

# There is a price to pay for every wetland reclamation and conversion: Experiences from Port Harcourt Municipality

## Abstract

Port Harcourt municipality has a variety of wetlands that contribute valuable ecosystem services to people, the natural species habitat, and tourist attraction. Wetlands are nourishing and important breeding zones for wildlife and provide protection and safe spaces for sea creatures. Typical of any natural habitat, wetlands are significant in supporting species diversity in addition to providing some climate restraining component. This study aimed at highlighting the price residents and government alike pay for the reclamation and conversion of wetlands. Achieving this was to ascertain the physical environmental challenges experienced by wetland dwellers within Port Harcourt municipality and proffer appropriate mitigation measures associated with the challenges of urbanization and wetland conversion. Three (3) settlements were purposively chosen out of the 41 identified wetland settlements in Port Harcourt municipality. A total of 293 questionnaires were distributed and SPSS was used to analyze the data. Also, satellite imageries of the study areas were obtained from Google earth, delineated. ERDAS imagine 2014 version was used to show spatial changes between the years 1986 to 2000, and 2000 to 2016. The study shows that from 1986 to 2000, Port Harcourt municipality lost a total of 1,255,500m<sup>2</sup>. This translates to a 5% loss with an average rate of 89,678.57m<sup>2</sup> per annum. Between 2000 and 2016, the rate of loss was 108,956.25m<sup>2</sup> per annum, and approximately 7.69% of wetlands totaling 1,743,300m<sup>2</sup> were lost to urbanization. The result indicates that some of the prices associated with physical environmental challenges include flooding, poor sanitary condition; poor refuse disposal system, and unplanned settlements leading to a decline in the urban quality of life. Also, some mitigation measures include the provision of affordable land, rehabilitation of failed drainage system. The study recommends periodic mapping of all wetlands and an effective development control framework to monitor incursions into existing wetlands.

**Keywords:** biodiversity, conversion, Port Harcourt municipality, price, reclamation, wetlands

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## Introduction

Wetlands are best designated as the intermediate lands located between marine eco-systems and terrene often characterized by a shallow water table. The global significance of wetlands is gaining momentum and progressively receiving appropriate attention because they in several ways add to a loveable and healthy environment.<sup>1,2</sup> During the dry season, wetlands tend to retain high water as they moderately stabilize the water table. Besides, in any flood scenario, wetlands play a significant role in mitigating floods as they entrap suspended solids and some of the accompanying nutrients. As such, rivulets emptying into lakes through wetlands often carry along with it less suspended solid nutrients to the lakes than flowing directly into the lakes as fish species and planktons fed on those nutrients.<sup>3,4</sup> Wetlands are vital resources to the natural ecosystem as they serve as feeding regions and breeding grounds for wildlife and protection and creation of shelters for sea creatures.

As obtainable in every natural habitat, wetlands are very significant in the preservation of the diversity of species, serve as tourist and recreation attraction that contributes to the economy of wherever they are found. Consequently, the act of eliminating such viable wetland systems due to industrial development, urbanization, and other

related factors mean a gradual extinction of sea animals and eventual deterioration of water quality.<sup>5,6</sup> Some of these wetland-subordinate animals exist in several local inhabitants and are supported by the occasional change. Preservation of minutest wetland densities in any human-controlled environment is vital in preserving both flora and fauna as well as other significant environmental benefits derived from wetlands.<sup>6</sup>

Biodiversity preservation and natural landscape depletion have shaped a rich biota connected to wetlands. Wetlands typically occur in distinct portions of an upland environment, such that some populations of wetland diversities are separated and small and sometimes they are prone to extinction.<sup>7,8</sup> Consequently, the reclamation and conversion of wetlands engendered by natural causes and anthropogenic activities require regular spatial assessment and strict regulations as there are prices to pay for such actions.

Typically, wetlands are described as “kidney of the landscape.”<sup>9,10</sup> Marine biodiversity is often reliant on factors such as the hydrologic regime and geological conditions. Diverse efforts are being made to enable the conservation of the biodiversity that exists in swamps, marshes, streams, wetlands, and waterways, and the reason for this intricate biodiversity is to reduce its loss through safeguard and practicable management practices.<sup>11,10</sup>

Therefore, this study is aimed at ascertaining the physical environmental challenges experienced by wetland dwellers within Port Harcourt municipality and proffer planning and other measures to mitigate the associated problems of urbanization and wetland conversion within Port Harcourt municipality.

### Port Harcourt municipality

Port Harcourt is a creation of the British colonial masters as the capital city of Rivers State in 1912 due to its proximity to the coast to ease the exportation of locally produced agricultural products and transact trade in the hinterland.<sup>12</sup> It was named after Lewis, Viscount Harcourt, and had 30,000 acres as its initial landmass before crude oil was discovered in Oloibiri in 1956 and the city began to experience rapid expansion beyond its original boundaries. As of 1997, Port Harcourt was approximately 470 km on latitudes 6°59' to 7°6' N of the equator and longitude 4°40' E to 4°55' E of the Greenwich meridian. It is in the Niger Delta and lies along the Bonny River an eastern distributary of River Niger which is 66 km upstream of the Gulf of Guinea.<sup>13</sup> Port Harcourt is within the sub-equatorial climate as 70% of the annual rainfall occurs between April and August, while 22% is spread through September to November.<sup>14</sup> Port Harcourt as a region has a unique surface characteristic because it falls within the coastal belt surrounded by low-lying coastal plains enmeshed in physically sedimentary formation predominant in the Niger Delta (Figure 1).<sup>15</sup>



**Figure 1** Map of rivers state showing Port Harcourt municipality. Source: Deeyah and Akujuru, (2016)

**Table 1** Population trend of Port Harcourt from 1921 to 2015

| Year       | 1921  | 1953   | 1963    | 1973    | 1991    | 2006     | 2015      |
|------------|-------|--------|---------|---------|---------|----------|-----------|
| Population | 7,000 | 79,634 | 179,563 | 231,600 | 703,420 | 1,382,59 | 2,343,310 |

Source: Source Rivers State Government, (1975) and Population.city (2015)

A fundamental technique deployed in the conservation of biodiversity is the appraisal of the diversity of natural resources accessible and identify those that are important and very critical.<sup>25,11</sup> The knowledge of the uniqueness of biodiversity contributes significantly to the management of the available quality and habitat species population in the wetland zones.<sup>26</sup>

Wetlands when effectively managed provide services and commodities to humanity. Local and regional wetlands are components

The population of Port Harcourt grew from 7,000 inhabitants as of 1921 to over 800,000 as of 2006 (Table 1). Port Harcourt City Local Government Area serves the heart of the Port Harcourt municipality with about 1,382,592 persons with a combined land and water area of 186 km<sup>2</sup> (170 km<sup>2</sup> and 16 km<sup>2</sup>) respectively.<sup>16</sup> The municipality is sited along mangrove swamps, marshlands, and creeks that make it difficult for effective urban development.<sup>17</sup>

### Wetlands in Port Harcourt

Previous studies have identified and delineated forty-one wetland settlements within the Port Harcourt municipality namely: as waterfront settlements of Port Harcourt municipality; Abuja, Afikpo/Abba, Andoni, Awkuzu, Bishop Johnson, Bundu, Baptist, Captain Amangala, Cemetery, Egede/Akokwa, Emenike, Egbema, Enugu/Aggrey, Eastern By-Pass, Elechi Beach, Ibadan/Yam zone, Igbukulu, Marine Base, Ndoki, NEPA, Nanka, Nembe/Bonny, Orupolo, Ogu/Okujagu, Okrika, Ojike/Urualla, Prison, Rex Lawson/ Etche, Timber/Okwelle, Tourist Beach, Udi, Witt and Bush (Reclamation Drive).<sup>18,19</sup> These wetlands have been existing since the inception of the Port Harcourt 1975 Masterplan. With time, some of these have been reclaimed and converted to other land uses due to community annexation and government negligence satisfies the growing demand for land for economic prosperity and urbanization. Urban growth in Port Harcourt is moving towards the southerly direction and occurs through the occupation, reclamation, and conversion of unoccupied wetlands for other land use.<sup>20</sup>

### Threats to wetlands

According to<sup>21</sup> there is a difference between wetland degradation and wetland loss because wetland loss is the consequence of converting wetland areas to non-wetland areas caused by human activities. These activities include the building of factories, agriculture, dredging and boating, industrial activities like mining, oil and gas exploration, lumbering, construction of marinas, and urbanization.<sup>22,23</sup> Urbanization has been a major threat to wetlands because as cities develop, rural areas in the urban fringes experience urban influences with an increased demand for land.

Wetlands that are habitats to biodiversity are continually being lost to urbanization and species in wetlands have become endangered with foreign species introduced into the environment.<sup>24</sup> Wetlands are not only being threatened, but they also become a threat to urban security in Port Harcourt municipality as the reclamation and conversion of these wetlands are undertaken and controlled by community groups and rival urban gangs, community groups in addition to forced economic migrants who see those wetlands as an opportunity for territorial expansion. Thus, residents and visitors cautious in most of those reclaimed and converted wetland settlements.

of larger natural landscapes, their functions, and values to humans who depend on both their area covered and location. Each wetland is unique ecologically and serves several useful tasks including the recycling of nutrients, urban climate change moderation, water filtering, the sustainability of streamflow, groundwater replenishment, floods attenuation, and provides wildlife habitat and potable water.<sup>2,6</sup>

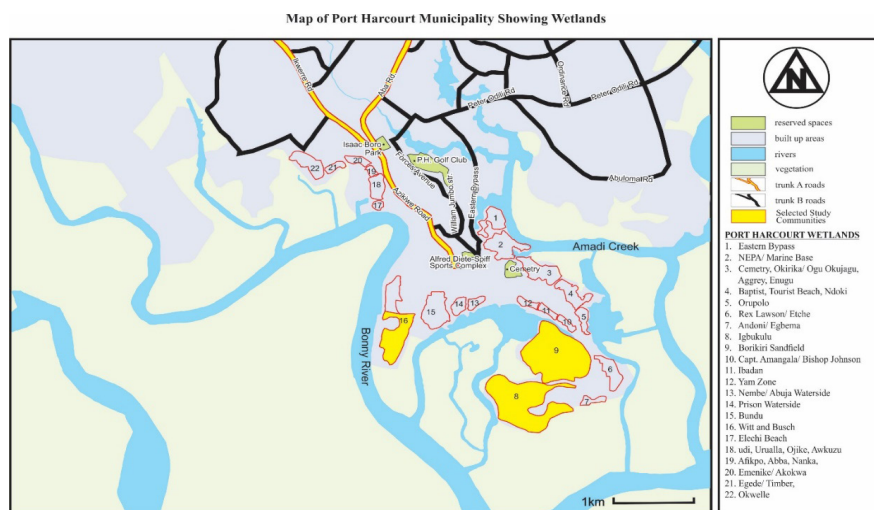
In the last few decades, the interaction between wetlands and man has become alarming due to the spike in population associated with

strengthened commercial, industrial and residential developments which lead to pollution of wetlands by agricultural and industrial practices, fertilizers, insecticides, feedlot wastes, and domestic sewage.

## Methods and materials

The study is a passive observational study that adopted mixed method research with no experimental manipulation as participants were in-situ. The multistage sampling technique was adopted with the listing of all forty-one (41) identified existing wetlands including

those reclaimed and converted to other land uses. The sample location was drawn purposively as Borikiri Sandfill, Bundu, and Reclamation Drive were selected for ease of access amid growing security concerns in those neighborhoods to conduct key informant interviews and photograph sessions with a total of 293 questionnaires. Secondary and primary data were collected. Secondary data was collected through existing maps from the 1975 Port Harcourt masterplan and satellite imageries of the study area. While primary data was collected through open-ended questionnaires, personal observation, and key informant interviews. Data were analyzed using ERDAS Imagine 14, Lansat interpretations, and SPSS (Figure 2) (Table 2).



Source: Adapted from Theis et al (2009)

**Figure 2** Map of Port Harcourt showing wetlands and the selected study sites. Source: Authors' adaptation (Theis et al., 2009)

**Table 2** Questionnaire administration schedule

| Study Site        | No. of questionnaires administered | %     |
|-------------------|------------------------------------|-------|
| Reclamation Drive | 52                                 | 17.75 |
| Borikiri Sandfill | 118                                | 40.27 |
| Borikiri New Road | 123                                | 41.98 |
| Total             | 293                                | 100   |

Source: Fieldtrip (2020)

## Results and discussions

### Physical environmental challenges of wetland dwellers in Port Harcourt municipality

The outcome of the study indicates that there are some physical environmental challenges experienced by the wetland dwellers within Port Harcourt municipality due to the unplanned nature and the palpable lack of basic amenities in these settlements. Some of these physical challenges include flooding, poor sanitary condition, poor waste management system. There has been a continuous depletion of urban wetlands in Port Harcourt municipality through reclamation and conversion of these wetlands for other land uses.

For instance, between 1986 to 2016 there has been a phenomenal increase in land-use changes as available satellite imagery indicates that the extent of spatial changes in the study area were both positive and negative changes. Table 3 indicates that the built environment increased from 7,407,000m<sup>2</sup> to 10,577,700m<sup>2</sup> which meant an overall

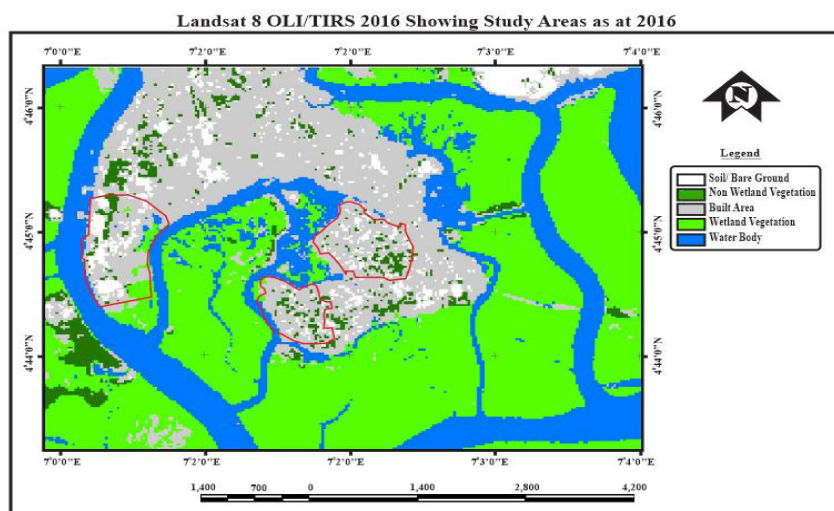
increase of 3,170,700m<sup>2</sup> representing about 29.98% of the wetlands. Nevertheless, these wetlands were reduced further from 25,649,100m<sup>2</sup> to 22,650,300m<sup>2</sup> representing a depletion rate of 13.24% representing 2,998,800m<sup>2</sup>. From the map data analysis, it is evident that with 30-years, these wetlands were being depleted at an average annual rate of 187,425m<sup>2</sup>, with a corresponding increase in the built environment at an annual average of 198,168m<sup>2</sup> (Figure 3).

Changes in wetland patterns over the years have some underlying natural elements like climate change, sediment condition differences, and human activities such as city growth, deforestation, and agricultural practices.<sup>27</sup> Environmental degradation and man-made activities have a significant impact on natural wetlands by way of altering natural landscapes with several human activities that might have adverse effects on ecological systems. Wetlands can also moderate the water quality and quantity in a watershed, as well as their capability to reduce pollutants as most wetlands, have experienced functional degeneration.<sup>26</sup>

**Table 3** Changes in wetlands in the study area (1986-2016)

| Attributes             | 1986 Area (m <sup>2</sup> ) | 2016 Area (m <sup>2</sup> ) | Difference (1986-2016) m <sup>2</sup> | %      | The annual rate of change (m <sup>2</sup> /year) |
|------------------------|-----------------------------|-----------------------------|---------------------------------------|--------|--|
| Non-Wetland Vegetation | 1,854,900                   | 1,988,100                   | 133,600                               | 6.72   | 8,350  |
| Wetland Vegetation     | 25,649,100                  | 22,650,300                  | -2,998,800                            | -13.24 | -187,425   |
| Soil/Bare Ground       | 2,380,500                   | 1,856,700                   | -523,800                              | -28.21 | -32737.5   |
| Water Body             | 11,265,300                  | 11,484,000                  | 218,700                               | 1.9    | 13668.75   |
| Built Area             | 7,407,000                   | 10,577,700                  | 3,170,700                             | 29.98  | 198,168.75                                       |
| Total                  | 48,556,800                  | 48,556,800                  |                                       |        |  |

Source: Authors' Landsat Image analysis, (2020)



**Figure 3** Spatial changes of wetlands within the study areas for 2016.

Source: Authors' interpretation of Landsat Image, (2020)

There is always a price to pay for wetland reclamation and conversion which often results in some form of physical environmental challenges. Flooding was one of the physical environmental challenges noticed in the study area as most of the residents. Responses from Table 4 indicate that 24% from Reclamation Drive, 19% from Borikiri Sandfill, and 22% from the Borikiri New Road confirmed that they experience flooding while another 42% from Reclamation Drive, 23% from Borikiri Sandfill, and 15% from Borikiri New Road affirmed that they experience periodic flooding in their neighborhoods.

Narratives from respondents indicate that the major cause of flooding within the study area is heavy and continuous precipitation which was affirmed by 43% while 39% indicated that the flood was

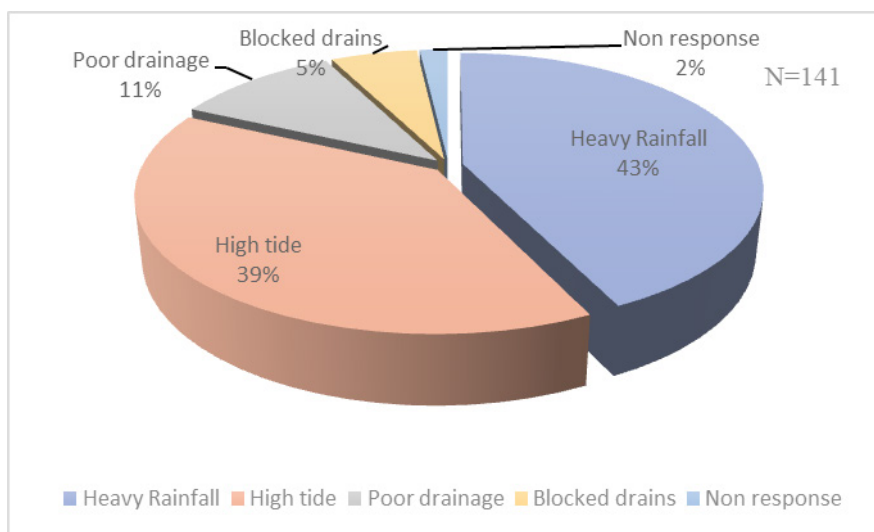
caused by tidal actions at the fringes of the study area (Figure 4).

Another price paid by residents of these reclaimed and converted wetlands in Port Harcourt municipality is poor sanitary condition and refuse disposal system. Residents struggle to dispose of household wastes as there is no functional arrangement put in place by the local and state governments to manage household wastes generated in these settlements. Most residents organize the process of evacuating their household wastes by engaging private cart pushers or resort to open dumping into available and unoccupied open spaces, rivers banks, and drainages whenever it rains in the neighborhood. This action, in turn, clogs the drains leading to flooding (Figure 5).

**Table 4** Knowledge of flooding in the settlement

| Study area        | Yes (%) | No (%) | Sometimes (%) | N/A (%) | Total |
|-------------------|---------|--------|---------------|---------|-------|
| Reclamation Drive | 24      | 28     | 42            | 6       | 100   |
| Borikiri Sandfill | 19      | 55     | 23            | 3       | 100   |
| Borikiri New Road | 22      | 54     | 15            | 9       | 100   |

Source: Fieldtrip (2020)



**Figure 4** Causes of flooding in the study area.  
Source: Fieldtrip (2020)



**Figure 5** Refuse dump used for reclamation in Bundu.  
Source: Fieldtrip, (2020)

Table 5 shows the method of refuse disposal across the study area. The cumulative modal method of refuse disposal is the private method of the refuse collection at 30.7%. Cumulatively residents dump refuse into the drains whenever it rains and into rivers for reclamation purposes, which represent 23.2% and 21.8% respectively. About 10.9% of the respondents use the neighborhood refuse dump (used for reclamation), and another 8.5% of the respondents use the government disposal system. Another 4.9% of the respondents did not answer the question.

Most of these settlements in the study area are a creation annexation by rival urban gangs and community groups as a mark of territorial expansion. These unplanned urban settlements often lead to planned urban chaos. They are planned urban chaos because in most scenarios the government turns a blind eye at the onset of these incursions into these wetlands and with time, they become marked territories as the government either deliberately or for lack of manpower ignores occupants of these wetlands. They, in turn, build substandard houses

after reclaiming these wetlands as shown in Figure 6. Implicitly, these unplanned and substandard houses have an overall negative impact on the quality of urban life and mount pressure on existing health facilities and social services in adjoining neighborhoods.

Field observation and photographic evidence indicate that most of the streets in these reclaimed and converted settlements have unpaved roads with no drainages and inadequate setbacks as this will eventually lead to urban chaos (Figure 7) (Table 6).

The government and residents of these reclaimed and converted wetlands have over the years proposed some mitigation measures that would enhance the quality of urban life and improve the living conditions in those settlements. Some of the mitigation measures put in place includes the rehabilitation of existing drains and where there is a total failure, the construction of new drains. As these settlements require a functional drainage system to ease the flow of runoffs to reduce the frequency and magnitude of flooding.

**Table 5** Refuse disposal system in the study area

| Method of refuse disposal    | Borikiri new road (%) | Reclamation drive (%) | Borikiri sandfill (%) | Combined % |
|------------------------------|-----------------------|-----------------------|-----------------------|------------|
| Government refuse collection | 0                     | 0                     | 21.2                  | 8.5        |
| Private refuse collection    | 2.4                   | 15.4                  | 66.9                  | 30.7       |
| Neighbourhood refuse dump    | 24.4                  | 0                     | 1.7                   | 10.9       |
| In river/drain               | 40.7                  | 19.2                  | 6.8                   | 21.8       |
| In rivers for reclamation    | 21.1                  | 65.4                  | 0                     | 23.2       |
| No response                  | 11.4                  | 0                     | 3.4                   | 4.9        |
| Total                        | 100                   | 100                   | 100                   | 100        |

Source: Fieldtrip (2020)



**Figure 6** Buildings erected on reclaimed land in reclamation drive.

Source: Fieldtrip, (2020)

**Table 6** Mitigation measures to alleviate environmental challenges due to wetland conversion

| Mitigation measures                          | Borikiri new road (%) | Reclamation drive (%) | Borikiri sandfill (%) | Combined (%) |
|--|-----------------------|-----------------------|-----------------------|--------------|
| Provision of drainage                        | 35.8                  | 50                    | 33.9                  | 37.5         |
| Legislation & enforcement                    | 32.5                  | 9.6                   | 12.7                  | 20.5         |
| Provision of affordable land for development | 16.3                  | 19.2                  | 38.1                  | 25.6         |
| Sand fill to raise the level                 | 8.1                   | 15.4                  | 8.5                   | 9.6          |
| Construct roads and driveways                | 7.3                   | 5.8                   | 6.8                   | 6.8          |
| Total  | 100                   | 100                   | 100                   | 100          |

Source: Fieldtrip (2020)



**Figure 7** An unpaved street in Borikiri Sandfill without proper setbacks and drainages.

Source: Fieldtrip (2020)

Currently, there are no functional physical planning and development control law(s) in the state regulating the reclamation, conversion, and use of wetlands. However, most of the respondents suggested the enactment of proper statutes and appropriate enforcement framework as such laws would reduce the impact of uncoordinated developments within the study area. Interviews with key informants also revealed that policy formulation, empowerment of extant regulatory bodies, and proper designation of wetlands as areas of natural assets, would also prevent arbitrary incursions into wetland reclamation and development.

The provision of affordable land within the municipality to construct decent and affordable units as part of the suggested mitigation measures made by some of the respondents. This land when provided will stem the trend of incursions into wetlands.

## Conclusion

The loss of wetland could pose an enormous challenge for many wetland species and the local communities who rely on them as a natural resource to eke out a living. Such important tasks indicate the need for improved management by both the environmental policymakers and the communities. Port Harcourt which started as a city of 7,000 people in 1921 has developed and metamorphosed into a burgeoning millionaire city with a steadily rising population of about 2.3million residents. The municipality has transited from an administrative centre into a commercial hub.<sup>28</sup> It has also become a strategic player in the oil and gas industry of the Nigerian economy as it has the capacity to join the global league of megacities. This study has attempted to highlight the physical environmental challenges of wetland dwellers in Port Harcourt municipality and proffer planning, and other mitigation measures associated with the challenges of urbanization and wetland conversion within Port Harcourt municipality.

This study has further indicated that flooding, unplanned settlement, poor drainage, and refuse disposal systems are some of the physical environmental challenges facing wetland dwellers in Port Harcourt municipality. Also, some mitigation measures suggested by residents include the provision of affordable land and the enactment of laws that will deter further incursions into wetlands reclamation and conversion.

## Recommendations

- i. There should be meaningful stakeholder engagement that should be carried out to prevent indiscriminate acquisition, reclamation, and subsequent conversion of wetlands.
- ii. The government should conduct periodic geospatial mapping of wetlands to enable the listing these wetlands and identify the extent of available wetlands; and
- iii. There should be a strengthened development control framework to guide and encourage professionally trained and equipped manpower to manage wetlands and ensure acceptable best practices.

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## Conflicts of interest

The authors declare there are no conflicts of interest.

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