



---

## Impacts of solid household and similar waste on the environment and on the health of the populations of M'batto in the centre-east of Côte d'Ivoire

Kassi Kadjo Jean Claude<sup>1</sup>, Coulibaly Aboubakar<sup>2</sup>, Aloko N'guessan Jérôme<sup>2</sup>

<sup>1</sup> Department of Geography, University Peleforo Gon Coulibaly (Korhogo-Ivory Coast), Côte d'Ivoire

<sup>2</sup> Institute of Tropical Geography, Félix Houphouët-Boigny University (Abidjan-Ivory Coast), Côte d'Ivoire

---

### Abstract

The rapid urbanization experienced by Ivorian cities has been accompanied by an increased production of household solid waste. The objective of this study is to show the impact of solid household and similar waste on the environment and on the health of the populations of the city of M'batto. The results are based on the use of data from secondary sources, the interview and the field survey. This results in attacks on urban sanitation and pollution problems, nuisances and deterioration of the living environment, soil, air and water pollution, etc. Indeed, these various problems are caused by the lack of funding, the insufficiency and quality of equipment and the poor management of the various partners. In addition, these environmental problems have enormous consequences which manifest themselves on the health of the population and on the sanitation networks.

**Keywords:** impacts, waste, environment, health, m'batto

---

### Introduction

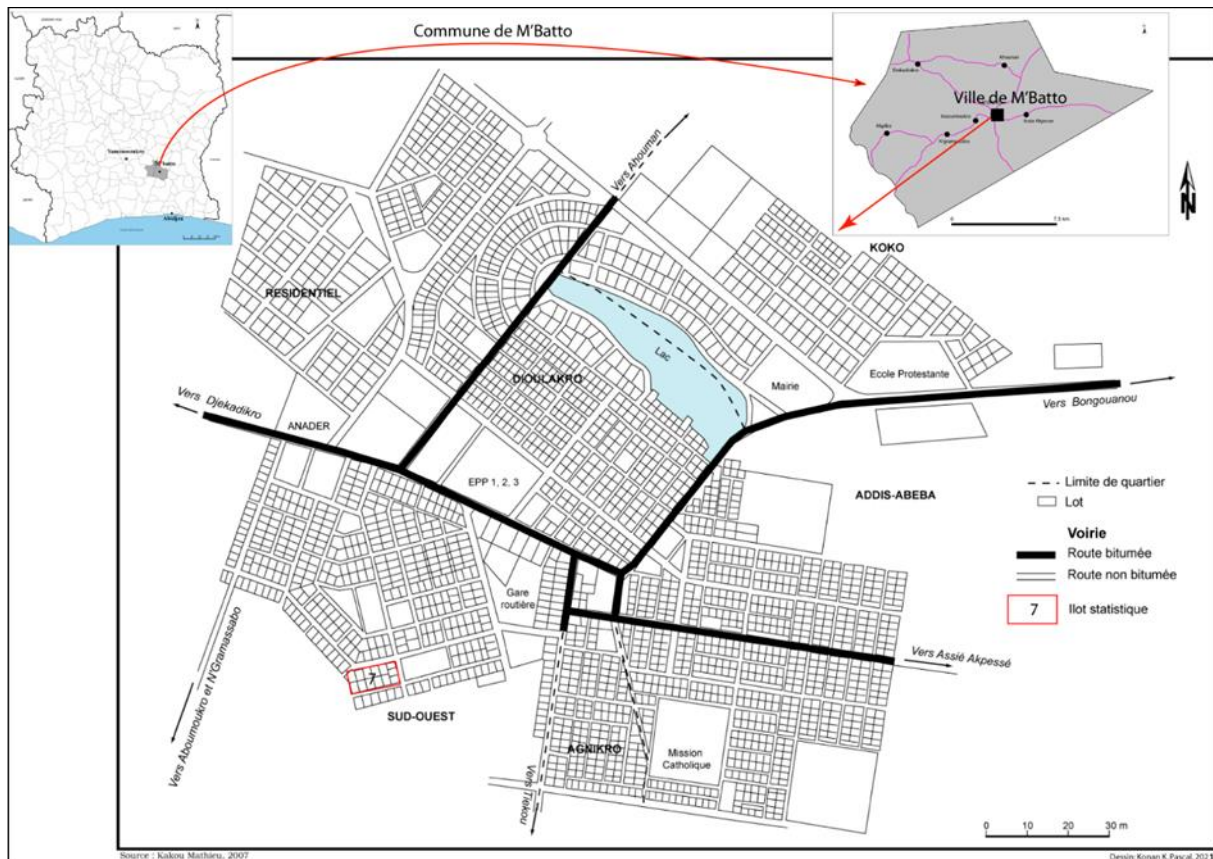
Côte d'Ivoire has experienced rapid urbanization since 1960 linked to the strong growth of its population. Indeed, the annual growth of its urban population estimated at 6,709,600 in 1975 subsequently increased to 10,815,700 inhabitants in 1988, i.e. 5.6% between 1975 and 1988. The urban population in 1988 represented 45% of the population total. According to the general population and housing census of 1998, Côte d'Ivoire had an urban population of approximately 48.20%. Today it has more than 22,671,331 inhabitants (INS, 2014). Thus, this accelerated urbanization is reflected by the multiplication of the number of cities and by the rapid demographic growth linked both to a high natural increase and to the migratory flows of populations from the countryside of Côte d'Ivoire or neighboring countries. Like the country, the city of M'batto is undergoing rapid urbanization with a growth rate that rose from 14.02% in 1975 to 35.35% in 1998. The population of the city thus went from 10,057 inhabitants in 1975 to 16,871 inhabitants in 1998 (RGPH-98) or an average annual growth rate of 2.27% for the period 1975-1998 (KJC Kassi, 2006 p. 17) <sup>[7]</sup>. The dynamics of the city of M'batto is observed not only through the increase in its population, but also at the level of the spatial extension and the proliferation of economic activities. Spatially, the village core which was limited to the Agnikro neighborhood has seen an extension with new neighborhoods such as Addis Ababa, Dioulakro, Residential, South-West and Koko. The urban space (in terms of area) is 141,000 hectares (s/p de M'batto 2009). Economically, M'batto is considered an administrative and commercial city based on the coffee-cocoa binomial precisely in the 1970s. Today, the activities are multiple and diversified. But they can be classified into three large groups, namely: primary activities (agriculture), secondary activities (carpentry, garages, mills), and tertiary activities (transport, trade, etc.). In addition, the city is home to socio-economic, socio-collective, educational, religious facilities as well as road infrastructure. Despite all these advantages, today the city presents a degraded environment which results in the multiplication of illegal dumping. In view of all these observations, the fundamental problem is that of the increasingly increased degradation of the living environment by the proliferation of solid waste. Thus, the central question posed by this study is what is the impact of solid household and similar waste on the health and living environment of the populations of the city of M'batto?

From this question arises the following specific questions: What are the environmental problems related to household and similar solid waste and their causes?

What are the consequences of environmental problems related to solid household and similar waste?

### Presentation of The Study Area

The city of M'Batto is located in the region of Moronou more precisely in the department of M'batto. It is limited to the south by the town of Agboville, to the west by the towns of Tiemelekro and Anoumaba, to the east by the town of Bongouanou and to the north by the town of Dimbokro (the limits announced in the text are not shown on the map).



**Fig 1:** Location of the city of M'Batto

**The Methodology**

The working method adopted is based on three basic techniques: documentary research, interviews and field surveys. Regarding the documentary research, the information collected made it possible to understand the concepts of management and solid and similar waste. It also enabled the collection of statistical and demographic data from the general population and housing censuses (RGPH) of 1988, 1998 and 2014.

Interviews are held with the Technical Director of the Town Hall, the Departmental Director of Construction and Urbanism and the Departmental Director of Health of M'Batto, NGOs. The data collected focused on the environmental management policy, the state of the environment, the quantity of waste, the frequency of collection, the problems and solutions, the types of waste, the equipment available to the Town Hall, the linear bituminized track.

**Sampling**

The questionnaires were distributed to 2,550 heads of households according to the type of habitat. This number constitutes 5% of total households. (Estimated at 51,000 according to the RGPH-2014 and due to the choice of a single household in the case of a common courtyard).

To determine the number of households to interview per neighborhood, we applied the rule of three. We have a total of 2,550 heads of households for a total of 51,000 households. For example for the Addis Ababa district which has 14943 we will have how many households?

$$51000 \quad 2550 \quad \longrightarrow$$

$$14943 \quad Y \quad \longrightarrow$$

Then  $Y = 2550 * 14943 / 51000 = \longrightarrow 747.15$  or 747

With the same process we obtained the share of the other neighborhoods which are summarized in Table 1.

**Table 1:** Number of heads of household interviewed by neighborhood

Neighborhoods	Total number of household heads	Number of household heads to be interviewed
Addis Ababa	14,943	747
Agnikro	4,135	207
Dioulakro	15,774	789
Residential	5,362	268
South West	3,491	175
Koko	7,295	365
Total	51,000	2,550

Source: Survey, July 2019

The choice of heads of households was made taking into account the type of habitat. In fact, to determine the number of households questioned according to the type of housing, we multiplied the number of heads of households of each type of housing per district by 5%.

Example: case of the Addis Ababa district

Residential housing  $811 * 5/100 = 40.55$  or 41

Evolutionary habitat  $632 * 5/100 = 656, 81$  or 657

Traditional and precarious housing  $6 * 5/100 = 6.23$  or 7

Using the same process, we obtained the share of the other neighborhoods (*table 2*);

**Table 2:** Number of heads of household interviewed according to type of housing per neighborhood

Neighborhoods	Number of household heads	Residential housing	Evolutionary habitat	Traditional housing
Addis Ababa	747	42	684	21
Agnikro	207	21	165	21
Dioulakro	789	42	726	21
Residential	268	125	143	0
South West	175	40	119	16
Koko	365	47	296	22
Total	2,550	317	2133	101

*Source: Survey, July 2019*

### Data collection tools

Three tools were used to collect data. These are the documentary research, the interview and the field survey. Regarding the survey, a questionnaire was sent to a sample of 2,550 heads of households. The choice of these heads of households was made according to the reasoned method by setting the following criteria: gender, level of education and type of housing.

### Data analysis and processing tools

The data collected was processed using software such as Word and Excel, which allowed us to enter, process and lay out the text, create tables and graphs. The maps were developed using mapping software including Adobe Illustrator and Arc view.

## Results

### Environmental problems related to solid household and similar waste and their causes

#### Environmental problems related to solid household and similar waste

#### Attacks on urban sanitation and pollution problems

Unsanitary conditions are observed both in public places and in places of residence. Public places like the market, the station are unsanitary. Indeed, this insalubrity is linked to the proliferation of commercial activities, which generate a lot of waste. These are dumped near the market. Places of residence are the spaces that house households. This concept includes dwellings and their immediate environment, namely streets and open spaces. The deterioration of the living environment in places of residence is a phenomenon linked to the behavior of waste-producing households. This behavior is in itself linked to the education and level of instruction of the individual. There are wild dumps everywhere in the city. The existence of wild dumps is due to the accumulation of solid waste, which is not subject to systematic collection in unbuilt open spaces, in gutters or in the streets. Indeed, the collection of waste is therefore related to the hygiene of the environment. They constitute a danger if their removal is not properly ensured, especially for nearby habitats but also for children who play in these piles of rubbish. This poses hygiene problems with enormous consequences, pollution and environmental degradation.



*Photo : Kassi Jean Claude, July 2019*

**Fig 2:** Pile of solid waste near the market



*Photo: Kassi Jean Claude, July 2019*

**Fig 3:** Wild dumping of fabric waste from sewing workshops

Fig 3 shows solid waste dumped on the ground at market level. This waste is made up of plastic paper, cardboard, attieké leaves, etc. As for photo 2, it shows a trash can filled with fabric waste. The excess waste is flush with the ground.

#### **Nuisances and deterioration of the living environment**

Waste is a source of food for mice, cockroaches, and mosquitoes. As a result, we are witnessing a proliferation of harmful and germ-carrying bugs. All the people and heads of households interviewed mentioned these critters as major nuisances related to the environmental situation. Indeed, most of the houses, especially those located near unsanitary spaces and the market, are constantly invaded by flies during the day. Other people, during the night, undergo the ordeal of cockroaches and that of mice which are transformed into real invaders emerging from the heaps of rubbish. They take over the rooms. Wild dumps give off fetid odors and also promote the proliferation of mosquitoes. Finally, this waste leaves real suffocating odors in the beautiful town. It results in the piled-up solid waste and sewage that litters the streets and brush. Very often, this solid waste mixed with wastewater, constitutes real factors of degradation of the living environment of the populations with the proliferation of cockroaches, mosquitoes and rodents. This situation is the cause of certain diseases.

#### **Soil, air and water pollution**

Soil pollution is manifested by deposits of solid waste piled up for several days or even months without being collected. Indeed, the waste decomposes to pollute the soil. Also, during the rainy season, the soil is subject to contamination by solid waste and by the phenomenon of leaching (contamination by the passage of rainwater through solid waste) which penetrates the soil. As for air pollution, it is due to the emission of odors, gas and smoke into the atmosphere. In addition, households incinerate their waste to get rid of it. All these operations carried out without prior device are a source of production of carbon dioxide (CO<sub>2</sub>). This will compromise the health of the population. With regard to water pollution, two types of pollution must be distinguished in M'Batto despite the absence of large industrial units: pollution of the lake and groundwater. Indeed located in a valley, the lake receives runoff water and all the wastewater from nearby households via the slopes. All this water is discharged into the lake without any particular treatment. On the other hand, the water table is subject to contamination by domestic wastewater and leaching water (contamination by the passage of rain through solid waste) which percolate through the soil.

#### **Causes of environmental issues related to solid and similar waste**

The current state of the environment of M'batto is explained by the weakness of funding, the lack of environmental management infrastructure and the quality of equipment and the poor management of solid waste by the various partners.

#### **A low municipal budget**

The municipal budget is one of the causes of environmental problems in M'Batto. During our investigation, the financial department of the town hall of M'Batto was unable to provide us with the budget for all the years. We obtained from him the budget from 1986 to 2005 and from 2015 to 2019. Table 3 shows the evolution of the annual municipal budget from 1986 to 2019 and its distribution.

**Table 3:** Evolution of the annual municipal budget from 1986 to 2005 and from 2015 to 2019 and its distribution

<b>Year</b>	<b>Global budget</b>	<b>Operating budget</b>	<b>Investment budget</b>
1986	70,845,260	47,617,382	23,227,878
1987	92,642,869	51,504,364	41,138,505

1988	63,925,000	39,952,000	24,000,000
1989	77,454,398	58,967,558	18,486,840
1990	79,847,564	62 102 023	17,745,541
1991	56,006,921	38,269,187	17,437,734
1992	85,497,371	41 207 029	44 290 342
1993	66,456,654	47,976,654	18,480,000
1994	64,664,888	48,783,777	15,881,111
1995	82 124 819	59 868 819	221,256,000
1996	81 837 482	54,724,635	27,112,847
1997	94 063 011	74 580 011	19,483,000
1998	109,664,438	85 071 438	24,592,000
1999	82 171 948	58,893,943	23,278,000
2000	82,772,197	67,416,197	15,356,000
2001	81,147,988	52,416,988	28,731,000
2002	118,949,990	77,331,990	41,618,000
2003	182 005 877	72,449,877	109,556,000
2004	118 689 873	75,381,873	43,308,000
2005	113 929 839	78,911,339	35,018,500
2015	95 063 011	75 580 011	20,483,000
2016	110,664,438	86 071 438	25,592,000
2017	119,689,873	76,381,873	44,308,000
2018	114 929 839	79,911,339	36,018,500
2019	183 005 877	73,449,877	110,556,000

*Source: Goly Mathieu 2006; Financial service of the Town hall of M'Batto 2019*

The analysis of Table 3 shows that the annual municipal budget from 1986 to 2005 and from 2015 to 2019 has grown. Indeed, from 1986 to 2005, that is to say 20 years later, we realize that the part of the budget of the municipality reserved for investment which amounted to 23,227,878 CFA francs in 1986 (see in the investment budget column) recorded an increase in 2005 with 35,018,500 F CFA. But this improvement is insignificant because during these twenty years, the needs of the populations have increased considerably because the population has increased from 15,699 inhabitants in 1988 to more than 31,525 inhabitants in 2005 and the investment per inhabitant became increasingly weak.

With its demographic dimension, M'Batto is subject to an investment rate of more than 30% which has been respected for the past 5 years. While the rate was high during the period from 1986 to 1992 (more than 32%) with a drop in 1989 and 1990. From 2015 to 2019, the overall, operating and investment budgets experienced a growth. This should enable the municipality to effectively manage household and similar solid waste.

#### **Insufficiency and quality of equipment and infrastructure**

There is an insufficient number of solid waste management equipment and infrastructure in households. This equipment and infrastructure is either aging or deteriorated. Sometimes they are misused. They are often used in households as containers for dishes. The municipality only has a dump vehicle with a capacity of 5 tons and two workers responsible for collecting solid waste. This machine breaks down too often.

This equipment available to the municipality is in a state of disrepair. The only tipper that works is always in the garage either for a mechanical problem or for tire problems. Waste collection rakes are worn. The workers sometimes do not even have a gang. They are exposed to diseases.

#### **The bad practice of the people of the city**

The poor management of waste by the population can be seen through the proliferation of illegal dumping of garbage in the neighborhoods. Indeed, once the small household containers are full, for lack of collection vehicles, the contents of these containers are dumped either at a place in the neighborhood or in the weeds that invade the undeveloped lots and certain public places. Moreover, on the edge of public roads, shopkeepers ignorant of the environmental state (vendors of gnamakoudji, bissap, sweet bananas, oranges, etc.) throw banana peels and bags in the street. Thus, some residents pour into the runoff waste piled up either in front of their door and others either in the alleys.

#### **Degradation of the city's internal roads**

The Town Hall is responsible for the collection of solid waste. Indeed, the internal roads of the districts being mainly in earth are degraded by the rain erosion which leaves large hollows in the middle of the roads making circulation difficult. Road maintenance is the responsibility of the municipality. In neighborhoods like Dioulakro, koko and some places in Agnikro, the roads are more degraded. This is explained by the fact that in these districts, we witness the presence of more or less steep slopes. Ultimately, the low budget allocated to environmental management by the town hall of M'Batto and the insufficiency of environmental management equipment and infrastructure are the immediate causes of environmental degradation.



*Photo: Kassi Jean Claude, July 2019*

**Fig 4:** Dirt road degraded by erosion revealing the SODECI pipe

Fig 4 shows the effect of erosion on the environment. In fact, the erosion has exposed the water pipes of the SODECI. This could damage the pipes.

#### **The consequences of environmental problems related to household solid waste On the health of the population**

The direct consequence of these problems on man is damage to his health. According to the WHO, in 1971, there was no doubt that vector insects and rodents could transmit various pathogenic agents (amoebic and bacillary dysentery, typhoid fever and salmonellosis, various parasitoses, cholera, yellow fever, plague, leptospirosis, etc.). It is often difficult to determine the correct relationship between the sources of infection and the health of the population. The poor environmental practices of households seriously threaten the health of populations. Indeed, the odors released by the waste also cause various diseases such as cholera, diarrhea, meningitis, etc. In M'batto, the most recurrent diseases linked to the environment are malaria, diarrheal diseases, typhoid fever, etc. and their frequency is given in table n°4.

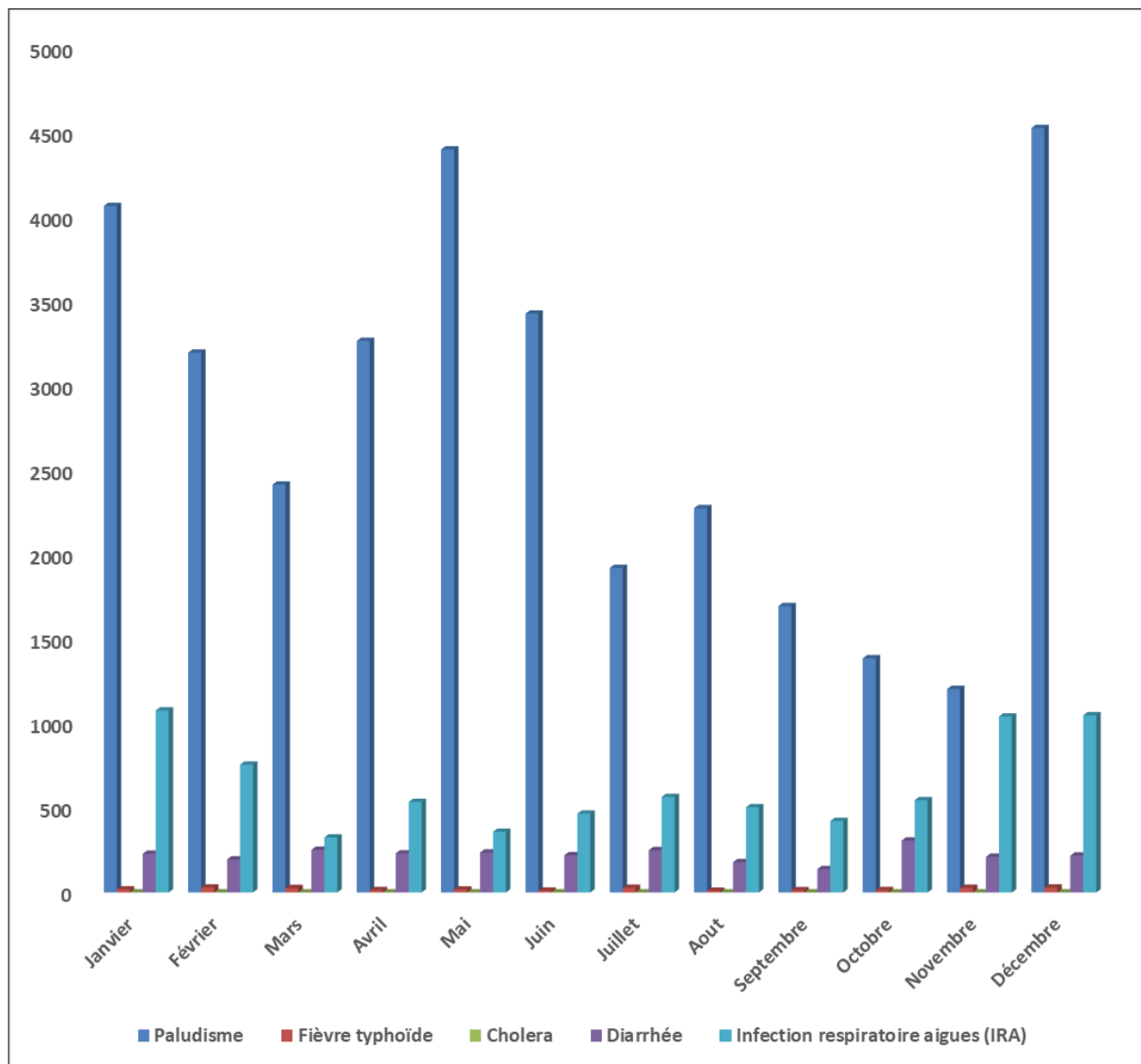
**Table 4:** Distribution of the population according to the pathologies encountered in M'batto in 2020

<b>Pathologies</b>	<b>Number of patients</b>	<b>Percentage (%)</b>
Malaria	33,748	75.73
Typhoid fever	235	0.53
Cholera	0	0.00
Diarrhea	2736	6.14
Acute respiratory infection (ARI)	7843	17.60
Total	44,562	100

*Source: Departmental Health Directorate of M'batto 2020*

The analysis of the table of the distribution of the population according to the pathologies encountered in M'batto shows that the so-called environmental diseases are the causes of morbidity in consultation. Malaria is the only pathology causing more illnesses in the city. Indeed out of 44,562 patients received by the hospital, only 33,748 suffered from malaria. Which is 75.73%. Then come Acute Respiratory Infections (ARI), diarrheal diseases and typhoid fever which caused respectively 7843, 2736 and 235 patients in 2020. All these diseases are caused by the unsanitary state of the environment.

Malaria, which is a parasitic disease, is the consequence of the presence of unhealthy stretches of water. Similarly, poor housing conditions do not allow effective vector reduction. Indeed, mosquitoes, vectors of malaria, develop in the larval stage in the lake, in puddles, on deeply degraded roads, in household water poured around streets and homes. Then come diarrheal diseases. These are caused by the consumption of polluted water, contaminated food and poor sanitation and hygiene. In M'batto, certain populations, especially those in the Agnikro, Dioulakro and Koko districts, consume well water (poorly sanitized) and relieve themselves, either in nature or in latrines that open into runoff water during the rainy season. Also, we observed restaurants and food vendors along the streets. All cooking takes place in the open air. Thus, the foods are covered with flies and other insects from the waste and sewage. What about the monthly distribution of the population according to pathologies in 2020?



Source: Departmental Health Directorate of M'batto 2020

**Fig 5:** Monthly distribution of the population according to pathologies in M'batto in 2020

The analysis of the figure of the monthly distribution of the population according to pathologies shows that during the year 2020, malaria is the only dominant pathology of morbidity in the city. There were more cases of malaria patients in January, May and December. Then come Acute Respiratory Infections, diarrhea and typhoid fever. In January, November and December 2020, Acute Respiratory Infections caused the morbidity of more than 3000 people. During the year 2020, more than 130 people suffered from diarrheal diseases each month. As for typhoid fever, it caused the morbidity of less than 30 people per month. No case of cholera has been reported in M'batto.

### On sewerage networks

The deterioration of sanitation networks is linked to the behavior of households in the practice of their activities. Indeed, the irregular collection of various types of waste leads economic operators and households to transform gutters and other sewerage networks into illegal dumping sites. This often causes gutters to clog, sometimes preventing the proper flow of storm and sewage water. Open gutters sometimes contain sand and solid waste (bags, peelings, pieces of cardboard, food scraps, etc.). In short, environmental problems are characterized by attacks on urban health, deterioration of the living environment, nuisances, soil pollution, air pollution, etc. In fact, these various problems are caused by weak funding, insufficient and quality equipment and poor management by the various partners. In addition, these environmental problems have enormous consequences which manifest themselves on the health of the population and on economic activities.

### Discussion

Issues related to urban waste management and, by extension, urban environmental planning and management are among the most complex that urban managers have to answer because of their effects on human health and sustainable development. Our study has shown that the irrational management of household and similar solid waste has caused environmental problems such as damage to urban health and pollution problems, nuisances and

deterioration of the living environment and soil pollution, air and water. It also identified the causes of the environmental problems which are only the weak municipal budget, the insufficiency and the quality of the equipment and infrastructures, the bad practice of the populations of the city and the degradation of the internal ways of the city. In urban growth and management of solid waste and excreta, a challenge for the city of Atakpamé in Togo, ATCHOLE Eyanah (2020) p.9 mentions that several causes explain the creation of uncontrolled dumps, in particular the lack of intermediate dumps in some neighborhoods, the incivility of certain people. It should be noted that the final dump is 5 km from the city at Kamina, which further complicates the evacuation of this waste. The ignorance of the population with regard to the sound management of garbage and the absence of garbage collection from some households accentuates this chaotic management of waste. Indeed, the intermediate dumps that exist are small and are very often overwhelmed, which means that an uncontrolled dump is often created next to it. BROU Huia Sidonie, *et al.*, (2018 pp.12-14) <sup>[3]</sup> explains that the poor management of household solid waste in San Pedro is due to ignorance of the laws, the non-ecological behavior of the populations, the degradation of the internal ways of the city and a low operating budget for the Regional Department of Health, Environment and Sustainable Development. The poor management of solid waste has consequences on the environment and on the health of populations. Concerning the health of the populations, the study revealed that in M'batto, the most recurrent diseases related to the environment are malaria, diarrheal diseases, typhoid fever, etc. So-called environmental diseases are the causes of morbidity in consultation. Malaria is the only pathology causing more illnesses in the city. Indeed out of 44,562 patients received by the hospital, only 33,748 suffered from malaria. Which is 75.73%. Then come Acute Respiratory Infections (ARI), diarrheal diseases and typhoid fever which caused respectively 7843, 2736 and 235 patients in 2020. All these diseases are caused by the unsanitary state of the environment. Koné-Bodou Julie Possilétya *et al.*, (2019 p.14) indicates that during the year 2013, malaria was the first condition of consultations at the Anyama Urban Dispensary (DUA) with 4932 out of 8574 consultations, i.e. a rate of 58%. It is followed by acute respiratory infection with a prevalence rate of 22% and diarrhea (9%), other illnesses represent 11% of consultations. The DUA had an attendance rate of 75% according to data from the 2013 assessment. 62% of all consultations and 43% of consultations related to malaria. ARI and Diarrhea had 17% and 8% prevalence rates respectively. In addition, during the month of July 2014, malaria had the highest rate of all consultations in this clinic with 62% of consultations. ARI and diarrhea represented respectively 21% and 11% of the total consultations of the said dispensary. Similarly for the month of July 2014, the rates for children under five years old were the highest with 26%, 17% and 9% of total consultations for reasons of malaria, ARI and diarrhea respectively.

## Conclusion

Poor management of solid household and similar waste is linked to several factors. The study showed that the weak communal budget, the insufficiency, the quality of the equipment and infrastructures, the bad practice of the populations of the city and the deterioration of the internal ways of the city make difficult the application of adequate method of work. in the area of solid waste collection. The irrational management of household and similar solid waste has caused environmental problems such as damage to urban sanitation and pollution problems, nuisances and deterioration of the living environment and pollution of the soil, air and water. water whose consequences are enormous and manifest themselves on the health of the population and on the sanitation networks. In view of these problems, the consequences of which are multiple, what actions can be taken for a healthy environment and living environment?

## References

1. Atchole Eyanah, Urban growth and management of solid waste and excreta, a challenge for the city of Atakpamé in Togo, *DaloGéo*, 2020, 21.
2. Brou Huia Sidonie, *Urban development and solid waste management in M'batto*, master's thesis Institute of Tropical Geography, 2012, 123.
3. BROU Huia Sidonie, KASSI Kadjo Jean Claude, FOFANA Lacina, The environmental impacts of household solid waste management in San-Pedro, *Revue Ivoirienne de Géographie des Savanes*, ISSN 2521-2125, 2018:4:215-228
4. INS, *1 volume, Overall results: Districts, Regions, Departments and Sub-prefectures of Côte d'Ivoire*, 2014, Report, Abidjan, at [www.ins.ci](http://www.ins.ci) (accessed, 2021)
5. KACOU Goly Mathieu, *Communalization and urban development: case of M'batto*, master's thesis Institute of Tropical Geography, 2006, 142p.
6. KASSI Kadjo Jean Claude, *Industrial companies and environmental management in the city of San-Pedro*, Single doctoral thesis, Institute of Tropical Geography, Felix Houphouët Boigny University, 2012, 322p.
7. KASSI Kadjo Jean Claude, *Sanitation and environmental management: case of M'batto*, master's thesis, Institute of Tropical Geography, Felix Houphouët Boigny University, 2006, 106p.
8. KONE-BODOU Julie Possilétya, Victor Kouame KOUAMÉ, Charles Fé DOUKOURÉ, Dope Armel Cyrille YAPI, Alain Sergeres KOUADIO, Zié BALLO and Tidou Abiba SANOGO, "Health risks related to household waste on the population of Anyama (Abidjan-Côte d'Ivoire)", *Vertigo - the electronic journal in environmental sciences* [Online], Volume 19 Number 1|March 2019, mis online March 05, 2019, accessed September 28, 2021. URL: <http://journals.openedition.org/vertigo/24417>; DOI: <https://doi.org/10.4000/vertigo.24417>