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Environmental Problems Induced by the Urban Dynamics of the City of a Daloa, Cote D'Ivoire

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Abstract

Daloa, an agglomeration of about 421,879 inhabitants, is the third largest city after Abidjan and Bouaké. Its current uncontrollable dynamics due to the massive influx of migrants is causing a number of environmental problems. The objective of this study is to highlight the environmental problems caused by the urban dynamics of the city of Daloa. The methodology used to achieve this objective consists of

bibliographic research, interviews and field surveys. The results of the study are as follows: poor wastewater management, natural hazards due to the very uneven terrain, overgrowth of most of the city's neighbourhoods, nuisance throughout the city, animal roaming and degradation of the road network.

Keywords: Environmental, Daloa, Dynamics, Problems, Urban

1. Introduction

The environment is the totality of physical, chemical and biological elements and socio-economic, moral and intellectual factors that may have a direct or indirect, immediate or long-term effect on the development of the environment, living beings and human activities (Environment Code, 1996) [3]. In the 21st century, the state of the environment is becoming increasingly worrying worldwide as people are confronted with numerous environmental problems. Indeed, the rapid growth of the urban population and the disproportionate expansion of urban space due to uncontrolled and unchecked urbanisation in Africa pose serious environmental problems (Nyassogbo, 2005a) [10].

Most cities in sub-Saharan Africa have high population growth rates, immigration to the main centres and increasing urbanisation rates, particularly in the metropolises, leading to environmental problems.

Ivorian cities, like other sub-Saharan cities, are experiencing rapid urban dynamics. This is the case of the city of Daloa. Due to its position as a crossroads town and the fact that it is an agricultural area, Daloa has always been a place of attraction for migrants (Alla, 1991) [1]. As a result, the population of Daloa increased from 121,842 in 1988 to 421,879 in 2021 (INS, 2021) [5]. At the same time, its surface area has increased from 1717 hectares in 1988 to 5305 hectares in 2021. The arrangement of jobs, shops, facilities, residences or more generally the spatial arrangement of the various urban functions in relation to each other in the city, leads to environmental problems that leave no one indifferent. The objective of this study is to highlight the environmental problems induced by the urban dynamics of the city of Daloa. The methodological framework used to achieve this objective is as follows.

2. Tools and Method

2.1 Synthetic presentation of the study area

Daloa is a town in the centre-west of Côte d'Ivoire located 383 km from Abidjan between 6°30' / 8° North latitude and 5° / 8° West longitude. It is bordered to the north by the department of Vavoua, to the south by the department of Issia, to the east by the departments of Zuénoula and Bouaflé, and to the west by the department of Duékoué. It had 421,879 inhabitants in 2021 with an area of 5.305 km² 35 districts (INS, 2021) [5]. Belonging to the large Ivorian logging area, Daloa is the second largest cocoa producing area and the largest coffee producing area according to the Ministry of Agriculture in 2021. Moreover, due to its status as a regional economic hub, Daloa has road infrastructure that facilitates human mobility and also benefits from a notable presence of regional public, parapublic and private services (Koukougnon, 2012) [8].

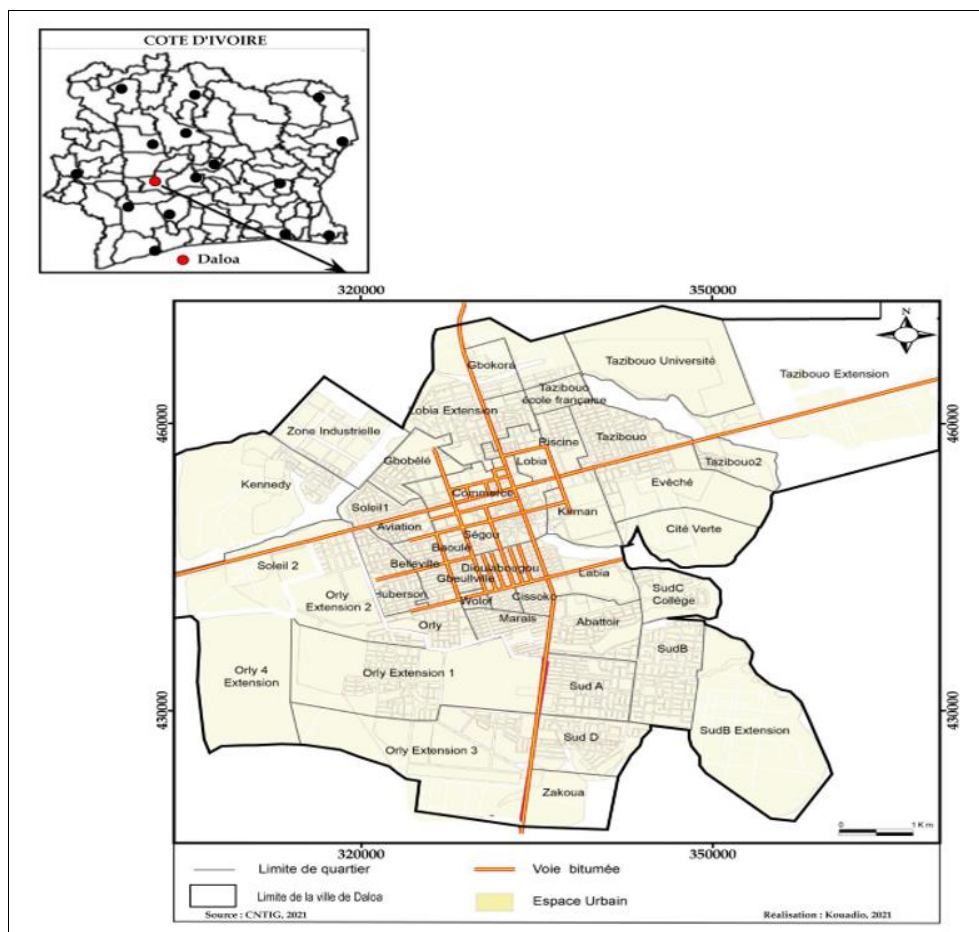


Fig 1: Location of the town of Daloa

2.2 Method of data collection

The methodological approach used to achieve the objective was based on documentary research, interviews and a field survey. The first phase of data collection consisted of using documentation from libraries, the Institute of Research for Development (IRD) and the Centre for Research and Action for Peace (CERAP). Statistical data on population and area were provided by the Institut National de la Statistique (INS). The second phase focused on interviews with the political and administrative authorities of the city. The third phase was devoted to the field survey which took place from July to August 2021. A questionnaire was administered to the head of each neighbourhood and to three heads of households per neighbourhood with at least 15 years of life in the neighbourhood. They are likely to be more familiar with the environmental realities of their neighbourhood. Thus, given the number of neighbourhoods mentioned above, 140 people were interviewed for this study. The information gathered during the desk study and the field survey was processed in the form of a cartographic analysis and a statistical analysis.

3. Results and Discussion

3.1 Precarious management of wastewater and household waste

Sanitation is one of the fundamental elements in the preservation or improvement of the health of the individual and the whole community. In the neighbourhoods of the city of Daloa, the disposal of wastewater is left to individual initiatives. As far as wastewater is concerned, there is a lack of a collective sanitation system and sewage network in the

entire neighbourhood. The absence of a collective sanitation system and sewerage network is an obstacle to the proper management of wastewater. The main method of wastewater evacuation, as evidenced by the work of (kouacou, 2014) [7], is still the 90% of the latrines that are mostly badly designed. Also, during the rains, runoff water does erosive work along the unsealed roads. This water creates gullies and crevices which are then transformed into wild dumps. The absence of a drainage network is expressed by the stagnation of dirty water throughout the district. This water is concentrated in makeshift pipes set up by the population to divert wastewater from their homes without worrying about their neighbours. Sometimes, the wastewater outfalls communicate with the stagnant water. The occupation of the streets by stagnant water and household waste is visible throughout the district studied.

Sewage and household waste are dumped directly onto the roads, into drains and gullies. Moreover, in all the sub-districts, sanitation is essentially autonomous. Modern systems consisting of flush toilets with septic tanks are also present. These pits are poorly constructed, almost never maintained, without a waterproofing system and subject to foul odours. As for the latrines, they are emptied directly onto the public highway or in the vicinity of the houses and the pit remains open for several days. People are forced to dig latrines and septic tanks that do not meet the required standards. It is a pit of about 1 to 4 metres in diameter and 3 to 4 metres deep, connected directly to the shower. It is often covered by concrete slabs, wooden boards, pieces of sheet metal or is open to the air. However, due to the lack of appropriate fittings, because they are made by craftsmen or

masons who are not trained in the construction of cesspools or latrines, these shallow structures are quickly filled, allowing the wastewater to overflow onto the public roads. The pits are emptied in the rain or at night. The methods used for domestic sewage disposal in the neighbourhoods are therefore inadequate. Such situations provide, to some extent, favourable conditions for the proliferation and accumulation of mosquitoes. Septic tanks or cesspools are used by 60% of households in residential areas such as Commerce, Tazibouo, Lobia, Evéché, Piscine, Tazibouo École Française, Kirmann, etc. A large proportion of households (25%) discharge wastewater directly into the streets (photo 1), in yards, unfinished houses or vacant lots, and 15% of households discharge into gullies or shallows or into open gutters. The 2003 Municipal Development Programme report confirms that most of this waste is dumped in swamps, gutters or on vacant lots. The removal of sludge and other faecal matter is generally carried out without any control of either the location or the handling conditions.



Source: Kouadio, 2021

Photo 1: Sewage making the street impassable in the South A district

Furthermore, the gutters that should be used for wastewater disposal are rarely cleaned and pose a real sanitation problem. During the rainy season, the situation is exacerbated by the existence of several unhealthy marshy areas, infected with pathogens and insects that carry several kinds of diseases. The lack of adequate surface water drainage is a serious problem for many low-income communities and can have serious consequences: frequent flooding, soil erosion, and increased transmission of a number of diseases (Who, 1992) ^[15].

3.2 Highly uneven terrain conducive to natural hazards

The relief of the town of Daloa is flat and consists of granite plateaus at 200 to 300 m in altitude. It is dotted in some places with hills, shallow, wide, flat valleys and slopes varying from 4 to 8%. The town is intersected by several north-east and south-west oriented talwegs. They are shallow, ranging from 10 to 30 m, and their slopes are gradual and very steep. Through their networked organisation, they guide the city's finger-like extensions, fragmenting the urban space and isolating certain districts from others (Alla, 1991) ^[1]. The marshy areas remain flood zones during the rainy seasons, due to the silting up of certain depressions. These depressions remain non-edificated areas, as they constitute real natural collectors of rainwater and wastewater. The work of Brou *et al* (2017) ^[2]

confirms this, emphasising that the manifestation of flooding in the commune of Cocody is a function of the topographical nature of the site. The surroundings are regularly threatened by flooding, especially in the Marais district. This situation is a source of poor quality of life in the neighbourhoods threatened by the flooding phenomenon. However, the talwegs or marshy areas that dot the city do not constitute an obstacle to the expansion of the city, since they do not undergo large-scale development to settle. The general morphology of the urban site of Daloa is characterised by alternating lowlands and interfluvies. However, this alternation of the site could have a major influence, or even be one of the causes of natural risks such as erosion (photo 2) and flooding, which are vectors of environmental degradation.



Source: Kouadio, 2021

Photo 2: An eroded street in the Marais district

3.3 The overgrowth of most parts of the city

The overgrowth of vacant lots by brush is mentioned as an environmental problem because it is conducive to pests. Undergrowth invades undeveloped land (photo 3), uninhabited buildings, vacant lots, some roads and unfinished housing.



Source: Kouadio, 2021

Photo 3: Scrub in the Marais district

In contrast to the evolving neighbourhoods, scrub is the prerogative of the residential and precarious neighbourhoods, which are largely peripheral areas. However, scrub, like household waste and wastewater, is a breeding ground for mosquitoes and a vector of disease. They are used by some populations as dumping grounds for household waste. The dumped waste attracts flies, rats, cockroaches and stray dogs, and as it rots, it emits odours.

Some types of waste, such as empty cans, can collect rainwater and become breeding grounds for mosquitoes.

3.4 Nuisances throughout the city

Nuisances in working-class neighbourhoods include noise, smoke, air pollution, mosquitoes and other biting insects, roaming pets and bad odours.

3.4.1 Noise

Noise is a cause of nuisance that is rarely perceived as such by those who suffer its effects. Noise is generated by all human activities, but its capacity to cause nuisance is exacerbated in Daloa by the close interweaving of popular housing and crafts, by the unregulated hours of activities (maquis, nightclubs, etc.), the absence of a social brigade and the laissez-faire attitude of the municipality. The sources of high intensity noise in the city are the various sawmills, markets, vehicles, ironworks and car mechanics. The study conducted by Dakouri, (2013) ^[4] comes to the same conclusion. His study indicates that the noise generated by vehicles, craft activities, discotheques, bars, bistros, evangelical churches, the animation of traders to attract customers and especially the "maquis" of all kinds that invade pavements, public spaces and undeveloped areas, represent sources of intensive noise pollution and infringements of the regulations. If it is true that noise is everywhere in the city, it is the neighbourhoods such as Gbeulville and Huberson that suffer enormously because of the Ramé Plus and 3G Plus maquis. However, within the range of tolerable intensity, excessive noise, even during sleep, can have adverse physiological effects.

3.4.2 Air pollution as a source of environmental degradation

Smoke is the most common air pollutant. It is the result of incomplete combustion due to insufficient air supply to the fuel. However, instead of conveying household waste to the collection point, some households in precarious neighbourhoods, progressive neighbourhoods and sometimes even the town hall prefer to burn it. The smoke from this action pollutes the air and also causes respiratory diseases. In addition to the burning of rubbish, the smoke also comes from the preparation of traditional soap (black soap and Kabakourou), palm oil, dyeing and smoking of fish and meat. In addition, there is black smoke from poorly maintained vehicles. Lanoix & Roy (1976) ^[9] state that air pollution is mainly caused by human activities and the development of technology, and that to some extent it can affect the health, comfort and economy of the community.

Indoor air pollution from the use of solid fuels and outdoor air pollution in cities are estimated to be responsible for 3.1 million premature deaths worldwide each year and 3.2% of the global burden of disease. More than half of the burden of disease from air pollution is borne by people in developing countries (Who, 2010) ^[14]. Air pollutants have been shown to have adverse health effects, including respiratory infections, cardiovascular disease and lung cancer. There is now evidence that the health effects of air pollution are not limited to the respiratory system, but extend beyond it to include cardio-respiratory pathologies, diabetes, cancers, strokes, pathological outcomes for pregnancy and child development, as well as psychiatric and central nervous system effects (Thurston, Kipen *et al.*, 2017) ^[13]. Reducing air pollution levels will reduce the global burden of disease

from these diseases (Jorge Boczkowski, Sophie Lanone, 2019) ^[6].

3.4.3 Roaming animals

In the neighbourhoods, livestock is mainly poultry, sheep and cattle. It is common to see chickens, sheep and oxen roaming the streets and even around the markets in Daloa. Sheep and chickens are mainly the fruits of small-scale domestic farming. Cattle breeding is the most important. Cattle breeding is the business of a few populations, Fulani and national owners. Animals (dogs, goats, sheep, oxen, chickens, etc.) that stray not only considerably impede car traffic and often cause traffic accidents (11 accidents in 2021 according to the police), but also dirty the town with their excrement (Photo 4).

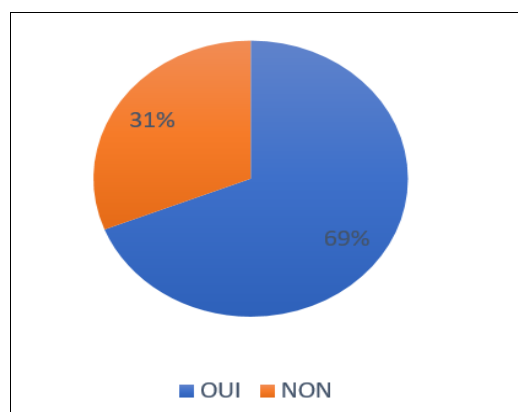


Source: Kouadio, 2021

Photo 4: A cattle farm in quartier Sud A

3.4.4 Proliferation of suffocating odours

Analysis of Figure 2 shows that 69% of respondents said that there are sometimes suffocating odours in all parts of the city.



Source: Field survey, 2021

Fig 2: People's perception of odours in the city

Unpleasant odours are harmful when they are present in high concentrations in the air. Such odours can be found in the vicinity of slaughterhouses, uncontrolled dumps, uncleaned gutters, sewage and black water. They can reduce appetite, cause migraines, nausea and vomiting. Flies, when numerous, can be a very unpleasant nuisance, harassing people while they work or rest. They soil the interior and exterior of homes with their droppings. They can also have an adverse impact on spirits as their presence is considered

to indicate a lack of hygiene (Rozendaal, 1999) ^[12]. Flies can spread certain diseases (diarrhoea, typhoid fever, etc.) because they feed on both human food and refuse. They carry pathogens with them as they move around without flying and as they feed. Germs that adhere to the surface of the insect's body only survive for a few hours, while those ingested with food can survive for several days in the crop or intestine. Germs are transmitted when the fly comes into contact with humans or their food. Most diseases can also be contracted directly from food, water, air or from a person's hands that have been contaminated, or from interpersonal contact. Intestinal infections (e.g. dysentery, diarrhoea, typhoid, cholera and some helminth infections), eye infections (such as trachoma and epidemic haemorrhagic conjunctivitis), poliomyelitis and some skin infections such as yaws, cutaneous diphtheria, some mycoses and leprosy are transmissible by flies (Nyassogbo, 2005b) ^[11].

3.5 Deterioration of the road system

Characterised by a very uneven terrain, the town's roads are in a very advanced state of disrepair (Table 1), although the repaving of some of them is underway.

Table 1: Distance to road by type and condition

Type of Road		Distance in KM
Bitumen national road	In good condition	17,17
	Poor condition	02,80
Asphalt urban road	In good condition	06,35
	Poor condition	21,08
Unsealed urban road	In good condition	0
	In poor condition	254,60
	Not open	199,09

Source: Technical department of the town hall, 2021

According to Table 1, while the national road is almost completely in good condition, the urban roads are in a very advanced state of deterioration. Overall, 23.52 km of asphalt road is in good condition, the unsealed road is totally degraded with 254.6 km and the undeveloped road is 199.09 km long. This deterioration is explained by the fact that there is a lack of sanitation and drainage of the roads, overloading by heavy trucks and, above all, the lack of periodic maintenance of the roads. These degraded roads are in very poor condition and impassable during the rainy season. They are strewn with gullies and ravines that sometimes serve as rubbish dumps. This gives motorists and users a hard time, making certain areas inaccessible. Indeed, the difficult access to the neighbourhoods adds to the precariousness of the living conditions of the inhabitants who have to make long detours to reach the city centre. The case of sick people and women in labour who have to be evacuated to the health centres and the crossing of makeshift bridges constitute major risks for the population (photo 6).

4. Conclusion

At the end of this study, it can be said that the urban dynamics of the city of Daloa lead to a multitude of environmental problems. These include poor wastewater management, natural hazards due to a very uneven terrain, overgrowth of most of the city's neighbourhoods, nuisances throughout the city, animal roaming and road degradation. This highlighting of these problems requires the public authorities to put in place an action plan to remedy them for the well-being of the population.



Source: Kouadio, 2021

Photo 6: A degraded road in the Dioulabougou district that has become a receptacle for rubbish and waste water

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