JOURNAL OF EVENT, TOURISM AND HOSPITALITY STUDIES
https://e-journal.uum.edu.my/index.php/jeth

How to cite this article:

Ajavi, A.O., & Adeleke, T. (2022). Soundscape mapping of Agodi Park and Gardens, Ibadan Southwestern Nigeria. *Journal of Event, Tourism and Hospitality Studies, 2*(1), 150-176. https://doi.org/10.32890/jeth2022.2.6

SOUNDSCAPE MAPPING OF AGODI PARK AND GARDENS, IBADAN SOUTHWESTERN NIGERIA

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Received: 10/5/2022 Revised: 11/10/2022 Accepted: 08/12/2022 Published: 23/12/2022

ABSTRACT

This study provides contextual evidence on recreational noise exposure in a typical Nigerian urban park. It investigated perceived sonic characteristics as well as the spatial noise variations across Agodi Park and Gardens in the city of Ibadan, Oyo State, Nigeria. Integration of noise mapping and soundscape methods was used to understand the nature of noise being generated in this outdoor setting. Sound Pressure Level (SPL) was used to obtain data from nine major locations within the park. Using a non-probabilistic method of sampling, fifty respondents were selected incidentally to participate in this study. With the aid of an instrument consisting structured questionnaires and observation checklist, information on respondents' demographic characteristics, their perceptions of the recreational noise, and desirability levels of soundscape in the park was obtained. Recreational noise data was analyzed using descriptive statistics and the Test of Difference (T-test) to investigate time-based variations in the level of noise (morning and evening periods). Although most respondents were oblivious of the noise exposure, findings show that the average sound level in the park was 77 dBA which exceeded the recommended noise limit of 60 dBA expected in recreational parks. The study recommends that soundscape characters should be considered in the design of future urban parks as they would go a long way in improving and enhancing the quality of perceived user's comfort.

Keywords: Urban sound planning, Noise mapping, Urban soundscape, Urban parks, Landscape management.

INTRODUCTION

Urban parks and gardens are examples of urban open spaces and they provide multiple services to the ecosystem generally. Urban open spaces exist on different scales (residential, neighborhood, and national), and their ownership can be either public or private. They can also be either free or fee-based (Ajayi & Amole, 2019). In terms of spatial configuration, some can be formal (purposely designed), while some are organic (informal) in nature. Out of the diverse typologies of urban open spaces; parks and gardens are the most popular globally (Stanley et al., 2012). Evidence from literature shows that parks and gardens are classified according to size, geographical location, target population, types of facilities, and the extent of naturalness of the site (Ajayi & Amole, 2019; Stanley et al., 2012; Bryne & Sipe, 2010). National Park, Urban Park, Community Park, District Parks as well as Pocket Parks are examples in existence. Apart from being pivotal in mitigating the effects of climate change, urban parks are also used by residents for leisure, tourism, cultural education, aesthetic appreciation, and spiritual needs (Gómez-Baggethun & Barton, 2013). Urban residents around the world express a desire for contact with nature and one another, including attractive environments, and recreational and play areas (Matsuoka & Kaplan, 2008). From the health perspective, parks and gardens have been reported to influence residents' health by encouraging health-promoting activities to take place. By this way, the availability and utilization of urban parks are associated with better health and quality of life of urban dwellers (Hartig et al., 2014; Ord, 2013; Lachowycz, 2013).

Individuals living in areas that lack urban parks may be more vulnerable to the negative impacts of stressful life events because they have less opportunities for nature-based coping strategies compared to individuals living in areas with abundant green spaces (Van den Berg et al., 2010). There is a compelling accumulation of evidence from a large number of studies that indicates a positive association between exposure to urban open space(s) and stress reduction (WHO, 2016; Hatrig et al., 2014; Hughes, 2014). Benefits are reported to include enhancement of mood, concentration, self-discipline, and reduction of physiological stress (Hughes, 2014). Although parks and gardens are preferred destinations for various physical and social activities, they can also be potential sources of urban noise generation, thus reducing the restorative impacts generated by their natural environments in urban parks. Urban parks are usually surrounded by busy streets, commercial buildings, and areas of high noise levels due to human activities and heavy traffic. Cao & Hsu (2021) affirmed that stress restorative benefits of urban parks may be compromised by overexposure to noise, which can have a negative impact on human health. It therefore goes without saying that patrons of urban parks might be denied the benefits of open space utilization if the noise level is beyond acceptable limits. A previous study opines that when urban parks are properly designed, they muffle urban noise pollution and can also provide relatively quiet areas to get away from the hustle and bustle of city lives (Lee et al., 2019).

Ozdemir et al. (2014) defines noise as the level of sound which exceeds the acceptable level and creates annoyance, therefore the perception of acoustic environment by humans is important. In the United States, a recent noise survey across 251 sites in 66 National Parks indicated that recreational noise was audible in 37% of recording (Buxton et al., 2019). The composition of urban noise is complex, due to a wide range of sounds originated from different sources, such as transport (road traffic, aircraft and railway noise), commercial and entertainment activities (Gagliano et al., 2020). Evidence reporting the impact of noise on human health is accumulating (Douglas & Murphy, 2016; Meyer et al., 2017). A World Health Organization report in 2011 classified noise as the third most hazardous type of pollution in cities after air and water. Consequently, noise exposure in urban centers deserves better attention than it is currently being given because findings from a World Health Organization study (2018) showed that globally, 466 million people are suffering from disabling hearing loss and in 2050 it is estimated to amounting a total of about 900 million people i.e., 1 in every 10 people will be affected.

According to Guski et al. (2017), environmental noise annoyance is a retrospective judgment comprising of previous experiences with a noise source over a particular period, and there are three elements to the noise annoyance response: a frequently repeated disturbance caused by noise, an attitudinal/emotional response, and cognitive response. Parks and outdoor areas offer a unique opportunity to conserve acoustic environments dominated by biophonic and geophonic sounds (Dumyahn & Pijanowski, 2011). Studies on outdoor soundscape have categorized acoustic environments into three categories; anthrophony, biophony, and geophony (Cao & Hsu, 2021; Buxton et al., 2019). Anthrophony sounds are generated from humans or man-made objects. The sound emanating from natural living sources are called biophony, while sounds produced by the natural non-living (geophysical) environment are called geophony (Li et al., 2018). In the United States, a study to understand the relationship between humans and sounds from biological, geophysical, and anthropogenic sources in parks found a clear preference for biophony and geophony and an aversion to anthrophony (Li et al., 2018).

The sonic environment although invisible, is a vital component of the urban environment that is influenced by population density and social contacts driven by urbanization. To stem the detrimental effects of noise pollution, government and agencies enact regulatory policies at various administrative levels. The standard approach for noise regulation is to set maximum thresholds for Sound Power Level (SPL) and to require mitigation activities when the limits are surpassed. The World Health Organization (WHO) recommends avoiding exposure to noise levels over 53 decibels. There are maximum acceptable noise levels (continuous equivalent sound levels–LAeq) for different environments recommended by the Environmental, Health, and Safety (EHS) Guidelines (2007) of the World Bank Group International Finance Corporation (IFC) (www.ifc.org/ehsguidelines). In the USA, for instance, the Noise Control Act was enacted by Congress in 1972 and amended in 1978; later, the primary responsibility for regulating noise was delegated to state and local governments (Asdrubali, 2014). Likewise, in Nigeria, the maximum permissible noise limits (LAeq) for various land uses are also enumerated in the Nigerian National Environmental Standards and Regulations Enforcement Agency (NESREA) Noise Standards and Control guidelines for community noise (Alani et al., 2020).

Noise maps, which are graphical representation of the noise levels are used frequently as a guide in urban noise management (Antonio et al., 2020; Alam et al., 2017). It can also help in the estimation of environmental noise exposure in a particular location as well as a tool for designing noise-control plans. Thus, noise maps serve as a useful strategic tool for environmental management decisions and environmental planning (Manojkumar et al., 2019). Soundscape analysis is one of the methods used in noise studies, and it consists of a set of audio recordings of an environment together with the perception of a group of people captured with the help of a questionnaire (Lee et al., 2019). Globally, studies have measured, predicted, and mapped noise levels in urban cities (Alam et al., 2017; Margaritis & Kang, 2017; Manojkumar et al., 2019), while some used participatory mapping techniques (D'Hondt et al., 2013; Guillaume et al., 2016). In the Nigerian context, considerable research work has been done in this regard, for instance, Alani et al. (2020) assessed spatial variation of noise levels within a section of the Festac residential area in Lagos and concluded that the highest mean noise levels occurred where a bus park is present.

In addition, Oyedepo (2012), examined environmental noise at selected locations in Ilorin metropolis, and the noise map developed reveals high noise exposure at the nucleus of the metropolis where commercial activities, high traffic volume, and clustered buildings with high population exist. Similarly, Oyedepo et al. (2019) assessed and mapped noise pollution levels in Ota metropolis, Nigeria using Geographic Information System (GIS). Using mobile phones, Ibekwe et al. (2016), evaluated the environmental noise levels in Abuja Municipality and reported that the daily noise levels in Abuja municipality were above the recommended tolerable values by the World Health Organization. While the findings from these studies are pertinent to mitigating the noise menace in our cities, the absence of specific and significant studies on recreational/leisure noise pollution in the Nigerian context validated this study. Moreover, the European Environmental Agency (EEA) in the Good Practice Guide on Recreational Centers (2018), opined that a holistic method that combines environmental noise policy using noise mapping with the soundscape approach is best suited for noise planning, however, studies using this method for recreation planning are sparse in Nigeria. It is therefore important to analyze the perceived sonic characteristics of Agodi Park and Gardens, examine and map the spatial recreational noise variations across locations of the park, and the significant difference between the daytime noise levels and night-time noise levels.

METHODOLOGY

Study area

Geographically, Ibadan city is in Oyo state, in the present south-western geo-political region of Nigeria (see Figure 1). It has served as the capital of Oyo State since 1967 and is currently reputed to be the largest indigenous city in Africa. Ibadan is situated within Latitude 7^{o} 25’0’’ North and Longitude 3^{o} 50’ 00’’ East approximately and rightly located 145 kilometers north of Lagos.

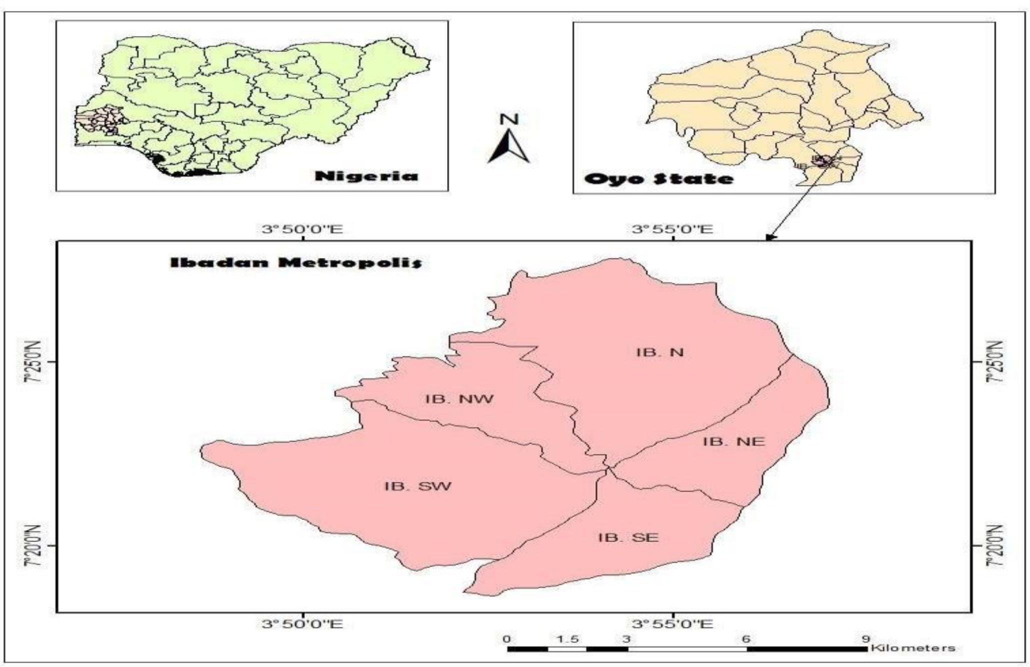

Figure 1. Map of Ibadan and Oyo State in Nigeria

(Authors’ Field work, 2021)

Figure 2. Map showing the locational setting of Agodi Park and Gardens

(Authors' Field work, 2021)

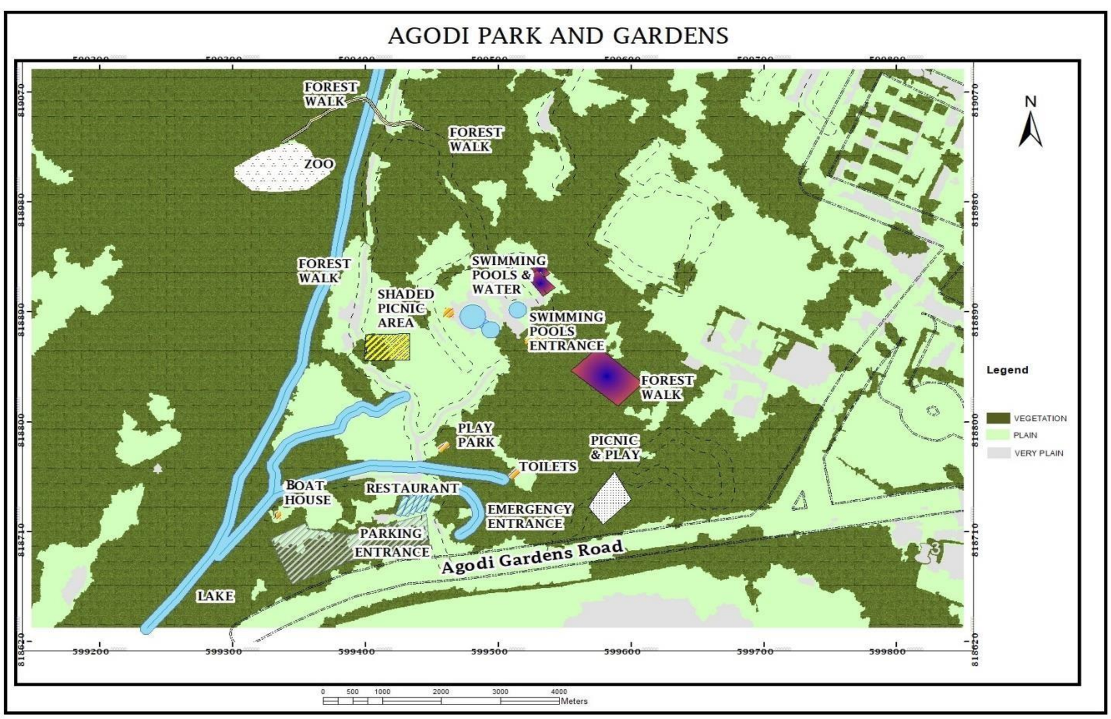

Figure 3. Map showing the physical Setting of Agodi Park and Gardens

(Source: Authors' Field work, 2021)

As shown in Figure 2, Agodi Garden Park is in the heart of Ibadan, with its ever-green landscape standing out among the city's brown roofs at the foot of Old Mokola Hill, along the University College Hospital -Secretariat Road. (Wikipedia, 2021). Agodi Garden Park is a tourist attraction in the city of Ibadan. Also called Agodi Botanical Gardens, the site is a serene environment on 150 acres of land (Figure 3). It is usually patronized by families during festive periods and weekends. While the children's facilities in the garden include a swimming pool with inflated floaters, grown-ups may use the shades provided by the tropical trees for picnics and other social gatherings.

Data collection

As presented in Figure 4 - 5, outdoor sound level measurements of recreational noise were carried out in nine distinct locations within the park. These included the ice-cream spot/ walkway, bar, picnic area, game area, restaurant, pool area, paint ball arena, car park, and the open field. Using the technique described in Lee et al. (2019), Sound Pressure Level (SPL) was used to obtain the instantaneous sound pressure level, the minimum SPL, the maximum SPL, and the continuous equivalent SPL at the nine locations. This information along with GPS locations was written to log files which were then used to generate noise maps. The SPL was placed at a height of 1.2 m above ground level to exclude reflections from the ground and pointed at the suspected noise source at a distance not less than 1 meter away from any reflecting object. In a related study by Lee et al. (2019), over 7 hours of environmental noise data were collected using the smartphone method, and accuracy of ±0.7 dB for 99.7% of the measurements was recorded. This range of accuracy validates the smartphone for measuring the sonic environment. In this current study, a-weighted continuous equivalent sound level (LA eq), instantaneous minimum (LA min), and maximum (LA max), sound level measurements were taken for a period of 5 minutes per location during the weekend. This procedure was repeated in the morning and evening because the park was usually busy during these periods and are fairly representative of daily recreational noise variations within the study area.

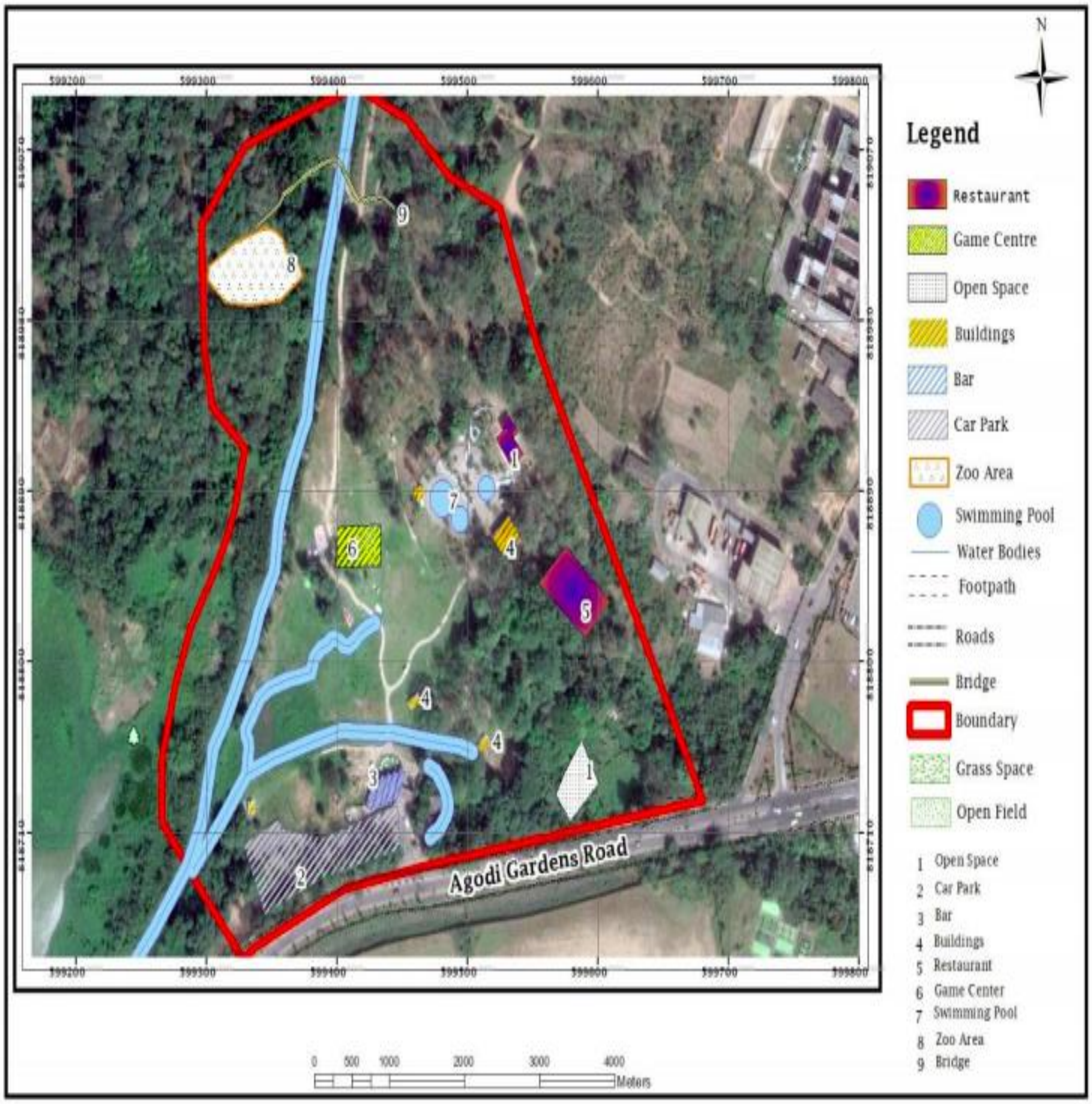

Figure 4. Sampling locations map

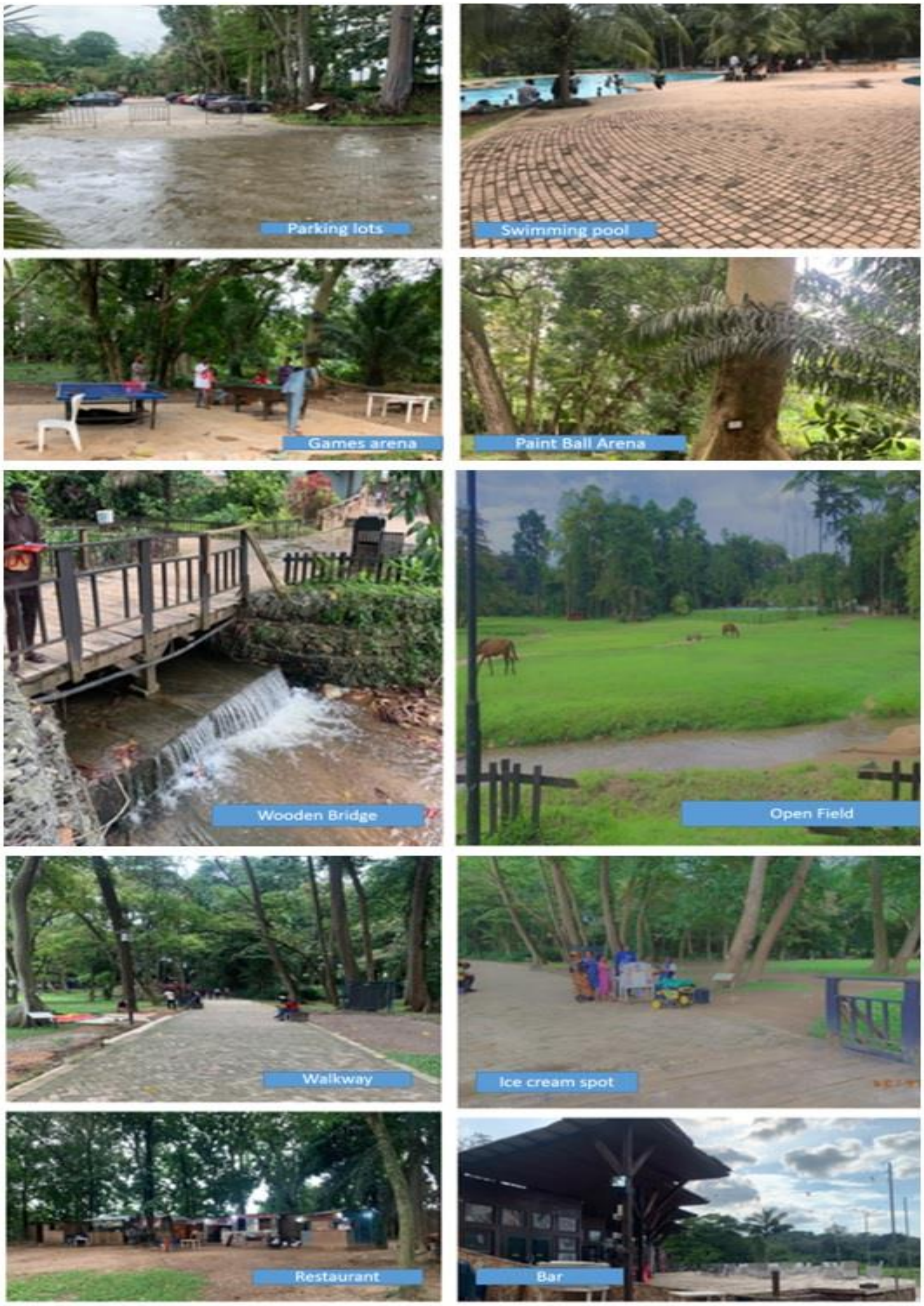

Figure 5. Sampling locations

Questionnaire survey

Using a non-probabilistic method of sampling, fifty respondents were selected incidentally to participate in this study. With the aid of structured questionnaires and an observation checklist, information on respondents' demographic characteristics, their perceptions of the recreational noise, and desirability levels of soundscape in the park was obtained in the morning and evening. A semantic differential scale was used to weigh the perceived sound level of respondents on a scale of 1-5. This was done by attaching values of weight to a different degree of responses as shown: Uncomfortably loud (5), Very loud (4), Moderate (3), Quiet (2), and Very Quiet (1). Similarly, the level of desirability of recreational noise by respondents was also examined. This was done by attaching values of weight to different degree of responses as shown: Desirable (3), No Effect (2), and Not Desirable (1). Data on sources of recreational noise were collected through observations. Recreational noise data was analyzed using descriptive statistics and the Paired Test of Difference (T-test) to investigate time-based variations in the level of noise (morning and evening periods). The SWV (Summary of Weighted Value) was obtained by summing up the product of the total numbers of responses to each variable and the weight attached to each rating i.e. (a x 5) + (b x 4) + (c x 3) + (d x 2) + (e x 1). The mean used in the course of the computation was also obtained by summing up the Mean Weighted Value (MWV) and dividing it by the total number of variables.

DATA ANALYSIS AND DISCUSSION

Socio-demographic characteristics of respondents

The results of the distribution as presented in Table 1 show that 44% of the respondents were male, while 56% were female. In addition, half of the respondents (50%) had tertiary education and only 4% had lower than secondary education. Therefore, the respondents were considered educated generally enough to understand the essence of the survey. It was also observed that majority of the respondents were aged above 18 years. The distribution of the respondents shows that majority were single (62%), and 42% of the total respondents came to the park for relaxation purpose.

Table 1.

Socio-Demographic Characteristics of Respondents

Variable	Frequency N=50	Percentage (%)
Gender		
Male	22	44
Female	28	56
Education		
Primary education	2	4
Secondary school	23	46
Tertiary education	25	50
Marital Status		
Single	31	62
Married	18	36
Widowed	1	2
Age of the respondents		
Less than 18	6	12
19- 25 year	18	36
26 - 35 years	17	34
36 - 45 years	6	12
46 - 55 years	2	4
56 years and above	1	2
Purpose of Visit		
Entertainment	6	12
Relaxation	21	42
For an event	9	18
For meet up	5	10
Other purposes	9	18

Respondents' perceptions of recreational noise in Agodi Park and Gardens

The study highlighted and segmented the perceived soundscape characteristics of the park by users into three categories. Perceptions of noise emanating from natural and non-living sources are referred to as geophony sound. Biophony sound is the second category, consisting of sounds generated from natural and living sources, while manmade source (anthrophony) is the third category. The results of the perceived geophony characteristics as depicted in Table 2, highlight that sounds from the natural and non-living sources in the park were soothing and not distressful in nature. The geophonic factor with the highest value was the flowing water with a mean weighted value of 2.32; followed by rainfall (2.10) and humming of the wind (2.08). The soundscape of a park is incomplete without the biophony sources of sound as seen in Table 2. Given the fact that Agodi Parks and Gardens has natural green vegetation and some elements of thick forest, animals can also be found in the environment.

Although most respondents were not perturbed by the biophonic sounds, the loudest came from chirping birds/ insects (2.14). However, the sound of music from events (amplified sounds) was the major source of anthrophony sound in the park. The respondents asserted that the music from events (amplified sounds) is often loud but not uncomfortable with the MWV of (3.58). Also, sound from electric power generator was another major source of sound (3.02). This finding is a reflection of the current situation in Nigeria; the country is faced with severe power supply shortage and most households and business are powered by generators. This result also corroborates the findings of Alani et al. (2020) that electric power generators are the major sources of noise pollution reported by residents of Festac Town, Lagos, Nigeria. Another source of sound is sporting activities within the area of study. Sport attracts crowds and amusement, and since people tend to become excited when engaging in competition, noise emanates. Furthermore, background noise (2.58) and traffic (2.56) along the major roads around the park also contribute to the high degree of the noise in the park.

Table 2.

Respondents' perceptions of the recreational noise in Agodi Park and Gardens

Sources of Sound	**F(NR)**	**SWV**	**MWV**	**Category Rank**	**General Rank**
Natural(non-living sources)					
Humming of the wind	50	104	2.08	3rd	12th
Flowing water	50	116	2.32	1st	8th
Storm	50	79	1.58	5th	18th
Rainfall	50	105	2.10	2nd	11th
Rattling sound of leaves due to wind	50	89	1.78	4th	15th
Natural(living sources)					
Chirping birds/ singing birds	50	107	2.14	1st	9th
Chirping insects	50	107	2.14	1st	9th
Animal sounds (domestic)	50	70	1.4	6th	20th
Animal sounds (wild)	50	85	1.7	4th	15th
Frog crocks	50	94	1.88	3rd	14th
Rattling sound of leaves by crawling animals	50	75	1.5	5th	19th
Manmade sources					
Traffic	50	128	2.56	5th	5th
Sound generated from maintenance activities	50	85	1.7	9th	15th
Sound from generating set	50	151	3.02	2nd	2nd
Voices	50	123	2.46	7th	7th

Music from events (amplified sounds)	50	179	3.58	1st	1st
Sport activities	50	142	2.84	4th	4th
Background Noises/ Park Vitality	50	143	2.86	3rd	3rd
People walking (footsteps)	50	103	2.06	8th	13th
Furniture sounds	50	70	1.4	11th	20th
Rattling sound of leaves by footsteps	50	80	1.6	10th	17th
Gunshot	4	10	2.5	6th	6th
Total			**47.2**		

Total

Mean of ∑MWV/n = 47.2/22 = 2.15

Respondents' level of desirability of the soundscape in Agodi Park and Gardens

Table 3 reports the perceived level of desirability of the soundscape in the study area, and also reports the sum of weighted value (SWV) and mean weighted value (MWV). The table shows that the sound produced from power generators had the least level of desirability among soundscape characteristics in Agodi Park and Gardens. This was affirmed by the percentages of respondents who claimed not to be pleased with this type of sound with a MWV of (1.4). On the other hand, sound produced from the stream (flowing water) across the park was ranked as the most desired of the 22 soundscape characteristics with a MWV of (2.68). The respondents affirmed that the music from events (amplified sounds) is often loud but desirable with the MWV of (2.66) which was ranked as second. Also, sound produced from singing birds was another well desired soundscape characteristic in the study area with an MWV of (2.64).

Table 3.

Ranking according to level of desirability of soundscape in Agodi Park and Gardens

S/N	Sources of Sound	F(NR)	SWV	MWV	Category Rank	General Rank
	Natural(non-living sources)					
1	Humming of the wind	50	122	2.44	2nd	4th
2	Flowing water	50	134	2.68	1st	1st
3	Storm	50	95	1.9	5th	15th
4	Rainfall	50	100	2	4th	12th
5	Rattling sound of leaves due to wind	50	108	2.16	3rd	7th
	Natural(living sources)					
6	Chirping birds/ singing birds	50	132	2.64	1st	3rd
7	Chirping insects	50	99	1.98	4th	14th
8	Animal sounds (domestic)	50	104	2.08	2nd	8th
9	Animal sounds (wild)	50	100	2.0	3rd	12th
10	Frog crocks	50	82	1.64	6th	20th
11	Rattling sound of leaves by crawling animals	50	95	1.9	5th	15th
	Manmade sources					
12	Traffic	50	89	1.78	9th	19th
13	Sound generated from maintenance activities	50	90	1.8	8th	18th
14	Sound from generating set	50	70	1.4	11th	22nd
15	Voices	50	109	2.18	3rd	6th
16	Music from events (amplified sounds)	50	133	2.66	1st	2nd
17	Sport activities	50	122	2.44	2nd	4th
18	Background Noises/ Park Vitality	50	102	2.04	4th	9th

19	People walking (footsteps)	50	95	1.9	7th	15th
20	Furniture sounds	50	101	2.02	5th	10th
21	Rattling sound of leaves by footsteps	50	101	2.02	5th	10th
22	Gunshot	4	6	1.5	10th	21st
	Total			**45.16**		
	Mean of ∑MWV/n = 45.16/22=2.05					

Daytime sound level

As presented in Figure 6 and Table 4, the maximum level of sound was recorded around the ice-cream spot/ walkway with a range between 105dBA - 68dBA. The high background noise in this section of the study area might be associated with the unpleasant noise originating from the mobile power generating set in this vicinity. This could unsettle urban park users or lead to displeasure or might affect their health and psychological well-being. An earlier study exerted 60dBA as the exterior limit for urban parks and open spaces, beyond which annoyance and hearing impairment are inevitable (Dhananjay & Prashant 2007). Furthermore, in the bar and its surroundings, an average of 68dBA was measured, while the games area had an average of 80dBA, and 77dBA was the average sound level around the restaurant. Other areas around the swimming pool also had 77dBA in the level of noise exposure, paint ball arena (73dBA), car park (73dBA), and the open field was (71dBA).

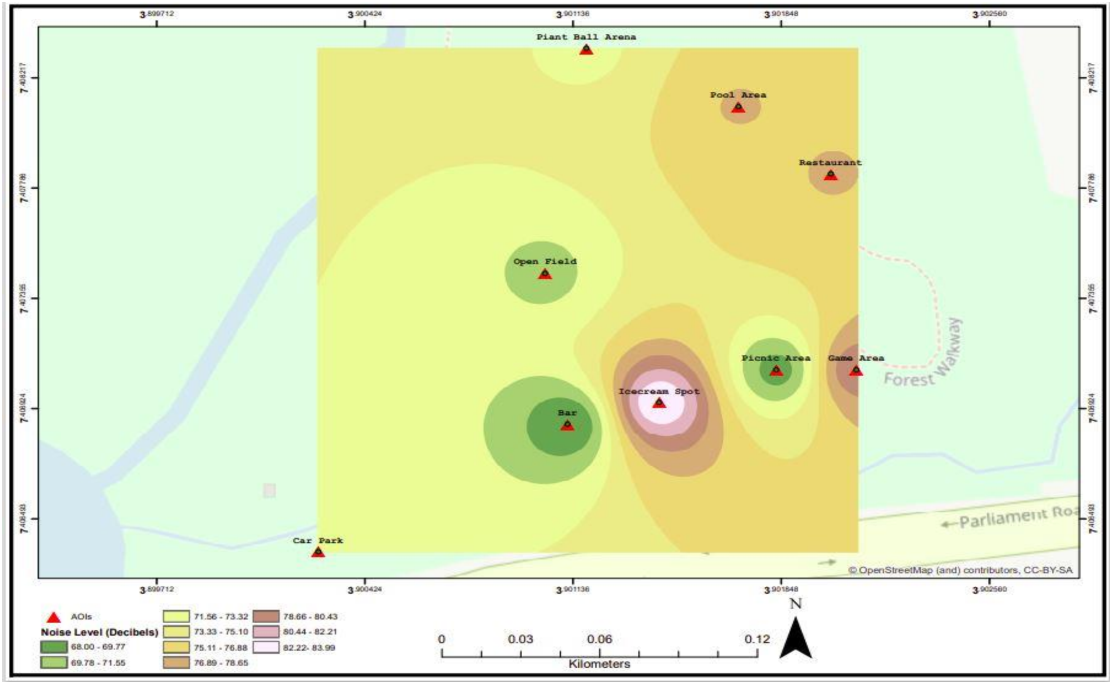

Figure 6. Morning sound map

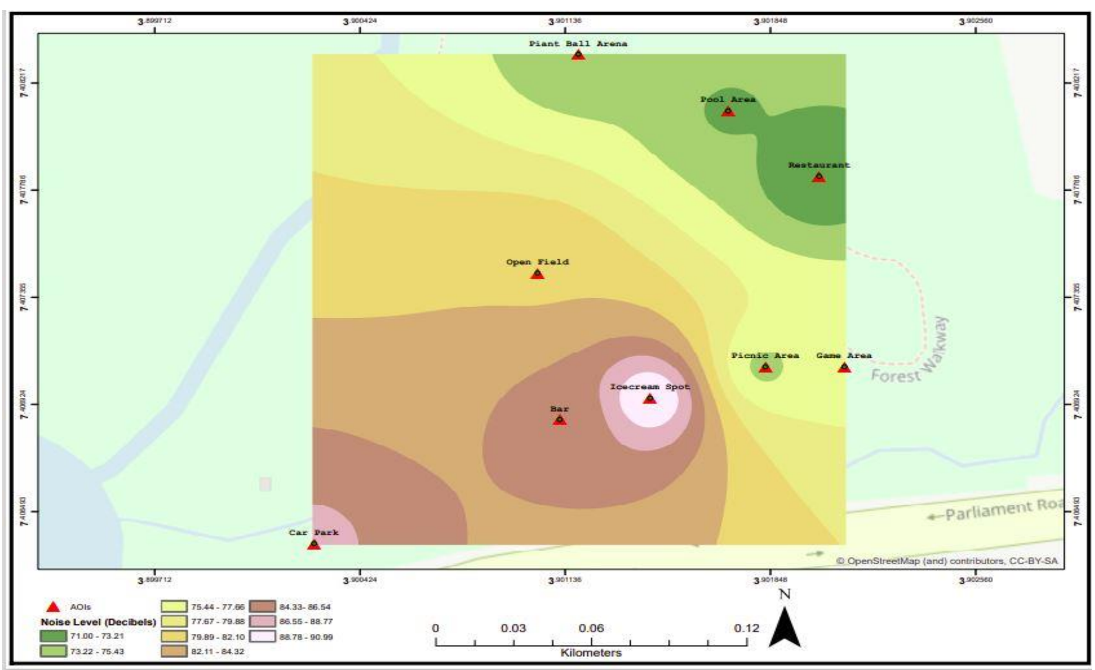

Figure 7. Evening sound map

(Source: Authors' Field work, 2021)

Table 4.

Morning sound level readings

Location	**Average (dBA)**	**Minimum (dBA)**	**Maximum (dBA)**	**Observation**
Bar	68	55	94	Amplified music/Flowing stream.
Ice-cream Spot/ Walkway	84	68	105	Generator/Flowing stream/ Horse riding.
Picnic Area	69	56	83	Traffic flow is audible.
Game Area	80	58	99	No on-going gaming activities
Restaurant	77	63	93	Amplified music.
Pool Area	77	63	93	Children playing/ Amplified music.
Paint Ball Arena	73	59	93	Paint shooting game.
Car Park	73	60	100	Traffic Flow is audible.
Open Field	71	53	96	Low human activities due to swamp.

Further investigation showed some variations in the measured noise levels in the evening (see Table 5 and Figure 7). This might be explained by the increment in the number of patrons as the night approaches. Most users often patronize recreation centers in the evening after daytime activities come to an end. The maximum level of sound recorded in the study area was at the parking lots, which might be due to the elevated vehicular traffic occasioned by the ingress and egress of users. It was also observed that the volume of traffic around adjoining roads increased in the evening and added to the noise filtering into the study area. This result is as expected, and similar to the findings of past studies (Oyedepo & Saadu, 2010; Lee et al., 2019). The ice-cream spot had an average of 91dBA sound level, while areas around the parking lots generated an average of 87dBA and the open field recorded an average of 82dBA.

Table 5.

Evening sound level readings

Location	**Average (dBA)**	**Minimum (dBA)**	**Maximum (dBA)**	**Observation**
Bar	85	72	102	Amplified music/Flowing stream
Ice-cream Spot/ Walkway	91	71	112	Generator/Flowing stream/ Horse riding
Picnic Area	75	64	95	Traffic flow is audible
Game Area	77	66	111	Board game activities
Restaurant	71	60	94	Amplified music
Pool Area	73	62	94	Closed for swimming
Paint Ball Arena	74	61	108	Paint shooting game
Car Park	87	74	114	Traffic flow is audible
Open Field	82	73	101	Low human activities due to swamp

Having described the sound levels at different locations in Agodi Park and Gardens, it is imperative to examine the statistical difference between the two periods of observation. The study conducted a pair difference test (T-Test) between the evening and morning measurements. The descriptive statistics as reported in Table 6 shows that the average sound level in the morning was 74.66dBA, SD (5.2678,$P< 0.05$),while an average sound level of 79.44dBA was recorded in the evening. This depicts that sound level in the evening was relatively higher than in the morning.

Table 6.

Descriptive statistics of sound levels

Descriptive Statistics		**dBA**			
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Average(dBA) Morning	9	68.00	84.00	74.6667	5.26783
Average(dBA) Evening	9	71.00	91.00	79.4444	7.03760

The result of the inferential test of difference between the evening and morning indicates that there is a significant difference between the sound levels in the evening and morning (see Table 7). The mean difference indicated that evening sound levels are higher than the morning sound levels with a mean difference of 4.7778. The test statistics show that the difference is statistically significant at 5% level of significance (-11.733). This result implies that at the gardens, activities in the evening generated more sounds than in the morning.

Table 7.

T-test of difference between Times of the day

Variables	**Difference Test**
Mean Difference	-4.77778
Standard Deviation	8.27312
Standard Error Mean	2.75771
T-test statistics	-11.733
Degree of freedom	8
Significance	0.000

CONCLUSION

This study examined the perceived sonic characteristics of Agodi Park and Gardens, and mapped the spatial recreational noise variations across locations in an urban park in southwestern Nigeria. Findings show that park users found the recreational sounds tolerable, nonetheless, the noise levels exceeded the benchmark stipulated by NESREA and WHO regarding environmental noise. The findings of this study lend credence to the assertion that individual perceptions should be integrated with objective sound measurements in creating soundscape plans for urban environments. Giving the adverse effects of noise, noisy equipment or facilities located outdoor such as power generators should be fitted with sound attenuators, enclosures or barriers as deemed appropriate. Furthermore, soundscape characters should be considered in the design of future urban parks as they would go a long way in improving and enhancing the quality of perceived user's comfort. Urban Park administrators can use the information from noise maps to inform urban park users on the noise levels in different locations in order to help users navigate the park according to their moods and purpose of visit, besides maximizing the benefits of their experience at urban parks.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this study.

ACKNOWLEDGEMENT

This research was self-sponsored and no form of aid nor specific grants was solicited or received from any funding agency in the private, non-governmental or public sectors locally and internationally. The authors wish to express profound gratitude to the staff and management of Agodi Parks and Gardens, Ibadan, Oyo State, Nigeria for their commitments,

involvements, and support during data collection.

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