

**PROLIFERATION OF WORSHIP PLACES AND COMPLIANCE WITH LOCAL LAND USE
PLANS AND ACCEPTABLE NOISE LEVELS IN WA MUNICIPALITY**

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ABSTRACT

Environmental pollution has received global attention, particularly regarding noise pollution, but noise generated from worship places remains a concern in urban areas where worship places are on the rise. This raises a question about the compliance of worship places with land use plans and noise levels in urban areas. The study analysed the spatial distribution of worship places to ascertain their compliance with local land use plans and noise levels in the Wa Municipality of Ghana. Locations of worship places were mapped and analysed in the context of two local plans of the study area. Data regarding the planning standards, zoning regulations, and the Ghana Environmental Protection Agency (EPA)-approved noise range of 45-55 dB, as well as the views of key informants (n = 8) around the worship places were used to support the analysis. The results revealed that the spatial distribution of worship places was dispersed with a Z-score of less than 5%. About 88% of the worship places did not comply with local plans. Some worship places were sited in residential and other land uses, while areas earmarked for worship places were encroached upon by other land uses. Sound levels from the worship places exceeded the EPA permissible noise range of 45-55 decibels. The study concludes that worship places in Wa Municipality do not comply with the prescribed local land use plans and noise levels of the country. The study recommends that the Wa Municipality Assembly and the EPA should regularly embark on monitoring exercises to enforce compliance with local land use plans and acceptable noise levels in the Municipality.

Keywords: Local Plans, Spatial Analysis, Spatial Distribution, Spatial Pattern, Wa

INTRODUCTION

Land is a crucial possession and a vital input for development, as many development activities rely on it. The ways land is utilised can ensure or pose serious threats to sustainable development (Kalfas et al., 2023; Hogan & Ojima, 2012; Akanni, 2013). This suggests the need for land use planning, particularly in urban areas, where a growing population triggers an increasing demand for scarce land for various uses (Wei, 2017). Conventionally, land uses were mainly for residential, transportation, farmlands, markets, and shrines. Major urban areas are characterised by land use differentiation into administrative, industrial, recreational, commercial, residential, transportation, and religious, among others (Akanni, 2013). Some of these land uses can create conflicting desires, necessitating effective land use planning to ensure sustainable development (Hogan & Ojima, 2012).

Effective land use planning should ensure that public facilities are constructed in accordance with land use planning standards and requirements (Kalfas, 2023). This will generate the required environmental benefits such as effective resource use, good environmental health, easy accessibility, reduced pollution, convenience, spatial and social harmony, and minimal land use conflicts (Cobbinah & Korah, 2016). One category of public facilities that requires the attention of spatial planning is worship places, including churches, mosques, synagogues, and other places of worship (Allam & Allam, 2020). Thus, nowadays, religion has become an essential component in development thinking, studies, and practice because it influences individuals' understanding and well-being, especially in developing economies, and its impact on people's lives (Cobbinah & Korah, 2016; Rakodi, 2012). The increasing population and proliferation of religious denominations have led to demands for land to meet the worshipers' needs (Akintola, 2004). The development of worship places in the contemporary world is increasingly becoming an essential feature of the urban built environment, accompanied by numerous challenges, including conflicting land uses and noise pollution (Babere, Massawe, & Benussi, 2024; Chukwuemeka, 2023; Burchardt et al., 2023; Cobbinah & Korah, 2016).

Many urban residents consider worship places as a necessary cultural and social formation and development (Hancock & Srinivas, 2008). Ebaugh and Chafetz (2000) have described worship places as important symbols of spiritual expression, community engagement, and physical and social signposts of beliefs. Although the type of worship facility depends on the needs of a particular faith group (Cobbinah & Korah, 2016), these facilities often have negative externalities that sometimes conflict with other developments (Bouma & Hughes, 2000; Hancock & Srinivas, 2008). There is an increasing numerical strength in developing worship places in Africa, which, in most cases, contradicts land use planning requirements (Bouma & Hughes, 2000; Meyer, 2004). The increasing number of religious groups and population has led to the establishment of worship places within unauthorised land use areas, which results in some land use planning concerns and social disharmony (Kalfas et al., 2023; Greed, 2016; Hogan & Ojima, 2012). This is emphasised by Hancock and Srinivas (2008), who indicate that in most cases in Africa, the distribution and location of worship places in urban areas contradict the goals of land use plans and schemes. Most worship places, largely located in unauthorised

areas, often generate uncomfortable sounds during prayers and worship (Chukwuemeka, 2023; Bellomo et al., 2021; De Witte, 2016). These sounds emanate from the clapping of hands, ringing of bells, chanting, singing, call to prayers, drumming and the like. The recent increase in the use of public address systems further exacerbates the negative externalities of worship places (Egyegini, Danfulani, & Abubakar, 2023).

Although worship places play a crucial role in a multicultural urban society by providing an enabling environment for worship, meditation, spiritual care, pastoral counselling, and education, their proliferation could undermine the planning efforts of urban authorities (Kalfas et al., 2023; Hogan & Ojima, 2012). The proliferation of worship places, thus, poses a threat of encroaching on planned land uses and causing noise pollution to residents living within the neighbourhoods of worship places (Chukwuemeka, 2023; Egyegini, Danfulani & Abubakar, 2023). There is a planning problem of allocating adequate land for specific land uses, resulting in the encroachment of one land use by another. This has been emphasised by Kabir (2006), who observed that there is a persistent problem of encroaching on other land uses for the development of worship places in urban areas. Worship places are often found in areas designated as open spaces, educational lands, residential areas, among others, thus defeating the purpose of land use planning (Germain & Gagnon, 2003). The increasing proliferation of worship places is likely to compound the problem of unauthorised siting and development of these facilities in urban areas. It therefore raises a question about the compliance of worship places with land use plans and noise levels in urban areas. Addressing the growing effect of religion in urban spaces necessitates well-adjusted policies that integrate urban planning with religious and socio-economic needs. This provides the context for assessing the spatial distribution of religious facilities and their relationship with the existing Local Land Use Plans and acceptable noise levels within the Wa urban area.

CONTEXT

The pervasive influence of religion is widely acknowledged and continues to be a significant public phenomenon in African societies, including Ghana (Ghana Statistical Service, 2021; Kuperus & Asante, 2021). Ghana's urban centres feature various religious compositions; however, many of these religious denominations are situated in residential or commercial zones without proper authorisation, leading to spatial conflicts and regulatory challenges that have raised concerns over urban land use and planning in recent years. The unapproved siting of worship places and the increasing number of religious denominations in Ghanaian urban areas sometimes result in situations where urban planning authorities revise land use planning schemes to respond to the needs of these faith groups (Cobbinah & Korah, 2016). The Environmental Protection Agency (EPA) receives numerous complaints about noise. According to the 2011 EPA Annual Report, noise constituted 71% of all complaints, of which about 64% are attributed to religious activities, highlighting the problem of the spatial location of religious facilities and their social and health effects (Egyegini, Danfulani & Abubakar, 2023).

Many studies (Cobbinah & Korah, 2016; Numrich, 2000; Hoernig, 2006; Ebaugh & Chafetz, 2000) have emphasised that the location of worship places should be in accordance with sustainable land use requirements. The extent of non-conformity to spatial development standards and conformity to recommended national noise levels remains unanswered, downplaying the effects of the unauthorised spatial development of religious facilities and their externalities. Against this background, this study assesses the relationship between the locations of religious facilities and Wa's local land use plans, as well as the sound levels generated from these facilities during worship periods. Knowledge of the spatial distribution of religious facilities is a crucial component in contemporary urban planning (Paul, 1992). The findings of this study, in terms of the distribution of worship places, their relationship with local land use plans, and their effects on residents, extend the discussion of religious geography (Kong, 2025; Harris, 2022) and permissible levels of sound during religious services (Chukwuemeka, 2023). This would facilitate the development of effective policies for controlling the siting of religious facilities within Ghana's urban and rural areas.

LITERATURE REVIEW

Geography of Religion

This study was conducted within the context of religious geography. Religious activities and their impact on the geographical environment are a neglected study area (Jackowski, 2002). The geography of religion is a geographical discipline that examines the impact of religion on a geographical setting, focusing on the relationship between religion and geographical areas (Jackowski, 2002). Moreover, it is the branch of geography that deals with the impact of religion on the geographical environment and the impact of geographical factors on religion. Historically, the geography of religion was largely overlooked by the world until it was recorded in the late 1930s and immediately after World War II. Following this, there was intense research on religious geography, and many geographers began to notice the significance of religious factors in geographical space (Park, 2003). However, the subject of interest in modern geography and religion includes geography and religion, sacred landscape/sacred space, spatial development of religion, religious migrations, religion and types of settlements, religion and environmental protection, among others (Jackowski, 2002).

Most geography books rarely include sections on religion, and few human geographers have recognised the importance of religion in shaping people's beliefs, attitudes, and behaviour (Kong, 2025; Harris, 2022; Kong, 2010). Religion is also a major factor in culture and politics, yet geographers pay passing attention to such issues. This is partly due to academic territoriality – that is, other disciplines claiming the field of religious studies as their own (Kong, 2025; Harris, 2022; Park, 2004). It also reflects secularisation through the English-speaking world, encouraging many academics to downplay the possible significance of religion as a major influence on the day-to-day existence of many people.

Worship centres

All over the world, there is evidence of growing religious activity due to demographic factors and conversion (Deneulin & Rakodi, 2011). However, the growth rate is slower than in the past (Barrett et al., 2001). Religion has become an integral part of developmental thought, studies, and practice due to its significant impact on people's lives and its influence on individuals' well-being (Kong, 2025; Rakodi, 2012; Narayan et al., 2000). Deneulin and Rakodi (2011) found an increase in religious activities globally due to an increase in population.

Three major religions —Christianity, Islam, and African Traditional Religion —predominate in Africa, although their growth trajectories differ. Ghanaian cities provide vibrant religious spaces for these three dominant religions to coexist (Mensah, 2025; Asuming & Sarbah, 2025) and interact in multifaceted ways to shape various aspects of urban life, and sustainable urban planning and development (Fonu et al., 2024; Nkrumah-Pobi & Owusu-Afriyie, 2020; Ababio, Osei-Fosu & Dramani, 2023).

The number of people practising traditional religion in sub-Saharan Africa decreased from 75% in 1900 to an estimated 13% in 2010. The number of people who practised Christianity increased from 9% to 57%, and those who practised Islam increased from 14% to 29% during the same period (Forum, 2010). The formation of several faith groups is a feature of the rapid growth in Christianity. Deneulin and Rakodi (2011) assert that Christian faith groups include Orthodox, Protestant, Pentecostal, and Charismatic groups. In the Ghanaian context, the religious faith groups are mainly Christians (71.2%), Muslims (17.6%), and African traditionalists (5.2%), mirroring the situation across Africa (Ghana Statistical Service [GSS], 2012). Those who do not belong to any of these religious faith groups also constitute 5.3 per cent. Gifford (2004) describes the new dimension of Christianity in Ghana as the rise of a radical modernity dominated by Pentecostalism, accompanied by an increasing number of churches and unique ministries centred on prayer, prosperity, faith healing, and spiritual warfare.

The robust religious inclination overwhelmingly influences the socio-economic activities of the public, particularly in urban areas, from individual decision-making to social structures (Fonu et al., 2024), and accordingly contributes to economic resilience (Ababio, Osei-Fosu, & Buabeng, 2021). These diverse expressions contribute to the vibrant religious landscape of urban Ghana, though it has been established that the poor location of religious facilities for each of Ghana's three major religions may cause land use planning difficulties in various ways. Due to their prosperity-focused doctrines and emphasis on consumption, religious worship centres for Christian faith groups, notably Pentecostals, are becoming increasingly dominant in urban Ghana (Meyer, 2004; Gifford, 2004), sometimes in poor and unapproved locations (Ahmed & Dinye, 2012).

Conceptual framework

Geographic space is a crucial aspect of conventional Geographic Information Systems (GIS) and GIScience (Liu, 2012). Geographic space refers to the large-scale,

continuous space that covers the Earth and involves human activities. It is too large to be perceived and studied from a single viewpoint; rather, it must be learned via symbolic representations (Montello, 1993). There are two ways of representing geographic space within the context of GIS: the Cartesian mechanistic worldview, under which things are seen as a collection of mechanical pieces, and the Whiteheadian organismic worldview, where things are considered a coherent whole or living structure. Under this worldview, space is neither lifeless nor neutral but a living structure capable of transforming itself (Alexander, 2002).

Large-scale geographic space is effectively studied by dividing or representing spatial phenomena as minor aspects of the whole and assigning them geographic representations, such as vector and raster statistics, in conventional spatial analysis (Miller & Wentz, 2003). Geographic representation is an ontology through which people specify and conceptualise the real world. It serves as the bridge between the real world and research models. Land use conflict, therefore, arises when urban centres begin to experience urban sprawl and encroachment within the geographic space (Peprah, 2014). Urbanisation and its associated challenges have thus become one of the major topics of global discourse (Abanyam & Edwe, 2019). Land use planning, especially in urban areas, is crucial for addressing many countries' problems associated with rapid urbanisation. Globally, there is a strong connection between urban land use planning (ULUP) and the management of urban religious worship places, as the two form crucial components of sustainable development (Yigitcanlar & Kamruzzaman, 2015).

This study examines the relationship between worship places and land use plans within a geographic context. Therefore, religious geography is seen to have two main concepts: religion and geographic space in which religious activity occurs. Aspects of religion that directly influence geographic space include worship places, which are typically situated in specific locations and sometimes compete with other human needs for space. Therefore, geographic space is planned to ensure harmony in land use. The spread of religions and the growth of populations make it most likely to be distorted through encroachment, resulting in land-use conflicts with undesirable effects (Peprah, 2014). The relationship between religion, geographic space, worship places, the location of worship places, and land use plans is illustrated in Figure 1.

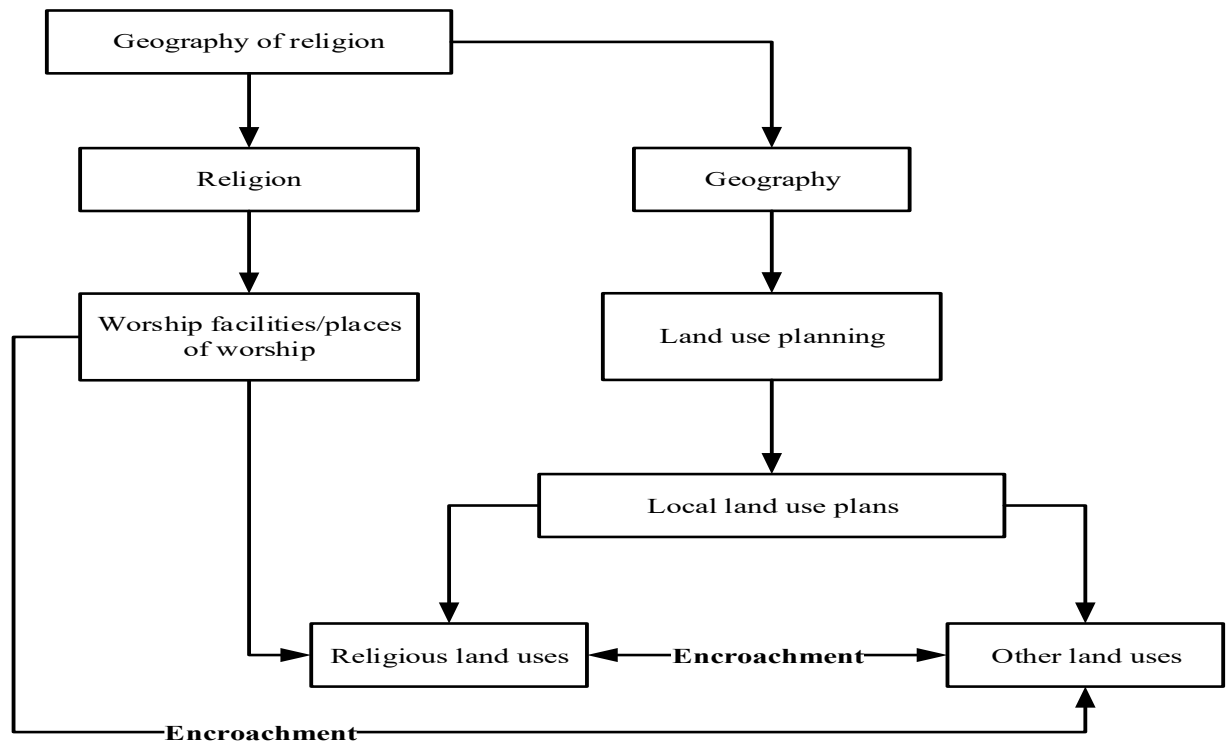


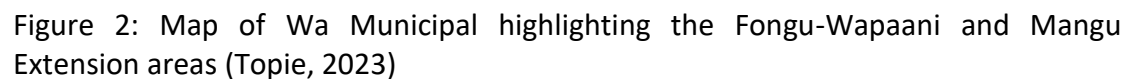
Figure 1: Conceptual framework illustrating the relationship between religion, geographic space, worship places, and land use plans.

Source: Authors' construct (2025)

METHODOLOGY

Description of study area

The study was conducted in the Wa Municipality of the Upper West Region of Ghana. The Wa Municipality shares political-administrative boundaries with the Nadowli District to the north, the Wa East District to the east and southeast, and the Wa West District to the west and southwest. It lies between latitudes 9° 50' N to 10° 30' N and longitudes 2°15' W to 2°40' W (See Figure 2). The capital of the Wa Municipality is Wa, which also serves as the regional capital of the Upper West Region. It has a land area of approximately 579.86 square kilometres, which is about 6.4% of the region's area (GSS, 2012). The Municipality is the fastest-growing city in the Upper West Region in terms of population and physical infrastructure development, including places of worship. Therefore, the demand for land is high, resulting in land grabbing and the distortion of land use. The location of Wa, the municipal and regional capital, makes it a transit point for many people travelling from other parts of the region to the southern part of Ghana. This also makes it necessary for physical development to contain the transient population and their needs.



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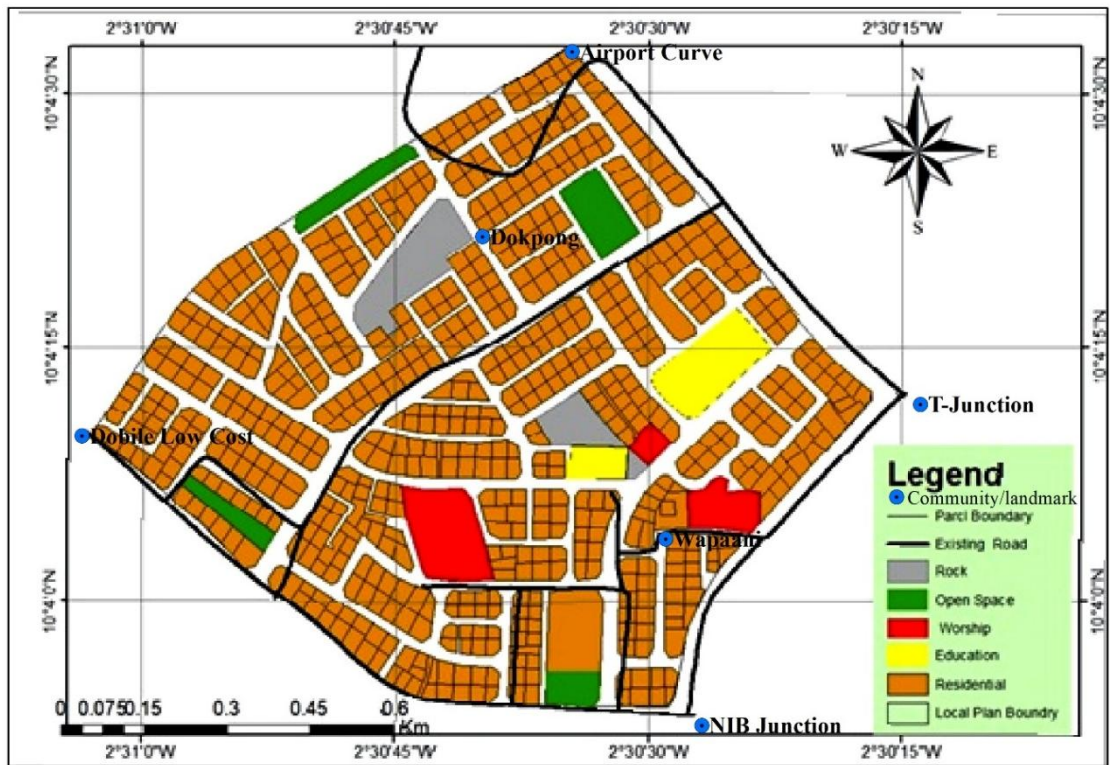


Figure 3: Fongu-Wapaani Local Plan (Land Use and Spatial Planning Authority, Upper West Region, 2022)

Figure 4, which is the Mangu Extension Residential Area, is a mixture of indigenous groups and new developments. These developments are also based on local plans. Mangu is an old settlement; developments at the periphery of old Mangu were done by settlers seeking land for private development.

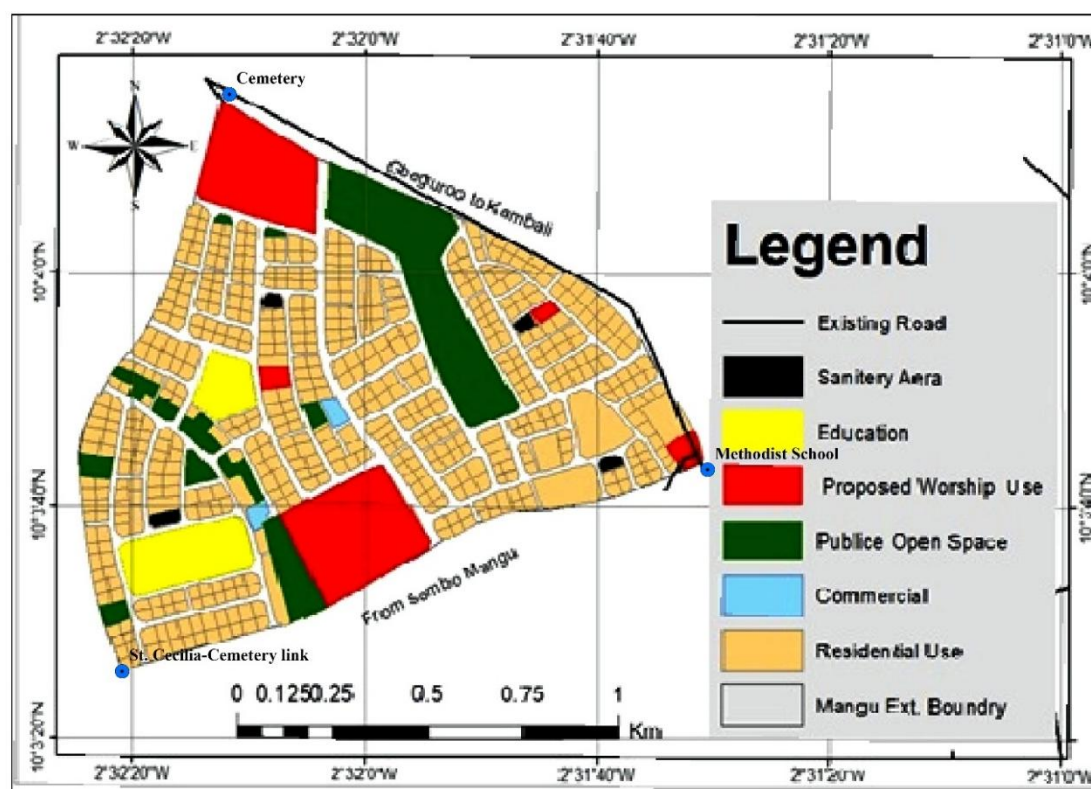


Figure 4: Mangu Extension Local Plan (Land Use and Spatial Planning Authority, Upper West Region, 2022)

Research design

The study used both quantitative and qualitative data to achieve its objectives. A mixed research design, underpinned by pragmatists' philosophy, was selected for the study. This choice is primarily informed by the study's objectives and the view of Kemper (2014) and Mennis et al. (2013) about qualitative data. Their view is that qualitative data is not just non-numeric data, but rather data intended to provide information about the context and meaning of situations and processes under study (Mennis et al., 2013). Examining the spatial distribution of worship places, their compliance with the local plans, and the effects of worship places on residents requires both quantitative and qualitative data to understand these issues.

Primary data were obtained from field mapping of the locations of worship places. Secondary data, such as existing local land use plans of Fongo-Wapaani and Mangu Extension were obtained from the Land Use and Spatial Planning Authority (LUSPA) office in Wa, and noise regulation guidelines and standards were obtained from the EPA office in Wa. The procedure of locating worship places, and noise regulation guidelines and standards were obtained from the Physical Planning Department and the EPA. Also, the study made use of relevant aspects of data, which are part of large data that was collected in 2022 for a Master of Philosophy Thesis submitted to the Department of Geography, Simon Diedong Dombo University of Business and Integrated Development Studies, Wa by the lead author (Topie, 2023).

Methods of data collection

The locations of public worship places were mapped using a Garmin hand-held Global Positioning System (GPS) receiver. Coordinates of all the public worship places were recorded for the areas covered by both local plans.

The Local plans of Fongu Wapaani and Mangu Extension residential areas were scanned and georeferenced in an ArcMap 10.3 environment using Ground Control Points (GCPs), which were obtained at identifiable locations using a hand-held eTrex 62 Garmin GPS receiver. The identifiable locations in the Fongu-Wapaani area were Tee Junction, National Investment Bank (NIB) Junction, Alhaji Big Junction, and Airport Curve. The landmarks for the Mangu Extension residential area included St. Joseph Mangu Junction, Mangu Cemetery Junction, St. Cecilia Cemetery link, and Mangu Methodist School. The total RMS errors obtained were 0.000002 and 0.000004 for the Fongu-Wapaani and Mangu Extension Residential areas. The geographic coordinates were transformed into plane coordinates using the UTM (Universal Transverse Mercator) system, with a WGS84 datum and Zone 30N. The UTM was used because it is the globally accepted standard.

Sound levels were measured during the day, from 6:00 AM to 10:00 PM, as prescribed by the Ghana Standards Authority (2018). The sound level at each worship place was measured three times, one measurement per week. A sound level meter App on an Android smartphone was used to measure sound levels. Five minutes were used to record the background sound before recording the sound during worship. The difference between the sound before and during the worship was computed as the sound produced during the worship. The sound was measured at the beginning, middle, and towards the end of worship to capture variations at different stages of the service. The average was taken as the sound produced by the worship facility. The measurements were taken in different directions to account for the effects of wind direction on the sound. The sound measurement was taken at 50m, 100m, and 250m from the source to assess the sound variation produced during worship (Ackah et al., 2021). The data were used to estimate parameters, including noise assessment and noise exposure levels.

A key informant interview was conducted with an officer from LUSPA, four religious leaders, an EPA officer, and two representatives of the residents, focusing on sounds from worship, their effects, and compliance with EPA and LUSPA regulations.

Data processing and analytical tools

The study areas' coordinates and boundary shape files were projected to UTM Zone 30N (Projected coordinate) to ensure accurate analysis. Spatial analysis was performed in ArcGIS 10.3. Overlay and the nearest neighbour tools were used to analyse the spatial distribution and pattern of worship places. The overlay tool was used to analyse facilities' compliance with the existing land use plans. The qualitative data were analysed based on themes after analysis of the contents of the responses. The relevant contents were summarised into quotes. The noise levels were processed and plotted against the EPA-acceptable noise level (Environmental

Protection Agency, 2008) and distance (50m, 100m, and 250m) from the noise source.

ANALYSIS OF RESULTS

Distribution and pattern of worship places in local plans

The spatial distribution of worship facilities revealed that a total of thirty-one (31) existing worship facilities were identified in the study area; twenty-two (22) were located within the Fongu-Wapaani Local Plan (Figure 5), while nine (9) were located in the Mangu Extension Local Plan. The concentration of worship places in the Fongu-Wapaani Local Plan was in the southern and south-eastern areas of the plan. This is attributed to the concentration of settlements in these parts of the local plan. The directional distribution also revealed a north-western and south-eastern directional pattern, although the shape of the directional ellipse is tilted more towards a circle than an ellipse. This suggests that the distribution of worship places in the Fongu-Wapaani Local Plan does not follow a linear pattern. However, many worship places within the plan are concentrated in the south-eastern part of the plan. This area constitutes some of the old settlements of Wa, such as parts of Dobile and Wapaani, which are very close to the Central Business District (CBD) of the Wa Municipality, as indicated in Figure 4.

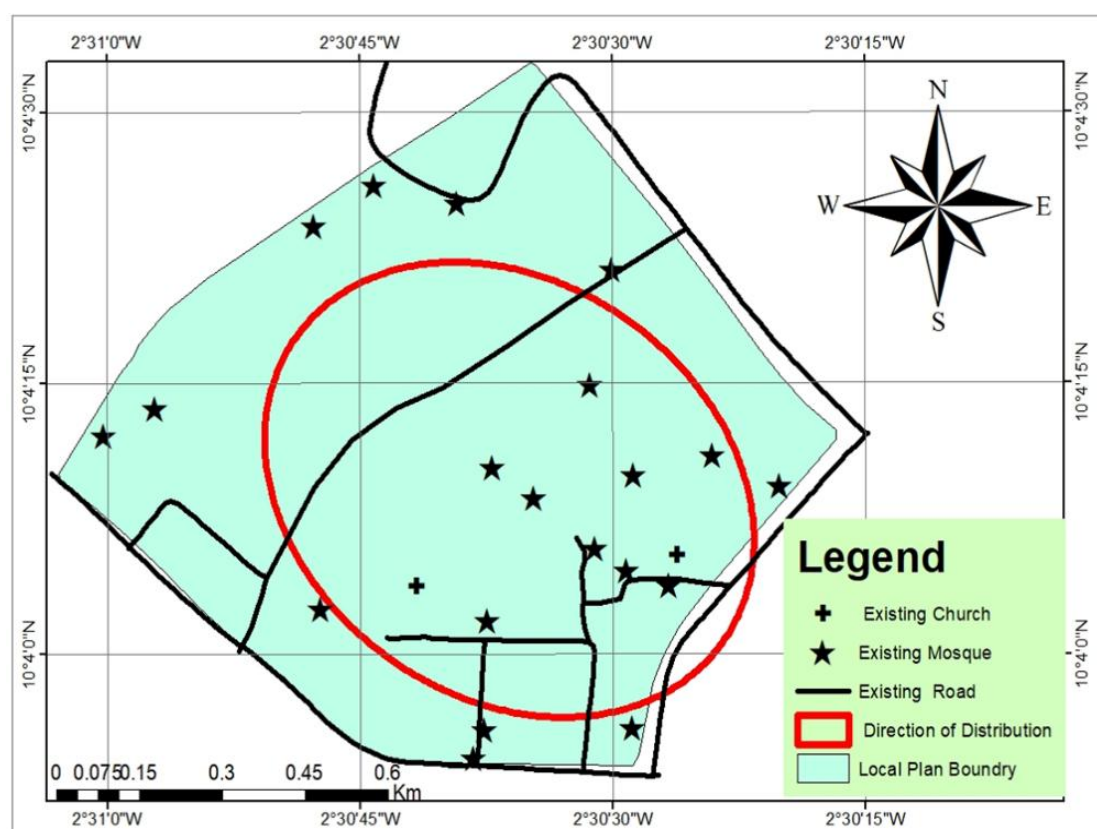


Figure 5: Spatial distribution of worship places in the Fongu-Wapaani (Topie, 2023)

Within the Mangu Extension Local Plan, the spatial pattern revealed that most worship places were located in the eastern part of the study area, with only one located on the southern flank (See Figure 6). The directional distribution indicated

that the spread of worship places was in the north-eastern and south-western directions.

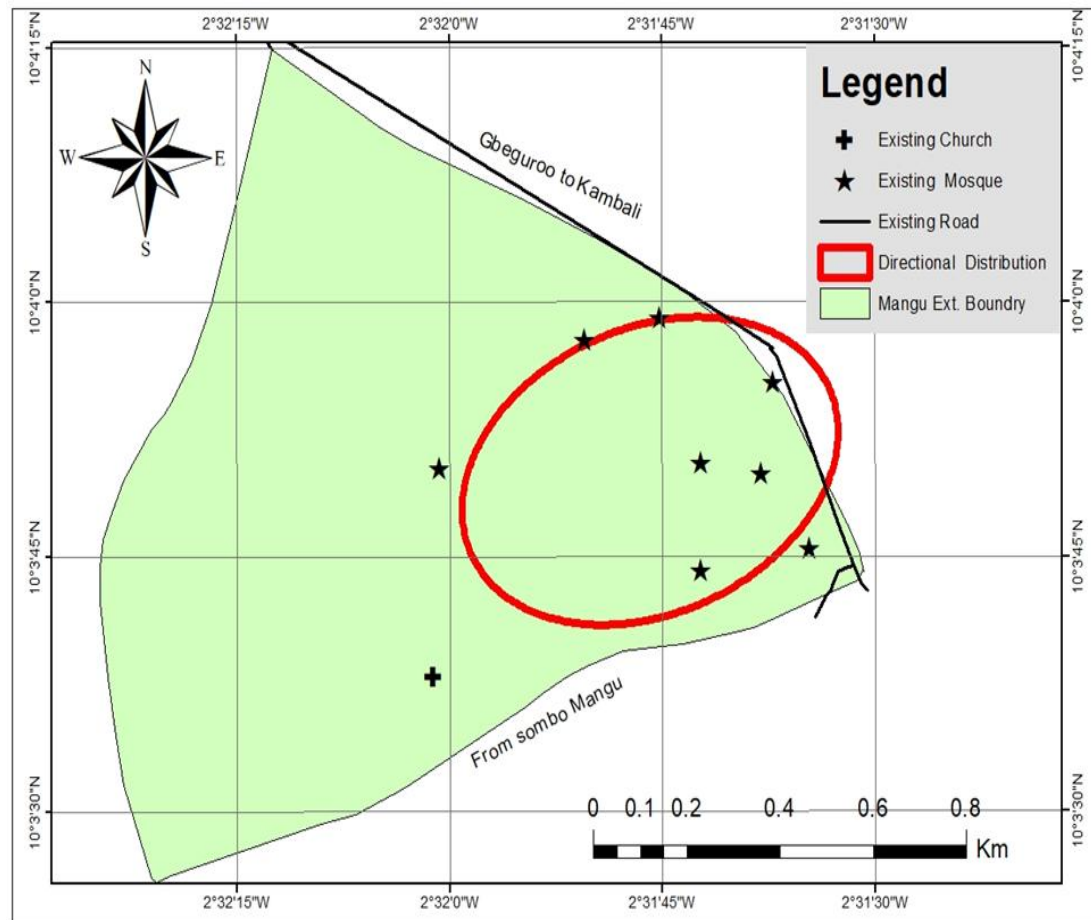


Figure 6: Spatial distribution of worship places in the Mangu Extension Local Plan (Topie, 2023)

The results of the Nearest Neighbourhood Analysis revealed that the expected mean distance between the facilities was 97.968m. In comparison, the observed mean distance was 124.049m with the Nearest Neighbour Ratio of 1.266. This suggests that worship places in the plan were dispersed throughout the area. The Z score of the distribution was 2.389 with a p-value of 0.0169 (less than 0.05) (See Figure 7A).

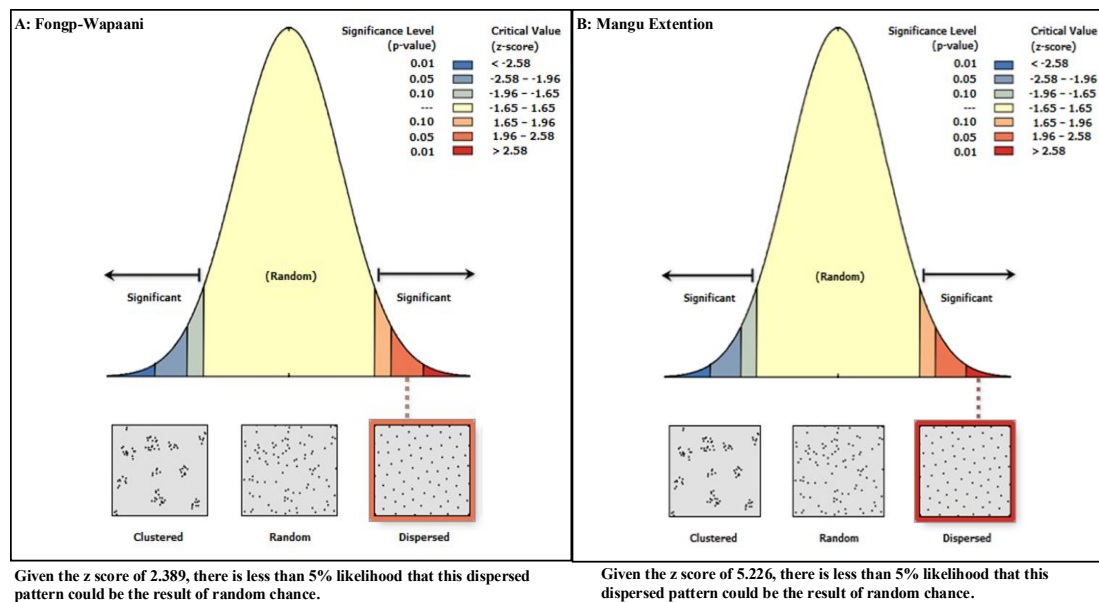


Figure 7: Pattern of worship places on the Fongu-Wapaani and Mangu Extension Local Plan (Topie, 2023)

The Mangu Extension local plans expected mean distance was 109.185 m, while the observed mean distance was 208.612 m, with a Nearest Neighbour Ratio of 1.911. The statistics revealed that worship places in the Mangu local plan were also dispersed. The Z score was 5.226 with a p-value of <0.0001 (which is less than 0.05) (See Figure 7B).

Compliance of worship land uses with existing land use plans

From Figure 8, it is evident that, out of the twenty-two (22) worship places in the Fongu-Wapaani local plan, 36% (8) of the worship places were located on proposed roads, and 50% (11) were found on residential plots. About 9% (2) were located on proposed worship places, whereas 5% (1) was situated in an area earmarked for an educational purpose (see figure 8). It is also evident that out of the nine (9) worship places in the Mangu Extension Area, 22% (2) of worship facilities were located on proposed roads, 66% (6) were found on residential plots, and 11% (1) were located on land earmarked for religious purposes (see figure 9). This indicates a clear defiance of the Mangu Extension Local Land Use Plan.

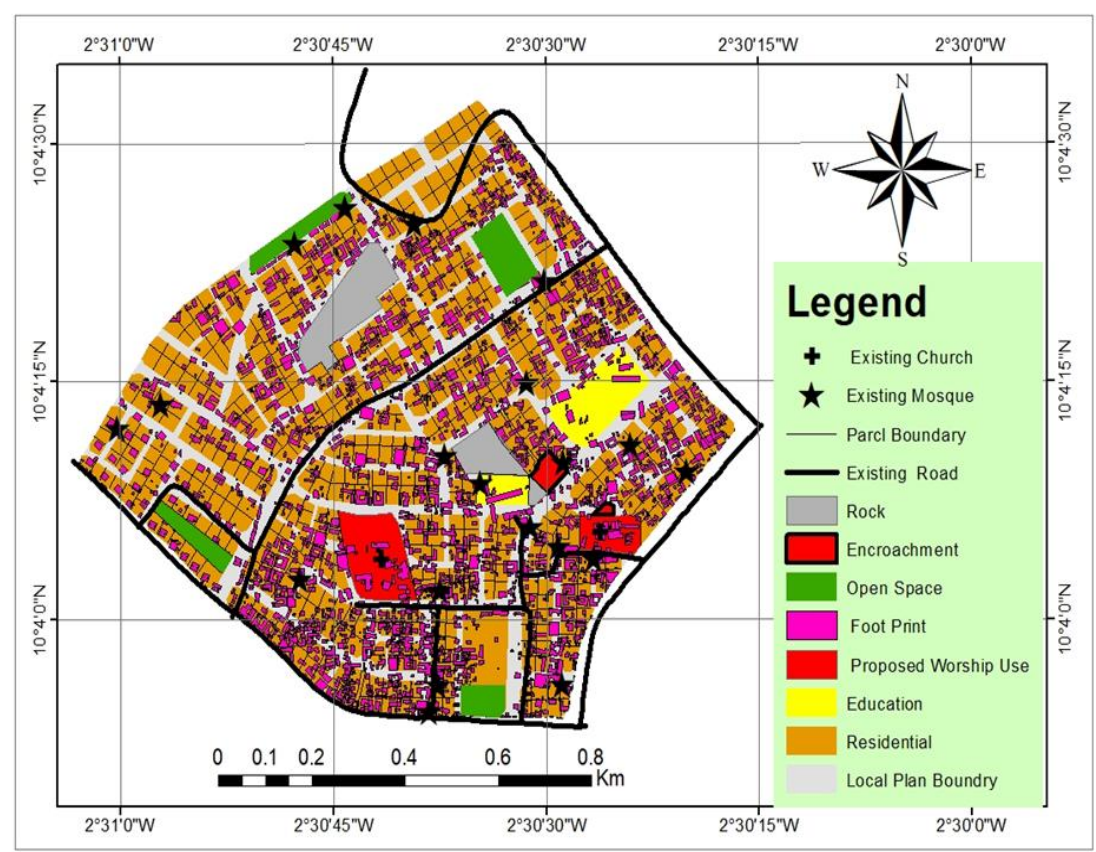


Figure 8: Compliance of exiting worship places with the Fongu Wapaani local plans (Topie, 2023)

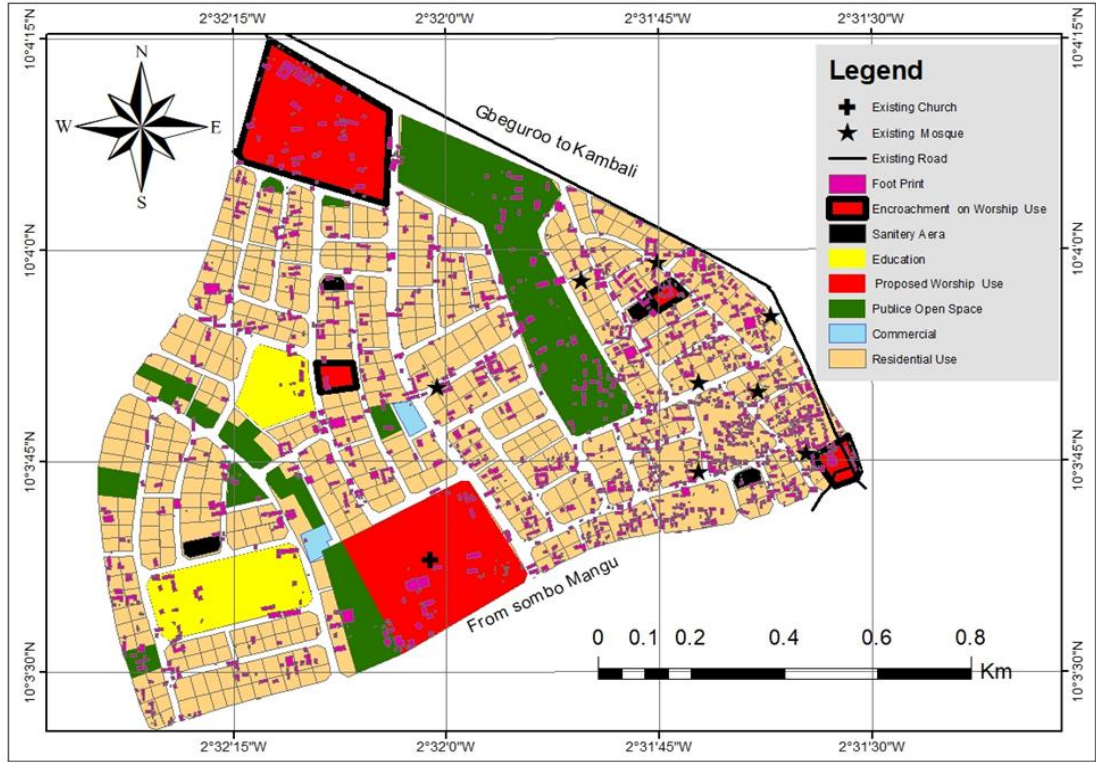


Figure 9: Compliance of exiting worship places with the Mangu Extension Local Plan (Topie, 2023)

Encroachment on proposed worship places

Eight (8) proposed worship places were provided for in both local plans (See Table 1). Out of this number, three (3) worship facilities were found in places proposed for worship places, whereas five (5) were encroached upon by other land uses. Residential developments were sited on some plots that had encroached on designated areas for worship places. In this case, it was expected that the existing thirty-one (31) worship places would have been distributed among the eight (8) sites provided for worship places. Unfortunately, worship places are now interspersed among other land uses.

Table 1: Analysis of Proposed and Existing Land Uses (Topie, 2023)

Name of Local Plan	No. of Proposed Worship Land Use plots	No. encroached upon
Fongu Wapaani	3	1
Mangu Extension	5	4
Total	8	5

Sound levels

Daytime noise level measured at various religious centres in the Fongu-Wapaani Residential Area is illustrated in Figure 10. The maximum sound level was 83dB, and the minimum was 61 dB. The noise level recorded at different worship places indicated that, at a distance of 50 m, all the worship places produced noise above the acceptable limit of 45 dB, as set by the World Health Organisation (WHO), EPA of Ghana guidelines, and the World Bank's limit of 55 dB. At a distance of 100m, noise levels measured at the various worship places ranged from 48 dB to 71 dB, while at a distance of 250m, noise levels varied from 47 dB to 62 dB. The observed sound levels were generally high and undoubtedly caused disturbances and other noise-related problems for those residing within 50m of these worship places. This is consistent with the views of one of the residents' representatives, who perceived the sound as noise and said, "Hmmm: I get worried that my child may have hearing problems." According to him, there is a "Jumma" Mosque that continues with "Dawah" for one hour, despite several complaints. The matter was reported to the EPA later, thinking that his concern was being addressed. To his surprise, the complaint yielded no result. He further indicated that he was waiting to vacate the area when his tenancy agreement with the landlord expires.

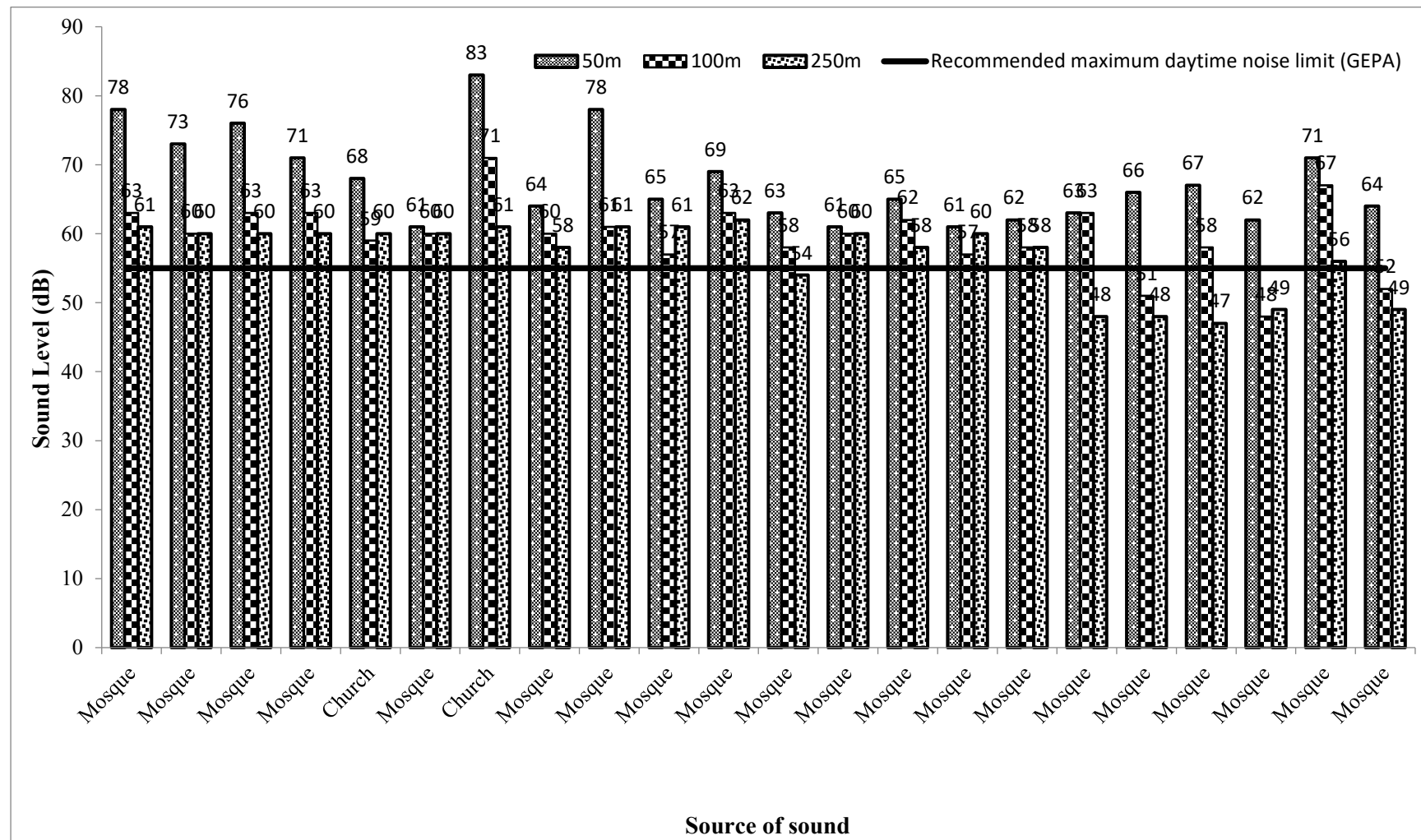


Figure 10: Noise Levels at various worship places in the Fongu-Wapaani area (Topie, 2023)

At the Mangu area, sound levels measured at 50m from worship places were found to be above the recommended EPA level of 55 dB. At a distance of 100m, two worship places were found to produce sound above 55 dB; and at 250 m, all worship places had sound below 55 dB (see Figure 11).

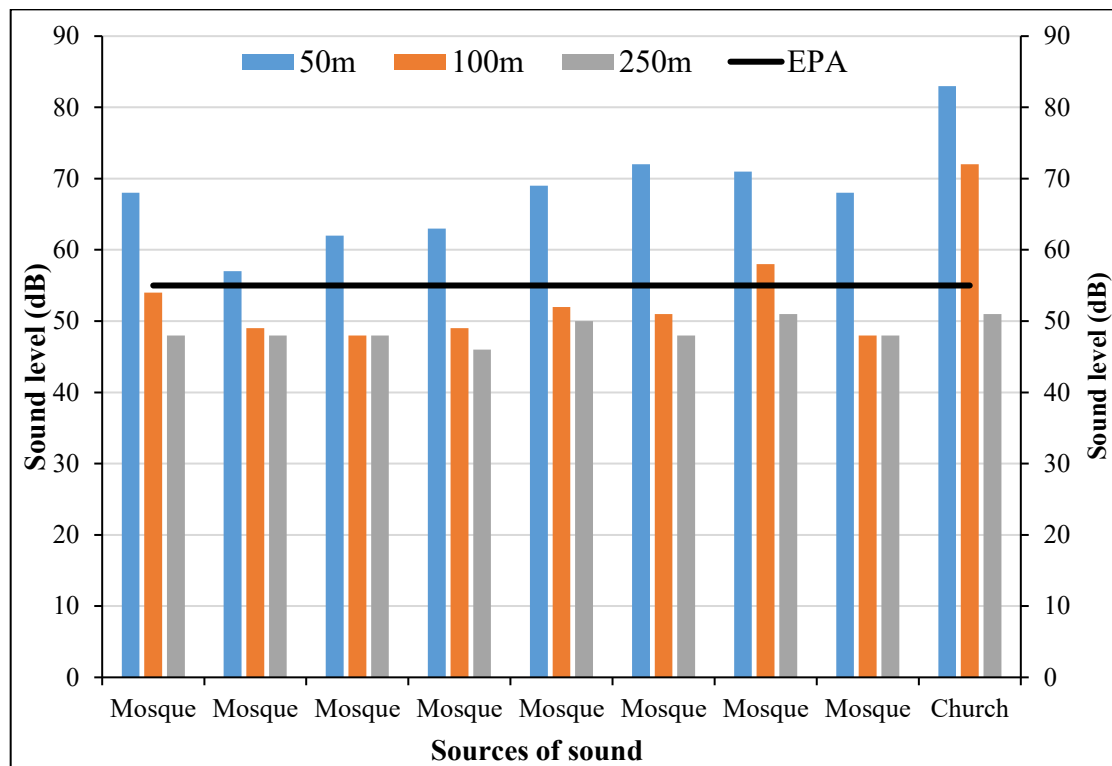


Figure 11: Sound levels measured at Mangu Extension Residential area (Topie, 2023)

Compliance with EPA recommended noise level

For the Fongu-Wapaani area, the sound recorded from all 22 worship places exceeded the maximum acceptable limit of 55 dB at a distance of 50m from the worship places (Figure 12). Only three worship places met the sound level requirements at 100m, and this number increased to six at a distance of 250m. The number of worship places that produced sound above the permissible limit decreased with distance. At the same time, the number of worship places that met the recommended sound limit also increased with distance. The results revealed that at 250m, the majority of the worship places still produced sound above the EPA-recommended values, highlighting the severity of the sound problem from worship places

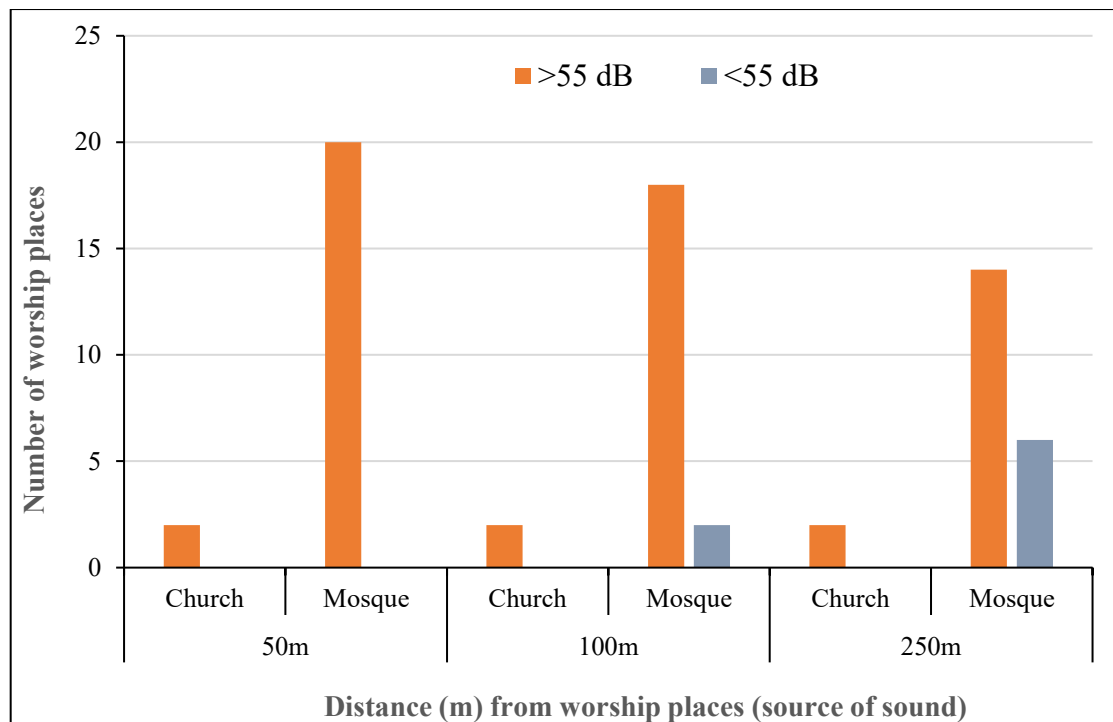


Figure 12: Relationship between the sound levels from worship places and distance from the facilities at the Fongu-Wapaani area (Topie, 2023)

The fact that all worship places produce sound above the recommended 55 dB level at distances of 50m and 250 m from the worship places, with the majority still exceeding 55 dB, creates discomfort for residents living around these places. It calls for strict compliance with regulations on sound limits to minimise the health implications.

In the case of the Mangu area, the sound produced from all nine worship places exceeded 55 dB (See Figure 13). Though the trends are similar, there were marked differences. At Mangu, the number of worship places that produced a sound which exceeded 55 dB decreased to zero at a distance of 250m; this was not the case in the Fongu-Wapaani area. Similarly, the number of worship places that produced a sound below the EPA acceptable limit of 55 dB increased from zero to nine (9) at 250m (see Figure 10).

The varying trends of the number of worship places that generated sound above and below acceptable limits in the two areas could be attributed to differences in the number of worship places. The Fongu-Wapaani local plan has twenty-two (22) worship places, while the Mangu one has only nine (9) worship places. Also, the difference could be attributed to the concentration of residential development. The Fongu-Wapaani area is more concentrated with residential units compared to the Mangu area. Though the spatial distribution in both cases indicated that these facilities were dispersed, the distances between the two facilities in each case may not be the same. Therefore, the likelihood of increased sound from nearby worship places cannot be taken for granted if more than one (1) worship place generates sound simultaneously.

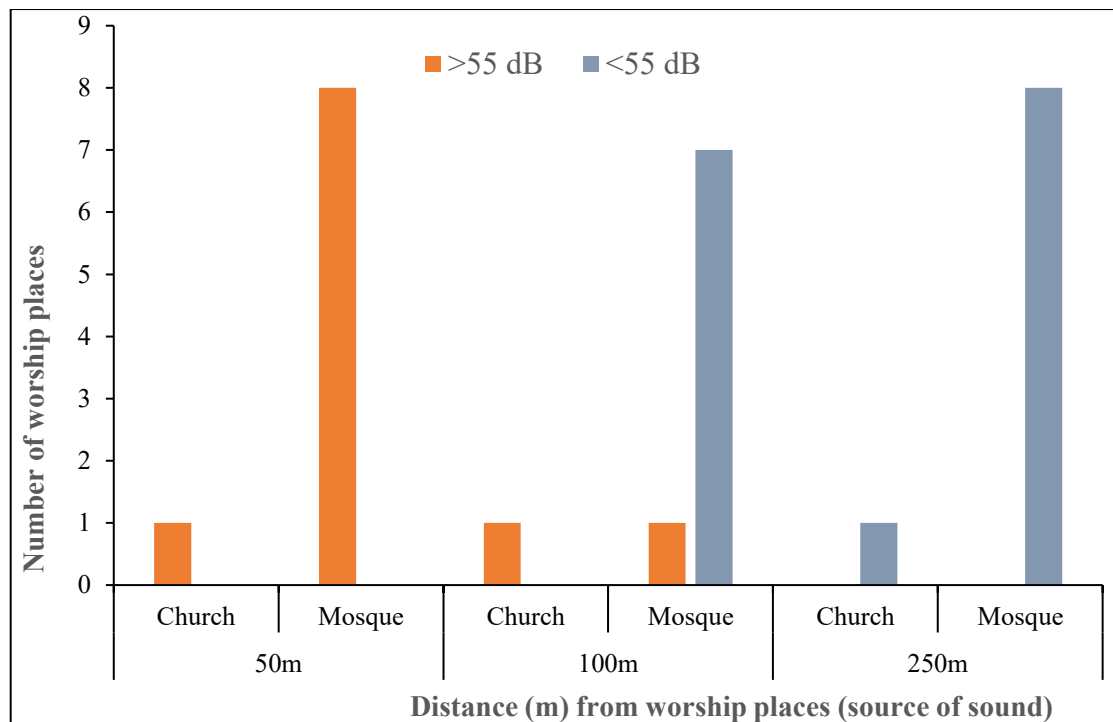


Figure 13: Relationship between the sound levels from worship places and distance from the facilities at the Mangu area (Topie, 2023)

An officer from the Environmental Health Department corroborated the resident's view and stated: *"Every day, somebody reports a complaint about noise from religious facilities"*. According to the informant, approximately 58% of the official working time was spent addressing noise complaints, primarily from worship activities. He cited a case where a church was established inside a family home in a residential area near Nakori, on the outskirts of Wa Township. The church leader did not see anything wrong with it and said complaints by his neighbours were unwarranted and a breach of his right to practice his religion. Another church leader stated:

I have received complaints on two occasions. We have been preaching at this place with sound systems for the past four years. The sound used to be loud, but it has been reduced in response to complaints from people. I believe those who still complain about the sound are not true Christians

The view of a resident in the community about religious sound also supported the church leader's view. The resident stated: *"This sound level does not necessarily translate into noise"*.

Similarly, an officer with EPA said:

EPA received several complaints; approximately 70% of noise complaints were about churches. We refer the matter to the Municipal Assembly for immediate action. One role of EPA is to ensure compliance for the well-being of inhabitants. The power to either stop a worship facility or regulate the use of the facility is not vested in EPA". The EPA ascertains the noise level, writes a

report, and recommends action based on the rules and regulations regarding noise levels to the Municipal Assembly to expedite action.

Authorities and inhabitants across Wa point to what is known locally as "one-man churches", small, independent evangelical churches with no organisational structure, as the biggest offenders. They spring up in unfinished buildings. Despite their small congregations, they often use loudspeakers and musical instruments during worship to create unnecessary sounds.

These divergent views of sound generated during worship can be interpreted differently. It is most likely that residents who share the same faith as worshippers who generate excessive sound during worship may find the sound to be somewhat purposeful and may not perceive it as noise. The differences in perceiving sound produced during worship as normal or noise could also be attributed to the length of time the sound persists. If the sound lasts for short periods, it could be considered tolerable, even if it is very loud. However, if the sound persists and is frequent, it can be perceived as noise, even if it is low.

DISCUSSION OF FINDINGS

The study aimed to analyse the spatial distribution of worship places to determine their compliance with land use plans and noise levels in the Wa Municipality of Ghana. The findings of the study are as follows: first, the spatial distribution of worship places was dispersed, and most of these worship places did not comply with the local plans. Second, some worship places were sited in residential and other land uses, while areas earmarked for worship places were encroached upon by other land uses. Third, the sound levels from the worship places exceeded the EPA permissible noise range of 45-55 dB (see Figures 12 & 13). These findings illustrate the relationship between religion, geographic space, worship places, and land use plans (Figure 1), and contribute to religious geography (Kong, 2025; Harris, 2022).

Most of the worship places in the Fongu-Wapaani Local Plan, for instance, were concentrated in the southern and south-eastern areas, while those of the Mangu Extension Local Plan were in the eastern part of the plan. These zones host the old settlements, and the population attract the establishments of worship places. Similarly, Dudzic-Gyurkovich and Mroczek (2022) found a considerable concentration of places of worship in old areas of Krakow, Poland. However, in this study, the majority of the worship places in the Fongu and Mangu areas of Wa were not very old.

Although the concentration of the worship places is skewed towards certain areas, they are dispersed throughout the area in the local plans. The Z score of the distribution in the Fongu-Wapaani Local Plan, for instance, was 2.389 with a p-value of 0.0169 (which is less than 0.05), signifying that the observed pattern of worship places could not be attributed to a random process. Similarly, the Z score of 5.226 with a p-value of <0.0001 (also less than 0.05) in the Mangu Extension Local Plan demonstrates that the observed distribution of worship places in this plan could be due to chance. Since the location of public worship places is dependent on population density, the dispersed pattern of the worship places is expected.

However, the dispersed spatial pattern of worship places in this study differs from a similar study conducted by Saidu et al. (2025) in the Sokoto Metropolis of Nigeria, where the pattern of places of worship was found to be random.

There is a high noncompliance with the local land use plan in the study area, particularly regarding the siting of worship places and residential areas. The worship land uses clearly deviate from the existing land use plans for both Fongu-Wapaani and Mangu Extension localities, mainly due to unnecessary encroachments from the rampant worship center establishments in urbanised areas in Ghana (Cobbinah & Korah, 2016; Akintaro, 2014). It is clear that the encroachment of other land uses by worship places, which defeats the purpose of land use planning (Germain & Gagnon, 2003), has become a common phenomenon not only in Kumasi and Accra but also in Wa. Recorded encroachment on residential plots, proposed roads, and educational land uses by worship places are comparable to the findings of Cobbinah and Korah (2016). These findings also confirmed the views of Yeboah and Obeng-Odoom (2010) and Adarkwa (2012) that, despite the availability of planning laws and administrative setup, sustainable urban planning in Ghana remains a distant hope as many urban areas remain characterised by unauthorised development. The findings above buttress Saeed's (2003) argument that development for religious purposes is not a term or definition evident in Ghana's government planning controls.

High levels of sounds generated from worship places pose not only a threat to the general public (Egyegini, Danfulani & Abubakar, 2023) but also remain problematic in both urban and rural areas. Thus, the sound levels from the worship places not only disturb but also create noise-related problems for most residents, especially those residing within a 50m range from the worship place. Most of these residents are unhappy and continue to lodge complaints to the authorities, but to no avail. The sound levels indeed exceed the 55 dB permissible levels of sound during religious services (Chukwuemeka, 2023), and are hazardous to public health as indicated in the reports of Zakpala et al. (2014).

The high sound levels from worship places are not peculiar to Wa, as similar high sound levels were also observed in other cities within the sub-Saharan region (Mufuruki, 1997; Oyedepo and Saadu, 2009). In the case of Ghana, Ackah et al. (2021) reported higher religious sound levels compared to the values observed in this study. The difference could be attributed to variations in the quality of sound systems used in the different study areas, as Ackah et al. (2021) attributed excessive noise to the use of loudspeakers and musical equipment. The findings of this study re-emphasise the problem of religious noise in Ghana as it tends to be a national problem, which requires strict enforcement of the laws regulating noise in the country. All these challenges reside in the context of using appropriate model to expatiate the relationship between religion, geographic space, worship places and land use plans thereby illustrating the adverse effects of high sounds associated with the proliferation of worship places in both urban and rural areas (Ackah et al., 2021; Zakpala et al., 2014; Oyedepo and Saadu, 2009; Mufuruki, 1997), which our framework demonstrates and hence appears unique in the literature of religious geography.

CONCLUSIONS AND RECOMMENDATIONS

The study addresses the compliance of worship places with land use plans and noise levels in the Wa Municipality, assessing the distribution and pattern of existing worship places in the local land use plans of Fongu-Wapaani and Mangu Extension, as well as the sound levels generated during worship. Worship places do not comply with local plans in the Fongu-Wapaani and the Mangu Extension Local Plans. Religious land uses are encroached upon by other land uses, and daytime sound levels from religious activities exceed the tolerable noise levels. Therefore, worship places in the two local plans were spatially dispersed, and compliance with the local plans and recommended noise level is weak in the Wa Municipality. The applications of geospatial tools, such as GIS, in the assessment of compliance of worship places with local plans are appropriate in contemporary complex urban environments. The incorporation of sound measurement in the evaluation facilitates comparison with standard values and makes it easy to quantify the discomfort experienced by nearby residents.

The study recommends that the Wa Municipal Assembly liaise with the EPA to enforce regulations on excessive noise from worship places. It is further recommended that the Municipal Assembly should engage in a dialogue with religious leaders whose worship places are situated in residential land uses to address the excessive noise levels. Also, the EPA should regularly monitor the sound levels from these worship places to ensure compliance with the requisite regulations and conditions of residential land use. The study should also be replicated in the other municipalities in the region to find a comprehensive and lasting solution to noncompliance of worship places with land use plans and noise levels.

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Author Representations

I confirm that I have reviewed and complied with the relevant Instructions to Authors, Ethical Approval, Declarations of Interest, Informed Consent noted below

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Ethical approval

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