INDO PAC J OCEAN LIFE
Volume 6, Number 2, December 2022
Pages: 94-105

P-ISSN: 2775-1961
E-ISSN: 2775-1953
DOI: 10.13057/oceanlife/o060205

Effects of urbanization on coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana

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Manuscript received: 7 Maret 2022. Revision accepted: 19 July 2022.

Abstract. *Dadzie-Paintsil E, Mensah JV. 2022. Effects of urbanization on coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana. Indo Pac J Ocean Life 6: 94-105.* Wetlands play an important role in the livelihood of humankind; on the other hand, the reciprocal gesture on ecosystem protection is on the decline. The result is the loss of wetlands, especially in urban areas. This study examined the effects of urbanization on coastal wetlands in the Sekondi-Takoradi Metropolis of Western Region Ghana. Therefore, using a mixed-method research design, 358 respondents were sampled from the metropolis to respond to the data collection instruments: questionnaire, interview, and Focus Group Discussion (FGD). The Statistical Product and Service Solutions (SPSS) program version 14 was used to facilitate quantitative data analysis, while content analysis was used for qualitative data analysis. The major finding was that wetlands in the Sekondi-Takoradi Metropolis was affected by urbanization, resulting in the loss of some portions of the wetlands. Furthermore, wetlands were perceived as 'wastelands' which should be used for other use. One major recommendation is that residents should be sensitized by the Metropolis Assembly and the Environmental Protection Agency to appreciate the value of the coastal wetlands in the metropolis. Again, there should be the co-management of the wetland resources and the provision of alternative sources of livelihood by the local authority, central government, and concerned non-governmental organizations.

Keywords: Ecosystem, Sekondi-Takoradi Metropolis, urbanization, wetlands

INTRODUCTION

Wetlands, both inland and coastal worldwide, are essential and deliver numerous benefits or ecosystem services to humans, including to provide services such as food and fiber, essential for human welfare, regulating services, recharging groundwater, and protecting from natural hazards, which are critical to vital ecosystem functions sustainably. Wetlands also have spiritual values and provide sustainable opportunities for recreation and tourism, considerable aesthetic, cultural, and educational (Mensah 2003; Yusuph and Munishi 2018).

Moreover, coastal wetlands also play a vital role in spatial development. They maintain ecosystem balance, serve as open spaces, and provide habitats for birds, fish, mammals, and invertebrates. They also provide a habitat for a high concentration of birds, flood prevention, and storm protection (Bishop et al. 2017). Regardless of its benefits, wetlands worldwide have been abused, encroached on, and degraded due to the human population's direct or indirect socio-economic activities. As a result, the world is continuously losing its wetlands. The Millennium Ecosystem Assessment Report (2005) suggested infrastructure development (such as dams, dikes, and levees), pollution, overharvesting, land conversion, water withdrawals, and the introduction of invasive alien species drive the increase in the loss of wetlands and their vital species globally. Furthermore, the recent Asian tsunami analysis by Dahdoub-Guebas et al. (2005) suggests that there may be an inverse relationship between tsunami damage and mangrove presence, which means that an increase in the loss of wetlands could increase the damage and the effect of natural disasters like hurricane, floods, and tsunami.

Usually, wetlands are shallow water-logged areas characterized by emergent vegetation. They could remain flooded all year round or undergo drastic changes in water level depending on the season. What constitutes a coastal wetland varies from considerations based on the level of ocean-derived salinity of the open water body or proximity to the sea. Marine wetlands include the open coast not subject to the influence of the lagoon system and river water. While forced resettlements and encroachments are also identified as associated with the development of extractive industries, which could drive the community's people to lose wetlands, die from contamination, venerate ancestral homes, and see their livelihoods jeopardized (Gary 2009).

Worldwide urban sprawl has been caused by population and income growth, little environmental awareness, and relaxed legal regulations. Traditional communities have revered wetlands. However, modern-day communities abutting wetlands see them as wastelands. Modernization and urban sprawls have encumbered suitable lands for development, and marginalized poor people who need land development are pushed to the peripheral lands, considered cheap or wastelands. That is why wetlands are encroached on, filled for physical development and waste disposal sites, and abused. Many of these wetlands are also used for solid waste and water disposal and are considered breeding grounds for mosquitoes by the population (Angulo 2000). Additionally, because of technical difficulties and greater

costs of urban expansion into other areas, such as the coastal range, the sprawl has been concentrated in the floodplains and wetlands (Riffo and Villarroel 2000).

The spread and emergence of urbanization have also significantly contributed to the loss of its wetlands which were once a habitat for most aquatic animals. Historically and globally, urbanization is a natural phenomenon wherever a surplus to feed non-agricultural workers with agriculture produces. Moreover, urbanization is generally considered as either the degree or increase in urban character. It may refer to a geographical area combining the urban and the immediate periphery, often rural (Satterthwaite et al. 2010).

The recent dramatic pace of urbanization in the Sekondi-Takoradi Metropolis, Ghana, and its destructive effect on coastal wetlands is currently obvious. Therefore, this study aimed to describe the current state of coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana; identify the institutions responsible for the protection and management of coastal wetlands in the Sekondi-Takoradi Metropolis; examine the urban activities that affect the coastal wetlands, and analyze the perception of stakeholders on the use and management of coastal wetlands.

MATERIALS AND METHODS

Study area

The Sekondi-Takoradi Metropolis, with Sekondi as the administrative capital, on the southeastern part of the Western Region, Ghana (Figure 1). The city's population grew from 103,834 in 1970 to 369,166 in 2000, with a growth rate of 3.2%, projected to 444,752 by 2013. The annual temperature is 22ºC, with annual rainfall is 1,380 mm, and an average of 122 rainy days. Precipitation occurs mainly from March to July, with nearly 70% rainfall. The second rainy season is between September to November, which is very severe. The dry seasons occur from August to September and extend from December to February, heralding the harmattan and drying up the area. The metropolis does not experience severe weather conditions and is favorable as a tourist spot destination. Their natural vegetation has been degraded largely due to farming practices and human activities, with existing vegetation being woodland in the north and central areas.

Research design

This study used the descriptive research method. As a result of the respondents' nature, mostly fishermen, assembly members, opinion leaders, youth representatives, and chiefs, the majority of which cannot write and read, to ascertain the data on the status of the wetlands in the Sekondi-Takoradi Metropolis, the research relied heavily on Focus Group Discussions. Retrieving data of such nature requires a descriptive approach to allow the respondent to describe the nature and state of the wetlands.

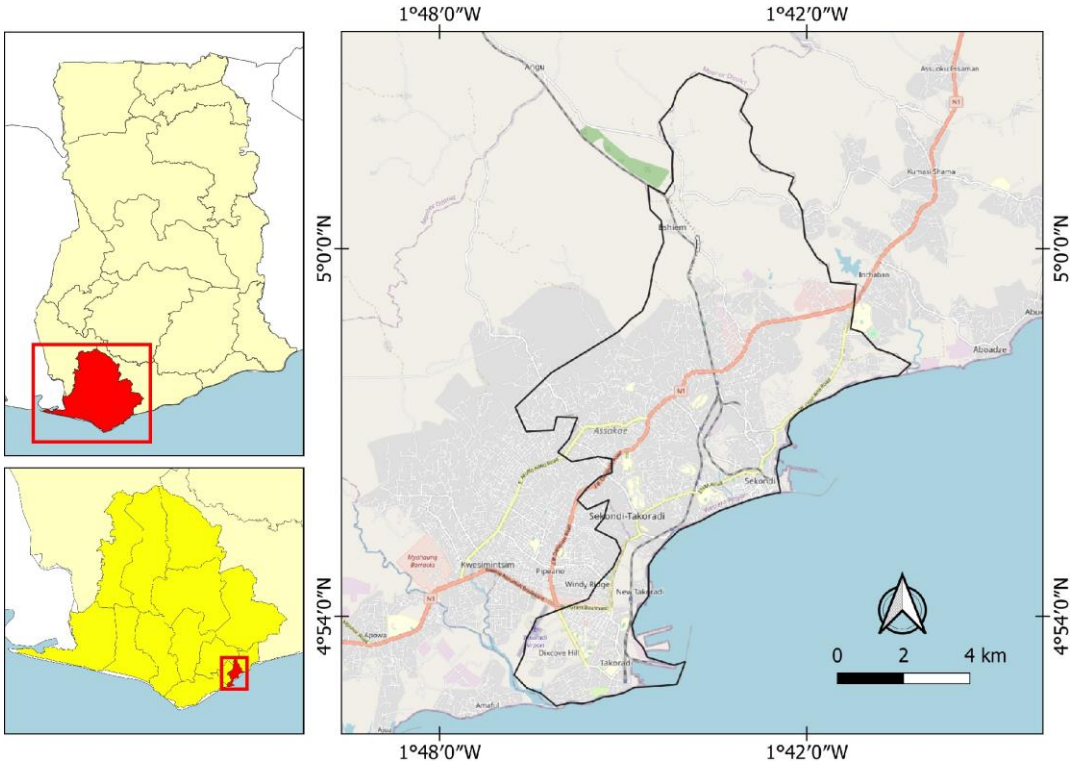

Figure 1. Sekondi-Takoradi Metropolis area in the regional and national context. Source: https://data.humdata.org/dataset/cod-ab-gha (2022)

Study population

The study population comprises the adult population (18 years and above) in all ten wetlands communities in the Sekondi-Takoradi Metropolis. The communities used are Whindo, Apremdo, Effia, Effiakuma, Sekondi, Bakado, Buabakrom, Kojokrom, New Takoradi, and Takoradi. These are areas where the wetlands are located in the metropolis. In addition, the study identified key stakeholders such as Assembly members, Chiefs, Opinion leaders, and representatives of Youth Groups who have stayed in the metropolis for not less than three years. That facilitated the identification of significant changes like the coastal wetlands. According to Ghana Statistical Service (2002) as shown in Table 1, the total population of these ten communities is approximately 225,491 people.

Sample size and sampling procedure

The non-probability sampling technique was employed to achieve the research objectives. Therefore, the quota sampling technique was used to select the respondents. This technique was adopted because respondents needed to meet several requirements and characteristics. For instance, a respondent must be a chief, assembly member, opinion leader, or youth group representative. In addition, the population is adequately represented using quota sampling if the sample strongly correlates with the study variable. Due to time and resource constraints, 1% of the study population's total population constituted the study's sample size. Hence, as indicated in Table 1, the sample size is 225 people.

Sources of data

The residents in ten communities in the Sekondi-Takoradi Metropolis were used to gather primary data. The primary data were derived from the respondents' answers during the survey process. On the other hand, the secondary data were obtained from journals, reports, books, and other relevant materials.

Data collection instruments

The questionnaire, interview, and Focus Group Discussion (FGD) tools were used as the main data-gathering instruments for this study. A questionnaire is not simply a 'tool' for collecting and recording information about a particular issue of interest but also consists mainly of a list of questions and should also include clear instructions and administrative details or space for answers. Should questionnaires always have a definite purpose related to the research objectives, and it needs to be clear from the outset how the findings will be used. The youth group's representatives and assembly members administered the interview guides. The questionnaires were divided into three main sections: The first section contains socio-demographic of the respondents' characteristics, such as educational background, sex, the number of years they have stayed in the Sekondi-Takoradi Metropolis, knowledge and status of wetlands, activities that affect wetlands, perceptions, institutions for wetland protection and management, urbanization impact, and recommendations.

The FGD is a rapid assessment, the semi-structured data-gathering method in which a selected set of participants (chiefs and opinion leaders in this case) gather purposively to discuss concerns and issues based on a list of key themes drawn up by the researcher/facilitator (Kumar 1987). This study explored the respondents' perceptions of the wetlands' encroachment and its impact on these communities.

Pretesting of instruments

A one-day pretest was conducted to test the instruments before the actual survey. After the questions had been answered, the researcher asked the respondents for any suggestions or necessary contributions to establish further improvement and validity of the instruments. Therefore, the researcher revised the data collection instruments. Then, the researcher excluded irrelevant questions and changed difficult or vague terminologies into simpler ones.

Fieldwork

The researchers recruited four assistants who helped collect and process data. After pretesting the instruments, the researchers sent an introductory letter to the institutional heads, chiefs, opinion leaders, and various representatives. An agreed date was scheduled at the interviewee's and discussants' convenience. Next, the research team solicited responses from the target population with the help of questionnaires, interview guides, and FGD guides.

Fieldwork challenges

As every reputable study encountered challenges, this study was no exception. For example, because discussants in some communities postponed our scheduled dates on more than three occasions, organizing discussants was arduous. Sometimes, the researchers and the research assistants had to wait the entire day for the discussants. Moreover, controlling the discussants' emotions was another challenge regarding the subject in question. Nevertheless, the researchers were able to calm nerves after thoroughly explaining the study's objectives and the intended use of the eventual result.

Table 1. The projected size of the study population and sample distribution

Community	Population size	Ratio (%)	Sample size
Apremdo	11,996	0.05	312
Bakado	1,858	0.00	82
Buabakrom	605	0.003	1
Effia	5,771	0.026	6
Effiakuma	45,245	0.200	45
Kojokrom	13,141	0.058	13
New Takoradi	18,668	0.083	19
Sekondi	50,672	0.225	50
Takoradi	75,428	0.335	75
Whindo	2,107	0.009	2
Total	225,491	1.000	225

Source: Ghana Statistical Service (2002)

Data processing and analysis

All recorded responses were transcribed after data collection. The transcribed data and questionnaire responses were edited and coded for analysis. The coded data were entered into a computer program named Statistical Product and Service Services (SPSS) version 14. Tables and basic descriptive statistics such as averages, percentages, and frequencies were generated for the analysis. In addition, content analysis exposed the qualitative data gathered using the FGD guide and interview guide.

RESULTS AND DISCUSSION

Background characteristics of respondents and discussants

Types of respondents

The ten selected communities involved in this study were 286 community members. About 61 were involved in organized focus group discussions, while the remaining provided information through questionnaires. Ten assembly members were also involved in organizing the focused group discussion participants. The youth were represented in all 10 communities, and about 8 institutional heads were contacted. Table 2 depicts the types of respondents used for the entire study.

The researcher also engaged chiefs, assembly members, youth representatives, opinion leaders, and women's organization representatives in the Sekondi-Takoradi Metropolis communities to constitute the study's discussants. The people, as mentioned earlier, were engaged due to their knowledge of the subject matter at hand and the history and environs of their community, deeply.

The third groups the researchers interviewed were institutional heads or representatives in the metropolis whose activities and operations directly or indirectly impact the conservation wetlands. These interviews to ascertain from their perspective the role they play in protecting and conserving the wetlands.

Sex of respondents

Although all the assembly members and chiefs used for this study were males, more than half (50.6%) of the respondents were females (Table 2). On the other hand, more than 50 % of the community members are females. Also, 3 out of 8 institutional heads similar to representing 37.5%, were females.

Age distribution of respondents

Table 3 shows the age distribution of the respondent used in all ten communities in the Sekondi-Takoradi Metropolis, about 40.8% of the respondents were between the ages of 30 and 39. Only 8 out of 225 youth, representing 3.5%, were less than 19 years old. Even though the destruction of the wetlands in the Sekondi-Takoradi Metropolis environment is worrying, there is still hope due to the interest expressed by the youth in preserving and maintaining these coastal wetlands. This assertion is bolstered by the fact gathered in the field that most of the respondents are relatively young and have indicated interest and zeal to preserve what is left of the coastal wetlands.

Marital status of respondents

Table 3 presents the marital status of respondents. The majority (60%) of the respondents used for the study were married. However, 29, 22, and 38 out of 225 respondents were also single, separated, and divorced, respectively.

Table 2. Type and sex distribution of respondents

Type of respondent	Male		Female		Total	
	F	%	F	%	F	%
Community members	125	43.7	161	56.3	286	100.0
Assembly members	15	100.0	0	0	15	100.0
Youth group rep.	12	63.2	7	36.8	19	100.0
Opinion leaders	7	58.3	5	41.7	12	100.0
Chiefs	8	100.0	0	0	8	100.0
Institutional rep.	5	62.5	3	37.5	8	100.0
Total	172	49.4	176	50.6	348	100.0

Note: Rep.: representatives

Table 3. Characteristic of respondents

Characters	Frequency	Percent
Age (years)		
Less than 19	8	3.5
20-29	76	33.7
30-39	92	40.8
40-49	25	11.1
50-59	14	6.5
60+	10	4.4
Total	225	100.0
Marital status		
Single	29	12.9
Married	136	60.4
Divorced	38	16.9
Separated	22	9.8
Total	225	100.0
Level of education		
Never been to school	12	5.3
Basic school	87	38.7
Secondary	100	44.4
Tertiary	26	11.6
Total	225	100.0
Occupational status	**Frequency**	**Percent**
Fisherman/fishmonger	88	39.1
Trader	82	36.4
Civil servant	25	11.1
Artisan	23	10.2
Other	6	2.7
Student	1	0.4
Total	225	100.0

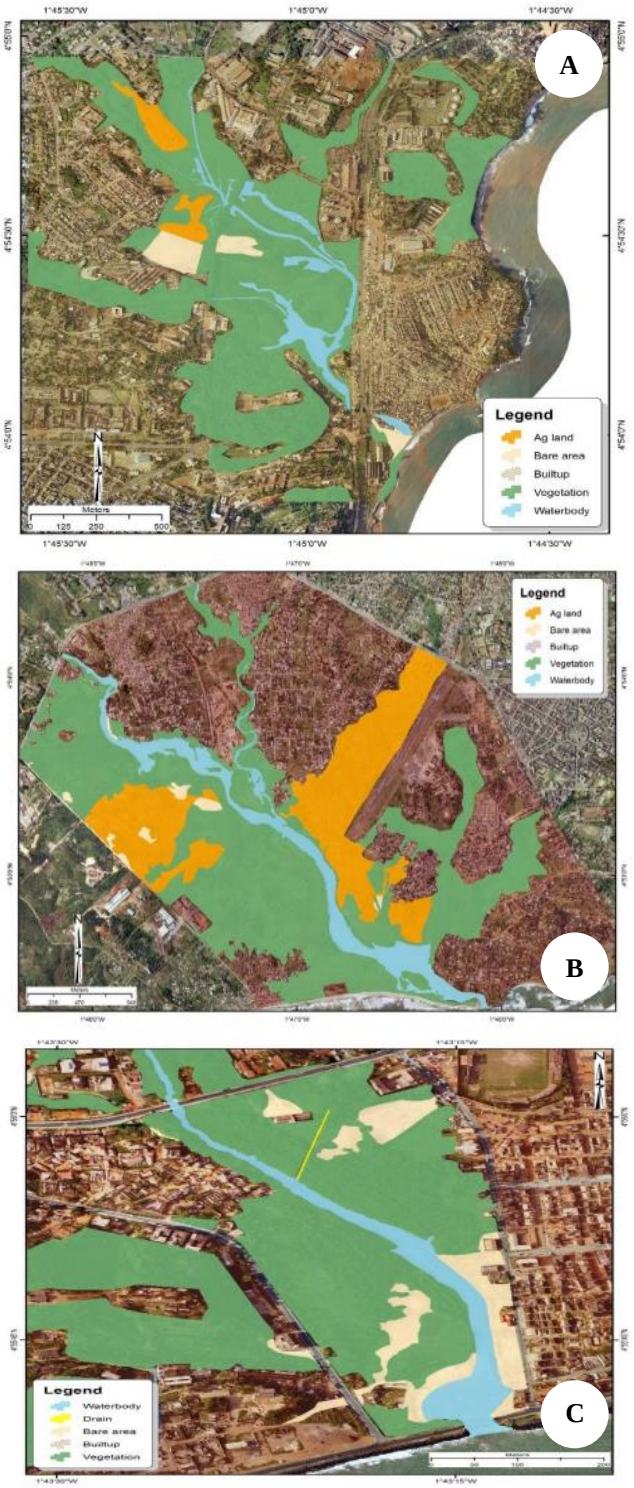

Figure 2. An aerial view of A. Butuah lagoon at New Takoradi, B. Whin River at Beach Road, C. Essei Lagoon at Sekondi

The educational level of respondents

The literacy rate in Sekondi-Takoradi Metropolis is relatively high. However, only 5.3% of the respondents have never been to school, 44.4% had secondary education, and 11.6% had tertiary education (Table 3).

Occupation of respondents

The majority of the ten selected community respondents were fishermen and fishmongers. As shown in Table 3, 39.1% of the respondents were either fishermen or fishmongers.

Knowledge and current state of wetlands in the Sekondi-Takoradi Metropolis

Three coastal wetlands were identified per the definition of a wetland used in this study. Figure 2 shows the respondents, the institutional representative, and some discussants identified as the Butuah Lagoon, Whin Estuary, and Essei Lagoon. Based on their knowledge of a wetland, the respondents were asked via questionnaires to identify wetlands in the Sekondi-Takoradi Metropolis. Table 4 shows that 39.6% of the respondents were able to identify the Whin Estuary as a wetland. Similarly, 29.3% and 31.1% of the respondents also identified the Essei and Butuah lagoons as wetlands.

The researchers' aim at this study stage was to allow the discussants to identify any wetlands in the Sekondi-Takoradi Metropolis in the case of the FGD. The discussants were allowed again to furnish the researcher with what they knew and perceived about the wetlands. The call for intensive education and sensitization on protecting and preserving the wetlands in the metropolis was very relevant. This request was made because people still perceived wetlands as 'wasteland,' Brown (1985) confirmed in the earlier study on the likely impact of municipal wastes on wetlands. Thus, the call on the Assembly and the government to support them in reclaiming these sites. Mensah (2003) made similar finding and call in a study on coastal wetlands in the Central Region of Ghana.

Wetlands in the Sekondi-Takoradi Metropolis have changed in appearance, size, and composition due to several factors. Therefore, attention must be paid to the current state of the wetlands to preserve and maintain them. The wetlands are now polluted with waste, particularly polythene wrappers, indicated in that study, which take longer to decay. Most of the wetlands are also encroached on by the prospective developers, leading to the narrowing of their channels. As a result, the water in these wetlands is not hygienic for domestic use and is now dirty, in sharp contrast with clean water as a benefit of the wetland, as espoused by Richard and Connell (2001).

Table 4. Knowledge of wetlands in the Sekondi-Takoradi Metropolis, Ghana

Name of wetland	Frequency	Percent
Whin estuary	89	39.6
Butuah lagoon	70	31.1
Essei lagoon	66	29.3
Total	225	100.0

From Table 5, 47.1% of the respondents indicated that the wetlands in their communities had been polluted with waste. About 31.1% of the respondents also stated that residents have encroached on these wetlands for industrial, commercial, and residential uses contrary to the approved scheme, which designates it as an open space area (green buffer). A case in point is Kojokrom, where 38.5% of respondents indicated that the wetlands' water is dirty and unhealthy for domestic use. In addition, residents have also encroached upon portions of the Sekondi-Takoradi Metropolis's wetlands, which has narrowed their channels.

In Bakado, an opinion leader on an FGD recounted the benefit of reclaiming a marshy area in their community. Similarly, a youth representative in Sekondi called on their chief and the Assembly to reclaim a portion of the Essei lagoon to point out the benefits some encroachers have derived from wetlands.

The public education need is justified by these contrasting views expressed while one group looked at encroachment on the wetlands as negative, the other saw it as positive. Sustainable resource use becomes paramount, thus the essence of public education. Most discussants could identify the three main wetlands in the Sekondi-Takoradi Metropolis (Essei, Butua, and Whin). Almost 95% of the discussants acknowledged that the Lagoons, as mentioned earlier, and the Whin Estuary and its environs located in Sekondi, New Takoradi, and Takoradi, respectively, were wetlands. However, some of the tributaries of these lagoons were not seen as wetlands. Moreover, about 87% of the discussants indicated that there are no more wetlands, as mentioned earlier, their current state was now deplorable compared to their state ten years back.

The chief of Buabakrom indicated that their community flooded the last three years due to waste disposal into the stream. In a similar faction, some developers were reported by the assembly member of Whindo for encroachment on the Whin River to the Sekondi-Takoradi Metropolis Assembly (STMA). An opinion leader at New Takoradi also expressed their displeasure with how the Butuah lagoon is deteriorating. A similar sentiment about the state of the Essei lagoon in recent times was also expressed by one of the youth representatives of Sekondi. Finally, a market woman at Kojokrom indicated that the Essie and the Whin rivers are now choked compared to their state in the early 1990s.

The chief Imam of Bakado, on the other hand, indicated that the Oberayeba stream is now in a better state than it used to be. He indicated that their community flooded during rainy seasons in the past years but has stopped over the past three years due to the dredging and diversion of the stream. It indicated they no longer enjoyed the benefits, such as fish harvested from the river. In general, from the study's responses, it was evident that the wetlands in the Sekondi-Takoradi Metropolis were under threat and disappearing faster due to increased population and human activities.

Benefits of coastal wetlands

Table 6 shows the respondents for the study admitted that the wetlands in the Sekondi-Takoradi Metropolis have significant benefits, which are enormous and cannot be overemphasized. These benefits range from food to shelter and supply humanity's basic needs, as supported by Costanza et al. (1997). In terms of food, more than 54% of the respondents identified crabs and fish as some of the benefits derived from the wetlands by the communities, which also serve as a source of income for some of the study communities' residents. In addition, especially in New Takoradi and Adakope, mangroves are also harvested from the wetlands for building. Therefore, preserving the wetlands in the metropolis should be put in place for the residents to continue deriving the above benefits.

Table 6. Benefits of coastal wetlands to the residents

Benefit	Frequency	Percent
Mangrove for building	78	34.7
Fish	76	33.8
Crab	48	21.3
Grass for roofing	14	6.2
Water for Irrigation	9	4.0
Total	225	100.0

Table 5. Community and current state of wetland

Community	Dirty	Encroached upon by buildings	Narrow channel	Polluted with waste	Total
Apremdo	3 (25)	3 (25)	0	6 (50)	12 (100)
Bakado	0	0	0	1 (100)	1(100)
Buabakrom	0	0	0	1(100)	1(100)
Effia	0	1 (16.7)	1 (16.7)	4 (66.7)	6(100.0)
Effiakuma	10(22.2)	10 (22.2)	0 (.0)	25(55.6)	45(100)
Kojokrom	5(38.5)	1(7.7)	1(7.7)	6(46.2)	13(100)
New Takoradi	5(26.3)	2(10.5)	0	12(63.2)	19(100.0)
Sekondi	12(24.0)	11(22)	0	27(54)	50(100)
Takoradi	6(7.9)	42(55.3)	5(6.6)	23(30.2)	76(100)
Whindo	0	0	0	2(100)	2(100)
Total	41(18.2)	70(31.1)	7(3.1)	107(47.5)	225(100)

Note: Percentage figures are in parentheses

Figure 3. Mangrove trees are used for building at Adakope, Ghana

Moreover, wetlands furnish people living closer to them or even beyond with numerous benefits: flood control, water supply source for domestic use, irrigation, coastal protection, and serving as a habitat for wildlife species. From the data gathered, the discussants also acknowledged that they derived many benefits from the wetlands. For example, a fisherman from Sekondi stated how they used to harvest a lot of tilapia during the rainy seasons from the Essei lagoon in the past years. He also added that they could not use canoes anymore because of the siltation of the lagoon, even though they were used for fishing on the lagoon. The mangroves were also cut for construction buildings in some communities, such as Adakope (Figure 3). A fishmonger indicated that some ten years back in New Takoradi, the Butuah lagoon was a food source for the residents during the rainy season; they also recounted how fishermen abandoned the sea to fish in the lagoon during that period.

A Sekondi's chief also indicated that the Essie estuary served as a site for foreign and local tourists and for educational purposes for students and researchers. At Effiakuma, the assembly member stated that the Whin lagoon was a tourist site. It was also revealed that in the past, fishermen, especially during the lean seasons, depended on these wetlands for fishing. Notwithstanding the benefits, a teacher from Kojokrom illustrated that human activities in the Sekondi-Takoradi Metropolis have contributed to reducing these benefits beyond imagination. He cited that the area between the Effia-Nkwanta Hospital and Sekondi has been reclaimed for residential and industrial use before an area that used to be a vast wetland with serene vegetation and birds.

Especially in the dry season, it was also evident that communities such as Bakado and Essaman mostly relied on the Essei lagoon for irrigation purposes. A farmer at Whindo indicated that even though the volume of water in the river has recently reduced, the Whin estuary is used to irrigate their vegetable farms. As a result of the lagoon's ability to purify and retain large volumes of water was lost, which provided a clean and reliable source of water for domestic use in the past. These wetlands maintain perennial rivers and streams because the Essei and Whin rivers flow throughout the year. They occasionally release their stored water slowly; community stakeholders revealed that during the interaction.

Mangroves and other plants are harvested for medicine and fuel, traditionally. Particularly, fishmongers in New Takoradi and Adekope often use the mangroves along the Butuah lagoon and the Whin estuary to process fish in commercial quantities for Takoradi and Sekondi markets, respectively. In addition, mats, baskets, and thatching materials derived from grasses and reeds are sometimes harvested in these wetlands. Livestock in the metropolis also relies heavily on the grasslands along these wetlands, especially in the dry season.

Problems associated with coastal wetlands

They pointed out some challenges they face living closer to the wetlands, contrary to the benefits the respondent identified above. The problems identified are flooding and the breeding of mosquitoes. About 49.8% of the respondents indicated that the wetlands breed mosquitoes in the Sekondi-Takoradi Metropolis, resulting in many residents, especially children, being infested with malaria. About 41.3% of the respondents also attested that most residents in their communities, especially those closer to the wetlands, relocate to other communities during the rainy seasons.

When they are not properly managed, as beneficial as coastal wetlands can be, they can especially create problems for residents living closer to them. For example, wetlands in the Sekondi-Takoradi Metropolis have ironically turned into breeding grounds for mosquitoes instead of spawning grounds for fish, as asserted by Costanza et al. (1997).

Table 7 shows that about 49.8% of the respondents indicated that the wetlands had become a breeding ground for mosquitoes. The respondents also indicated that most of the wetlands have been enroachment upon by prospective developers for residential and commercial buildings and have been choked with filth causing their communities to get flooded during rainy seasons.

At Whindo, the respondents particularly expressed their displeasure with the menace of mosquito breeding they have to cope with; respondents pointed out breeding mosquitoes as the main problem they faced due to the community's proximity to the wetland. However, refer to Rey et al. (2012), the mosquito population decreased after conservation measures in the wetlands. Table 8 presents community-specific problems related to coastal wetlands.

Effects of urbanization on coastal wetlands

There have been enormous physical developments in the Sekondi-Takoradi Metropolis over the past two decades. Most of these developments could seriously threaten the preservation of the wetlands. Table 9 shows that 97.3% of the respondents affirmed this position, which calls for adopting and implementing a stringent bye-law to stem this.

There are a lot of activities that affect wetlands worldwide. This study shows in the metropolis, four main physical development activities affect the three identified wetlands. These are the encroachment and subsequent

development into residential, commercial, and industrial building activities and refuse to dump on site. Among the four main activities, residential development is the one that affects the loss of wetlands most in the Sekondi-Takoradi Metropolis, as shown in Table 10.

About 38.2% of the respondents identified residential building construction as one of the main activities affecting wetlands. About 29.3% of the respondents identified an activity affecting wetlands, which is the commercial building. Dumping of refuse in the Sekondi-Takoradi Metropolis was identified by 24.9% of the respondents as another activity that affect the three main wetlands.

From Table 10, about 34.2% of the respondents identified the residential building as the main activity in the Sekondi-Takoradi Metropolis, affecting the loss of coastal wetlands. Commercial activities have also increased in the past few years. These have also affected wetlands in one way or the other. Thus 30.2% identified commercial activities in the Sekondi-Takoradi Metropolis as another activity that affects the loss of wetlands. Industrial activities and refuse disposal have also affected wetlands, with the last choking the wetlands. The improper disposal of waste into the wetlands pollutes and affects the aquatic life within its immediate environments.

However, the activities affecting wetlands in the Sekondi-Takoradi Metropolis vary from one community to another. For instance, in Effiakuma, as many as 33 out of 45 respondents representing 73.3%, believed the loss of wetlands affected by the commercial activities in the community. Similarly, 35 out of 76 respondents representing 46.1% in Takoradi, indicated that residential buildings affect coastal wetlands (Table 11). In addition, some of the respondents in Takoradi confirmed the increasing inflow over the past 5 years of people from other parts of the country into the Sekondi-Takoradi Metropolis. However, all the respondents In Bakado and Buabakrom believe improper waste disposal affects the wetlands significantly. Referring to Asselen et al. (2013), agricultural development, population growth, and market/economic factors were identified as important causes of various types of land change (e.g., desertification and deforestation).

Natural resources worldwide are depleted or affected by natural occurrences like flooding, tsunami, earthquakes, and to a larger extent, human activities. The wetlands in the Sekondi-Takoradi Metropolis are no exception. Human activities in the metropolis have impacted the wetlands significantly. Building construction and waste disposal were some of the case points in this study. The impact of these activities is astounding due to the gradual effect on wetlands as their fauna and flora species are being lost.

Table 7. Problems associated with the coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana

Problems identified	Frequency	Percent
Breeding mosquitoes	112	49.8
Flooding	93	41.3
Flooding & breeding mosquitoes	17	7.6
Breeding reptiles	3	1.3
Total	225	100.0

Table 9. The threat of physical developments to the wetland

Response	Frequency	Percent
Threats	219	97.3
No threats	6	2.7
Total	225	100.0

Table 10. Activities affecting coastal wetlands loss in Sekondi-Takoradi Metropolis, Ghana

Activity	Frequency	Percent
Residential building	86	38.2
Commercial building	66	29.3
Refuse dumping	56	24.9
Industrial	17	7.9
Total	225	100.0

Table 8. Community and problems associated with coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana

Community	Flooding	Breeding mosquitoes	Breeding reptiles	Flooding & breeding mosquitoes	Total
Apremdo	4 (33.3)	4 (33.3)	0	4 (33.3)	12 (100)
Bakado	0	0	0	1 (100)	1(100)
Buabakro	0	1 (100)	0	0	1(100)
Effia	3(50)	0	0	3(50)	6(100)
Effiakuma	10(22.2)	7(15.6)	11(24.4)	17(37.8)	45(100)
Kojokrom	3(23.1)	10(76.9)	0	0	13(100)
New Takoradi	6(31.6)	6(31.6)	3(15.8)	4(21.1)	19(100)
Sekondi	0	20(40)	0	30(60)	50(100)
Takoradi	0	35(46.1)	12(15.8)	29(38.2)	76(100.0)
Whindo	0	2(100)	0	0	2(100)
Total	26(11.6)	85(37.8)	26(11.6)	88(39.1)	225(100)

Table 11. Community and activities affecting coastal wetlands loss

Community	Residential building	Commercial building	Industrial	Refuse dumping	Total
Apremdo	2(16.7)	4(33.3)	2(16.7)	4(33.3)	12(100)
Bakado	0	0	0	1(100)	1(100)
Buabakrom	0	0	0	1(100)	1(100)
Effia	2(33.3)	2(33.3)	0	2(33.3)	6(100)
Effiakuma	5(11.1)	33(73.3)	2(4.4)	5(11.1)	45(100)
Kojokrom	5(38.5)	2(15.4)	6(46.2)	0	13(100)
New Takoradi	4(21.1)	5(26.3)	5(26.3)	5(26.3)	19(100)
Sekondi	23(46)	10(20)	0	17(34)	50(100)
Takoradi	35(46.1)	11(14.5)	4(5.3)	26(34.2)	76(100)
Whindo	1(50)	1(50)	0	0	2(100)
Total	77(34.2)	68(30.2)	19(8.4)	61(27.1)	225(100)

Note: Percentage figures are in parentheses

About 96% of discussants indicated that the main cause of pollution and destruction of these wetlands is the human activities mentioned earlier. The assembly member noted, for instance, in Bakado that the wetland was choked with silt and debris from upstream. Furthermore, they associated this with construction and development activities at Kansaworado and its environs. Similarly, a sub-chief in Sekondi also associated the choked lagoon with the wreckless waste disposal and building activities upstream; the Assembly recently also said this resulted in the total blockade of the lagoon. Finally, the end is that the lagoon has lost its unique flora and fauna species.

Moreover, an opinion leader in Takoradi recounted how improper waste disposal and building construction along the Whin River has significantly affected the river. People living along the river throw both liquid and solid waste into it. They said most of this liquid waste is not good for some fish in the river; hence, they occasionally observe dead fish floating on the Whin river. Solid waste also prevents the river's free flow, especially during the dry and causes the river to overflow its banks during the rainy season. The assemblymember also noted that people have encroached upon the river banks, which have been personally reported to the Assembly.

In Effiakuma, New Takoradi, and Kojokrom, the situation was not far different. In New Takoradi, a fishmonger indicated that some residents were using the wetland as an easing site, which they visit every morning, and refuse dumping. That quickly added to how these activities had affected their low fish harvesting catch and the area's aquatic life in general.

Institutions responsible for wetland protection and management

There are institutions in Sekondi-Takoradi Metropolis whose activities are in one way or the other related to the preservation, protection, and management of wetlands. In responding to this question, most discussants only identified the Assembly and two Non-Governmental Organizations (NGOs), namely Friends of the Nation (FON) and Coastal Resources Centre (CRC). However, an opinion leader at Bakado commended FON for the sensitization programs they organized in July 2012 for the residents in the community.

The assembly member for Apremdo also acknowledged that he was invited to a forum organized by Friends of the Nation (FON) to sensitize them on the need to preserve and protect wetlands and the coast. Table 12 shows details of the responses that most discussants identified three main institutions for protecting and preserving the wetlands in the Sekondi-Takoradi Metropolis. First, FON was highly recognized by the discussants as an institution that organizes workshops and sensitization programs for the people in the community. About 72% of the discussants could recognize FON and its role in preserving wetlands in the metropolis's.

The discussants also recognized another NGO called CRC (Hen Mpoano). Thus, 62% of the institutions acknowledged their role in protecting the wetlands in the Sekondi-Takoradi Metropolis. Furthermore, the NGO CRC was recognized for educating the residents on the need to preserve the wetlands and planting trees along the wetlands. Interestingly, the discussants could not separate the roles of the various departments in the Assembly. Hence, for this study's purpose, the role of Town and Country Planning, Works Department, Lands Commission, Environmental Health Sanitation and Management, and Parks and Gardens have been merged. As a result, the Assembly was perceived by the discussant as a law enforcement agency with the sole responsibility of preventing people from encroaching on wetlands and preserving them. On the other hand, the tourist Board and the Fisheries Commission were not recognized by the discussants as institutions interested in wetlands preservation.

Table 12. Institutions responsible for the preservation of wetlands

Institution	Number of discussants	Percent
Environmental Protection Agency	10	8
Game and Wildlife	6	5
Assembly	67	54
Fisheries Commission	12	8
Parks and Gardens Department	2	2
Friends of the Nation (NGO)	89	72
Coastal Resource Centre (NGO)	76	62

Role of the institutions

Every institution is set up to play a particular role in the country. However, due to the institution's malfunctioning or inadequate resources, most of these responsibilities have been left unattended. For example, the Parks and Gardens Department is responsible for beautifying the town and cities of the country. The department also plants trees along river banks and preserves some extinct plant species in the country. However, their role has been restricted to nursing plants, grasses, and flowers. A respondent indicated that the department was handicapped regarding resources and could not effectively execute its mandate.

The Wildlife Division is also responsible, in general, for conserving wildlife and managing wildlife-protected areas, in particular within the country's representative ecological zone. All five RAMSAR sites in the country have also been mandated to be managed by this division, sensitizing residents on the importance of natural resource protection. Again, the division is responsible for preserving and protecting the country's animals, flora, and fauna. Workshops and seminars were sometimes organized to create awareness of the need for the protection of the natural environment.

The orderly development of human settlements has been mandated to the Town and Country Planning department to plan and manage, and also provides planning schemes to guide this orderly development. Moreover, possible conflicts can be detected and resolved between the actual situation on the ground, approved schemes, and ownership claims. While wetlands are protected by buffers provision on the schemes, the department also ensures that no physical development occurs within any wetlands area through the permitting system. In addition, through development control, the Works Department ensures that no physical development occurs in a wetland and its buffer as proposed in the approved scheme for the area.

In collaboration with other institutions, Ghana's Environmental Protection Agency (EPA) manages, protects, and enhances the country's environment. The agency also creates awareness of the mainstream environment in national, regional, district, and community development. The EPA again ensures that the country's desire for effective, long-term maintenance of environmental quality consistent with the implementation of environmental policy and planning is integrated. Furthermore, it is the responsibility of the EPA to ensure the environmentally sound and efficient use of renewable and non-renewable resources in the process of national development. It also guides development to reduce, prevent, and eliminate pollution and actions that lower the quality of life as far as possible.

In addition, FON is a non-profit organization that provides services to communities and institutions through research, capacity building, networking, and advocacy that could catalyze increased action for sustainable natural resource management and healthy environments. FON also educates and creates awareness about natural resources' health and good governance. Moreover, FON provides advocacy for the rights of the voiceless communities on natural resources. The benefits of wetlands in the Sekondi-Takoradi Metropolis cannot be overemphasized. A representative from GWD indicated three major wetlands in the metropolis, which have not been declared as the country's RAMSAR sites. However, numerous benefits recounted from these wetlands offer communities abutting it and the metropolis. Wetlands provide water supply, flood control, and irrigation, protecting the coast and wildlife species habitat. A Ghana Tourist Authority (GTA) representative also stated that little had been done about the wetlands to serve the purpose of these wetlands as recreational centers. A respondent from the EPA stated that wetlands serve as spawning grounds for fish and some marine species. However, the encroachment and disturbance of the wetlands are attributed to the current low catch by fishermen. For example is the Essei Lagoon, which has been choked with refuse, especially closer to the estuary.

Belief systems associated with coastal wetlands

In African tradition, there are a lot of belief systems that are associated with natural resource usage. These sometimes help in the preservation of the natural resource in question. Though 70.7% of the respondents were unaware of any belief system associated with any of the wetlands within the Sekondi-Takoradi Metropolis, names such as "Matei" and "Nana Obrayeba" resonate well with the people of Sekondi and Bakado, respectively (Table 13). Additionally, to protect and preserve the wetlands from encroachment and pollution in the past, respondents recognized that the fear and respect of such belief systems helped. Verschuuren (2016) states that spirituality contributes significantly to wetland services and values but often remains overlooked and undervalued. The declining observance of cultural beliefs and taboos has contributed to the degradation of coastal wetlands in the Central Region of Ghana (Mensah 2003).

Challenges faced by government institutions

In the course of administering their role, the institutions such as Game and Wildlife are confronted with many challenges that hinder the effective delivery of their services, which have been around for a while. They must be addressed to facilitate the preservation and protection of wetlands in the Sekondi-Takoradi Metropolis and, by extension, the country. Almost all the institutions are grappling with the most challenging is the high rate of indiscipline among the community members. Most communities perceive wetlands as 'wasteland'; hence any attempt by a particular institution to discourage the use of these areas is considered as those retarding the growth and development in the metropolis. The Metropolis Town and Country Planning Office observed a confrontation with prospective developers in their duties that people become furious when denied permits to develop in such areas.

Table 13. Belief systems associated with coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana

Response	Frequency	Percent
Don't know	159	70.7
Essei	50	22.2
Matei	13	5.8
Nana Obrayeba	3	1.3
Total	225	100.0

During the interview, The EPA further revealed that residents around wetlands perceive dumping refuse in these wetlands as assisting the government in reclaiming those sites. The drastic decline in fish catch resulting from the loss of the entire mangrove through clearing in a lagoon at Anlo Beach near Shama, cited by the Game and Wildlife Division of the Ministry of Lands, Minerals & Natural Resources, a lack of education as responsible for the loss of the entire mangrove. Therefore, the division organized a sensitization program to educate them on the decline of the catch and the need to maintain the mangrove and other plants in the lagoon. However, many people in the study area do not appreciate why wetlands in the middle of the city are undeveloped.

Another significant challenge was inadequate budgetary support and logistics. For example, a Parks and Gardens Department representative stated that her department was constrained in carrying out its duties due to inadequate funds. Hence, their inability to perform their role of beautifying and developing the wetland buffers in the city. Furthermore, institutions in the Sekondi-Takoradi Metropolis also lacked the basic logistics to monitor and manage these areas. The result was the difficulty in policing the wetlands.

The weak collaboration among the institutions has also been a serious challenge in managing and preserving the wetlands in the Sekondi-Takoradi Metropolis. The GWD, for instance, indicated that their work after detecting any improper conduct by the resident or any individual ends in prompting the authorities in charge to prohibit or prosecute those who infringe on such areas. However, it sometimes falls on deaf ears hence rendering them ineffective. The representative from FON also recounted instances where some residents reported encroachment and improper disposal of waste into the lagoons and wetlands to the authorities responsible for protecting and preserving these areas. These people sometimes end up being taunted as laughing stock in their communities because the authorities fail to take appropriate actions to deter others in the community. Thus, the inaction of a particular institution sometimes compromises the work of other institutions that try to protect and preserve the wetlands.

Another significant challenge is the absence of a bye-law to protect, conserve and determine the use of wetlands. GWD, in this instance, indicated that it has been simply impossible and difficult for people to misuse the designated RAMSAR sites. Again, some institutions are faced with the absence of implementation and enforcement of laws that preserve and protect the wetlands in the Sekondi-Takoradi Metropolis. CRC (HENPOANO) indicated that the Assembly is overwhelmed and lacks the commitment to deal with recalcitrants who defy the laws in developing wetlands due to the absence of a bye-law. Other legal instruments, such as the LI 1630 (Section 2), which deals with developers who build without a permit, in the meantime, would have to be enforced to stem this cancer.

Suggested solutions to protect and preserve coastal wetlands

Several institutions like EPA, CRC, and Game and Wildlife Commission were implementing measures to preserve the coastal wetlands in the Sekondi-Takoradi Metropolis. These measures could therefore be complemented by the measures mentioned earlier. In all the study communities, about 75.1% of the respondents stated that the wetlands in the metropolis must be dredged to ensure easy flow to avoid flooding and breeding of mosquitoes which have been some of the problems facing residents living closer to the wetlands. About 15.6% of the respondents indicated that the wetlands should be preserved by planting trees along their banks. As a result of encroachment of the wetlands in the metropolis, 6% of the respondents also mentioned that the channel of some of the wetlands should be diverted (Table 14).

A rise in population in the metropolis and the country at large has increased land demand for development. However, the pressure to obtain land for development should not compromise the protection and preservation of these wetlands. The FON representative indicated the need to educate and sensitize people to understand the significant role wetlands play in the ecological balance of the environment. From the study, it was evident people had low or no idea about the significance of wetlands in their communities. They rather saw it as a wasteland and a nuisance to their communities. Hence, educating and sensitizing them would help to appreciate these wetlands and preserve them for future generations.

A respondent during the interview revealed that the communities should be involved in preserving the wetlands. For instance, the people of Essaman and Bakado had a strong belief that some of these lagoons were gods (usually called "Matei" and "Nana Obrayeba"); hence they revered and protected these lagoons through various traditional practices aimed at maintaining and preserving them. Again, a respondent from the Game & Wildlife Division also suggested during discussions that all the wetlands in the Sekondi-Takoradi Metropolis must be put under one formal management regime like RAMSAR to make its management easier and more difficult to infringe. Further, wetlands could be protected by putting them under Community Resource Management Areas (CREMAS) to involve the community. In this case, the people in the community itself would serve as watchdogs and prompt the authorities.

Table 14. Suggested solutions to conserving coastal wetlands in the Sekondi-Takoradi Metropolis, Ghana

Remedies	Frequency	Percent
Dredged	169	75.1
Preserved	35	15.6
Diverted	14	6.2
Diverted	7	3.1
Total	225	100.0

In collaboration with the NGOs who work directly on wetlands, the Assembly should draft bye-laws solely to preserve the wetlands. The absence of the bye-laws makes it difficult for the authorities to prosecute people who misuse wetlands which would serve as a deterrent to others. A respondent from EPA also revealed that the Assembly should ensure compliance with the Environmental Impact Assessment to assess the impact of every activity that residents embark on in the Sekondi-Takoradi Metropolis before permits are issued.

In conclusion, the structure of the Sekondi-Takoradi Metropolis throughout history encouraged urbanization with its accompanying devastating effects, yet current measures and research to avert the challenges have failed to look at the possible impact urban activities on coastal wetlands; Urbanization generally would accelerate the waste generation and the rate of construction of new houses, offices, roads, and related real estate development. Most often, as this study has revealed, the residents perceived wetlands as wastelands, built their homes, and dumped refuse. Wetlands, especially coastal wetlands, are widely regarded as an important natural resource that requires a complex combination of policies, programs, and activities at the national and local levels to harness and protect their potential effectively.

Even though wetlands have also been seen negatively as breeding mosquitoes and reptiles; appropriate measures should be used to protect and manage the wetlands for the use of current and future generations; To preserve coastal wetlands, strategies like the formation of Wetland Conservation Clubs and establishment of buffer zone laws should be part of the wetland management agenda of the Sekondi-Takoradi Metropolis.

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