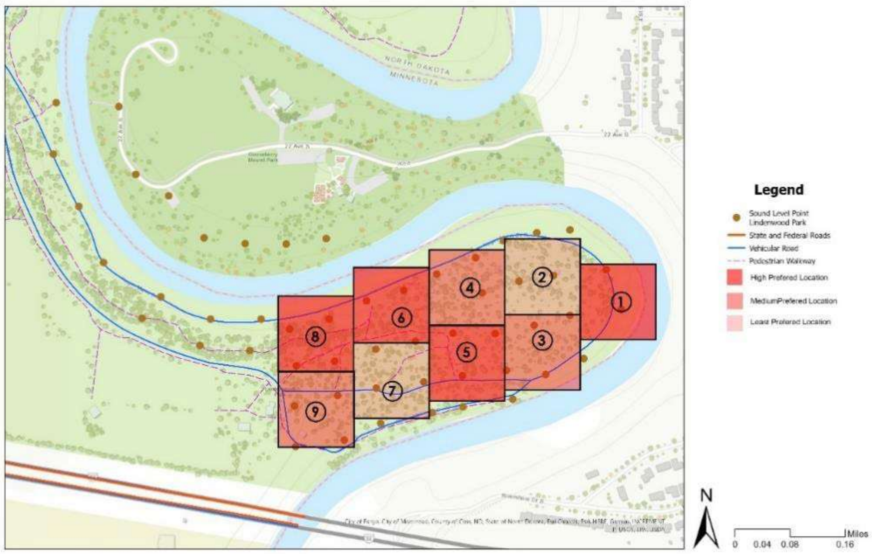

Figure 6. Visitor-preferred location map of Lindenwood Park. Diagram by the authors.

Lindenwood Park's maximum sound level data analysis map for the morning and afternoon and the segment map according to park activity reflect that in the morning, segments 5 and 9 have the highest level of sound intensity, and these two park sections are the most active areas. The main picnic shelter, children's play area, and parking lot for the main shelter are in Segment 5, and the RV ground is located in Segment 9. These two areas' sound sources are human, natural, and mechanical. In the evening, it also reflects the same sound intensity pattern in segments 5 and 9 as in the morning, but it also includes 3 and 7. Segment 3 has a secondary picnic shelter and parking facilities, and Segment 7 is the entry point of the park and small parking facilities.

Overall, the correlation between sound level and park activity is significantly related. The nature of the sound source and activity of that part of the park are major detrimental factors to attracting visitors and their preference to stay there.

5 CONCLUSION AND DISCUSSION

In conclusion, this study at Lindenwood Park in Fargo, North Dakota, provides valuable insights into the role of acoustic comfort in shaping visitors' perceptions and acceptability of urban park environments. By utilizing online questionnaire surveys and qualitative assessments through the sound walk survey method, this research highlights the intricate relationship between soundscapes and visitor experiences within urban parks.

The findings reveal that visitors highly value the tranquility and quietness of the park's soundscape, with a preference for areas with minimal human-made noise. Interestingly, the quietest areas did not always correlate with the highest preference values. This study underscores that, alongside visual comfort, acoustic comfort significantly influences users' acceptance of urban park environments. The sound walk survey captured visitors' perceptions and evaluations of the park's soundscape, while the qualitative questionnaire survey explored their experiences and preferences regarding acoustic comfort and preferred locations within the park.

The study identified locations within the park where visitors perceived the most and least positive acoustic comfort. Natural sounds, such as bird songs and water sounds, were preferred over human-made sounds like traffic and construction noise, as they were found to be more soothing and pleasant. However, the study also found that group activities were comfortable with decibel levels up to 72dB, while individuals seeking solo activities preferred levels up to 60dB. This analysis of 234 park visitor responses, combined with sound walk survey readings, revealed varying preferences for the intensity and complexity of the soundscape. Some visitors preferred a quiet and straightforward soundscape, while others enjoyed a more diverse and complex one.

The results suggest that urban park designers should prioritize the soundscape in their planning. They should carefully plan for programming group elements where masking anthropogenic sound is difficult and extensively buffer mechanical sound in areas where individuals prefer solitude.

The preference for birdsong and flowing water over traffic noise is expected. Still, the tolerance for higher decibel thresholds near active parts of the park indicates that sound preference is multivariate and cannot rely solely on decibel level readings. This makes sound walk surveys a high priority for future studies.

It is essential to acknowledge the limitations of this study. Conducted in a single park in Fargo, North Dakota, the findings may not be generalizable to other urban park settings, such as parks in warmer climates or larger cities. Future research should explore a broader range of park environments across different geographic regions and protracted across seasons to better understand the factors influencing park soundscapes and visitor experiences.

Additionally, while objective sound measurements provide valuable data on sound levels within the park, they may not capture the full range of visitor perceptions and preferences regarding the soundscape. Qualitative assessments, such as sound walk surveys and in-depth interviews, could complement objective measurements and focus the sound walk survey recordings in a linear network that can be easily followed by park users participating in the preference survey.

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