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Adaptation strategies of health 3 populations in the face of environmental problems Abidjan, Ivory Coast

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Abstract
The continuous growth of Abidjan's population has encouraged the formation and multiplication of precarious neighbourhoods in the city. Some of these are developing in areas subject to natural and man-made hazards, such as the precarious Health 3 neighbourhood in the commune of Attécoubé. Despite the natural disasters that strike this precarious neighbourhood every year, causing considerable loss of life and material damage, it continues to be inhabited. The aim of this article is to show the coping strategies developed by residents in the face of environmental problems.
The methodological approach adopted is based on documentary research, inventory, observation and a questionnaire survey of a sample of 384 of the 1 835 heads of household in the district. The results of the study show that the population of Santé 3 is constantly faced with natural and man-made environmental problems. Particularly during the rainy season, these problems cause loss of life and extensive material damage. In order to adapt to these problems and live in the area, residents are implementing strategies to improve their living conditions.

Keywords: Adaptation, living environment, health 3 (mossikro), resilience and health risk

Introduction

Situated on the Atlantic seaboard, Abidjan, the economic capital of Ivory Coast, boasts a number of economic assets port, airport, factories, etc.) which contribute enormously to the development of sub-regional and even international commercial transactions. The result is strong demographic growth. From 912 358 inhabitants in 1975, the population of the city of Abidjan rose successively to 2 877 948 in 1998, 4 395 243 in 2014 and 5 616 633 in 2021 INS-RGPH, 1975, 1998, 2014 and 2021). The increase in the urban population and the pressure on space are concerns for city managers. Exponential demographic growth and urbanisation uncontrolled by the public authorities are contributing to the emergence of spontaneous settlements, evolving in an unhealthy environment and lacking some of the usual amenities. As a result, the public authorities, who in principle had a duty to take account of all social strata without exception in urban planning, have neglected a fringe of the population. Since 1909, according to Yapi 2000) [13], these people, feeling marginalised, have had to settle on sites classified as non-constructible or at risk. We are therefore witnessing the creation of precarious neighbourhoods despite the existence of the first urban planning texts borrowed from colonisation Kouassi, 2015, p.301) [7]. This situation generates landscapes that become places of multiple and varied interactions between health and the environment I. Sy., 2011, p. 1).
The municipality of Attécoubé is no exception, with eleven precarious neighbourhoods located on high-risk sites. These areas are off-limits to construction and are therefore not included in the municipality's urban development programmes. In these neighbourhoods, newcomers carry out earthmoving and clearing work to clear plots of land, and housing is generally built from salvaged materials. Santé 3, commonly known as Mossikro, located in the aforementioned commune, is one of these precarious neighbourhoods built on very steep slopes, in a low-lying area regularly flooded by waste water and run-off. The safety of residents is not guaranteed. Construction is haphazard, using precarious or hard building materials. Houses are built close together, in the form of shanty towns. This situation contributes to the deterioration of the environmental conditions specific to these urban sites, which are considered fragile and whose reality is amplified by the lack of infrastructure adapted to anarchic and poorly controlled urbanisation Coulibaly and al., 2018, p. 48) [3]. These populations live in difficult conditions. They lack all the usual amenities: drainage channels for waste water and run-off, electricity, roads, health centres and social facilities. The near-absence of basic infrastructure means that people live in degrading conditions, under the threat of hazards such as flooding, landslides, pollution, etc., thus affecting people's well-being by making them vulnerable. Despite all these risks environmental problems), the people of Santé 3 manage to live and enjoy this environment. In fact, they use strategies to solve these problems. In view of these observations, it is important to understand the presence of the Mossikro populations on this site despite the numerous environmental problems to which they are exposed and confronted. From these observations, a central question arises: How do the Mossikro populations adapt to environmental problems? The aim of this study is to find out about the adaptation strategies developed by the Mossikro populations in the face of environmental problems. Specifically, it involves listing the various environmental problems faced by the population of Santé 3, analysing the health risks incurred by the population, and listing the actions taken by households to reduce these environmental problems.
To achieve this, the following methodological approach was adopted.

Materials and methods

1. Presentation of the study area

The study area is the Santé 3 district, commonly known as Mossikro. It is one of 39 neighbourhoods in the commune of Attécoubé. It is bordered to the north by the Djéné Ecaré district, to the south-west by the commune of Yopougon, specifically by the Toit rouge, Jean Paul 2 and Nouveau quartier districts, to the south-east by Caréna and to the east by Santé village and the Banco bay Ebrié Lagoon). Mossikro is located in the centre of the commune of Attécoubé see map).

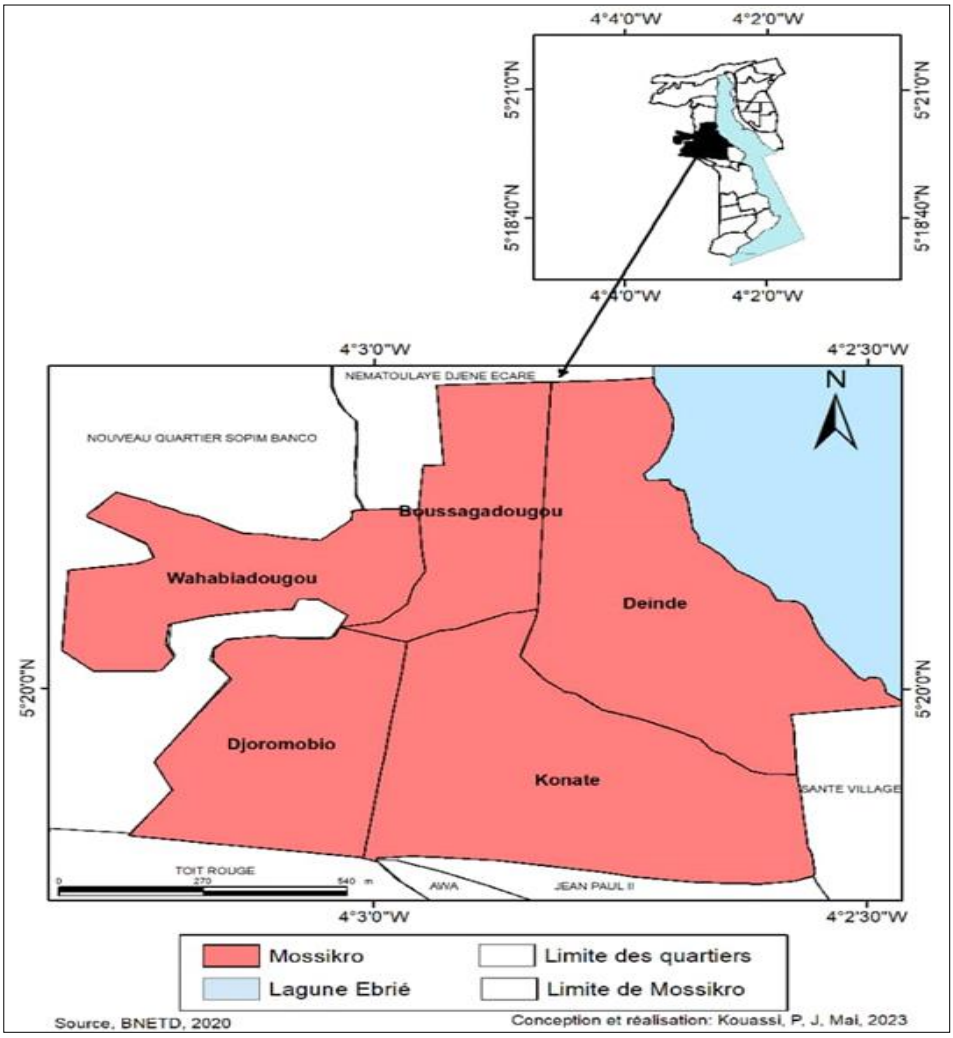


Fig 1: Presentation and location of Mossikro

The area was chosen for this study because of the many environmental problems it faces. Located in a valley on the urban fringes, the population is vulnerable to the slightest rainfall.

The demographic make-up of this district is cosmopolitan, although the majority are Gur, an ethnic group from Ivory Coast whose commonly spoken language is Malinké. A large population of non-nationals, 41% of the heads of households surveyed, is strongly represented by Burkinabe, Nigeriens, Malians and Guineans. According to the 1998 population census and the estimates made by the town hall in 2022, the population of the study area has risen from 6 127 in 1998 to 13 091 in 2014 and 70 000 in 2022.

2. Data collection method

The method used to carry out this study is based on documentation and fieldwork.

The documentary research consisted of consulting scientific documents, a range of works reports, articles, reviews, etc.) on methodology and geographical analysis, and a review of publications, theses and dissertations relating to the topic under study. These are on urbanisation, precarious neighbourhoods, environmental problems, ways of managing environmental problems, and strategies for adaptation or resilience to these problems by people in Africa, and particularly in Ivory Coast. These writings have given us a clearer idea of how environmental problems are managed.

The field survey carried out in the Mossikro district in July 2022 included observation, interviews and a questionnaire survey. Observation consisted of direct contact with the study area. It provided information on the various forms of land use housing, activities, settlement), the state of the living environment, infrastructure and facilities sanitation, drinking water supply, health and safety facilities, roads, educational, socio-cultural and leisure facilities, etc.), rubbish dumps, wastewater and rainwater, the evolution of the urban area and the use of a digital camera to take photographs.

The interview consisted of interviews with the head of technical services at Attécoubé town hall, the chiefdom and the Santé 3 management committee CGQ). It provided

information on the intervention policies, the representations, the sanitation and environmental objectives for each of the stakeholders and the problems encountered.
The questionnaire survey was carried out among 384 heads of household selected at random on the basis of available demographic data Attécoubé Technical Town Hall, 2022). In fact, by estimating a sampling rate of 20,9% out of 1 835 households in the district Attécoubé Technical Town Hall, 2022). We obtained a sample of 384 heads of household. The households surveyed were spread across the five sub-neighbourhoods of Health 3, and the sample varied from one sub-neighbourhood to another depending on the number of households. The number of households selected per sub-neighbourhood was based on the rule of proportionality, as shown in Table 1.

Table 1: Breakdown of households surveyed by sub-neighbourhood

Sub-districts	Household size	Households surveyed	Proportion %
Deindé	528	110	28,65
Wahabiabougou	467	98	25,52
Boussagabougou	300	63	16,41
Konaté	290	61	15,88
Djoromobio	250	52	13,54
Total	1835	384	100

Source: Attécoubé Technical Town Hall / CGQ/ our investigations, 2022

The head of household was chosen at random, taking into account the spatial coverage of the neighbourhood. The responses of the heads of household were recorded using Android mobile phones on which the Kobocollect application had been set up with the various questions. Five interviewers were assigned to the task, distributed among the different sub-neighbourhoods.
The data collected was processed statistically using Word for text input and Excel for tables and graphs. Arc gis and Qgis were used to produce the maps.

Results

Environmental issues at Santé 3

The environmental problems recorded in the Santé 3 or Mossikro district are of a natural nature, in particular landslides, landslides, erosion, flooding, and the incivilities of the residents causing the district to be unhealthy.

Landslides and landslides

Landslides are massive and relatively rapid descents of material down a slope. They involve uprooting followed by displacement of masses of earth over more or less long distances. The speed and volume of the mass make these movements spectacular, even catastrophic Djatcheu, 2018, p. 119) [4]. In Mossikro, landslides occur where settlements are located on steep slopes, unstable slopes or escarpments. This situation is due to the incivism of the inhabitants of Mossikro. In fact, some homes are built on hillsides, at the foot of slopes or against them. Other residents even strip the slopes to make way for their homes, regardless of the risk involved. And when it rains heavily, homes built on unstable slopes are at risk of landslides. This causes serious damage to the houses built on the slopes and at the bottom of the valley, and to the inhabitants photo).

Photo: police rescue, 2021

Fig 2: Destruction of a house following a landslide

Areas with steep slopes are prone to landslides followed by mudslides during the year's heavy rains. The clods of earth are easily uprooted and spill onto the houses built at the bottom of the valleys. The photo above shows the consequences of haphazard construction. During the torrential rains of June 2021, the house built on a steep slope was destroyed by a landslide, killing several people in the neighbourhood.

Forms of erosion observed in Mossikro

In Mossikro, erosion is due to the inadequacy of the drainage system. This poses the problem of managing rainwater and wastewater. Rainwater either stagnates or

runs off, eroding the slopes to varying degrees. This is the most widespread threat to the neighbourhood's slopes. At Santé 3, erosion takes various forms depending on the slope and nature of the soil. During the rainy seasons, run-off water flows in a diffuse manner and leads to the removal of patches of soil of varying size. It attacks and undermines the foundations of houses on the slopes, exposing them to the elements. Steep slopes increase their erosive force. Erosion also takes the form of the creation of a network of gullies caused by concentrated rainwater run-off. This form of erosion, caused by run-off, detaches and transfers particles in suspension, resulting in diffuse slope erosion that progressively strips the soil surface. Added to this is gully erosion, which is even more pronounced than the first, exposing the soil. These open gullies drain rainwater, wastewater and rubbish dumped by some households. As it rains, these gullies deteriorate and widen, creating an alarming landscape that makes human activities difficult. Erosion destroys human installations, alleyways deteriorate and the foundations of houses are exposed.

A neighbourhood vulnerable to flooding

The scenario of torrential rain followed by devastating floods is a recurring one in the city of Abidjan. Buildings in flood-prone areas, often inhabited by disadvantaged groups, are legion in Abidjan. Santé 3, located in a high-risk area, is no exception. However, during the rainy seasons from May to July, the environment in this district is not at all bright. The lack of a drainage system makes it difficult to evacuate rainwater and household wastewater. As a result, homes built in high-risk areas, i.e. at the bottom of valleys and on the edge of the lagoon, are the most exposed to the risk of flooding. Photo shows a flooded area.

Photo: Agence France Presse photographer, 2018

Fig 3: Houses submerged during the rainy season

Run-off water floods homes built alongside open gutters and in talwegs. This causes enormous damage to homes and communities. These homes, located at the bottom of valleys, are highly vulnerable to flooding. In addition, the presence of clay in the lower horizons reduces the soil's absorption capacity. Under these conditions, during heavy rainfall, saturation occurs more or less quickly and the water stagnates, increasing in volume until it floods a large area. The stagnant water penetrates homes, carrying all kinds of waste in its wake.

Difficult management of household waste

Mossikro suffers intensely from the problem of its rubbish. The accumulation of rubbish is currently the most spectacular and visible form of environmental degradation. Heaps of rubbish are piled up all over the place, in the vicinity of homes, in alleyways and in the lagoon. As a result, 38.2% of households surveyed prefer to dispose of their household waste beside their courtyard or house, 20% in drains and gutters, 11% directly in the lagoon, and only 30.8% in rubbish bins.

This situation is due to the fact that the management of household waste is the responsibility of the children, with the various rubbish bins installed on the edge of the main road. For fear of causing accidents, the children prefer to dispose of their rubbish close to home.

As a result, the neighbourhood is crumbling under the weight of household waste. No area has been spared. All offer the same distressing scenery of full bins, alleyways, carnivores, sewers and the bay invaded by rubbish. This situation represents a real danger for local residents. Rubbish ferments all the faster in hot, humid climates. With this fermentation, the waste contains a considerable quantity of pathogenic germs. The danger posed by household waste lies in the proliferation of flies, mice and other animals that are harmful to human health.

Health risks for the Health 3 population

The rainy season is having a difficult time for the residents of Santé 3 or Mossikro. Torrential rains undermine the efforts made by residents. During this period, homes generally located near storm basins and on slopes or hillsides often fall victim to landslides or landslides, causing devastation destruction of property and loss of human life). Table 2 shows the damage caused by landslides and landslides from 1996 to 2022.

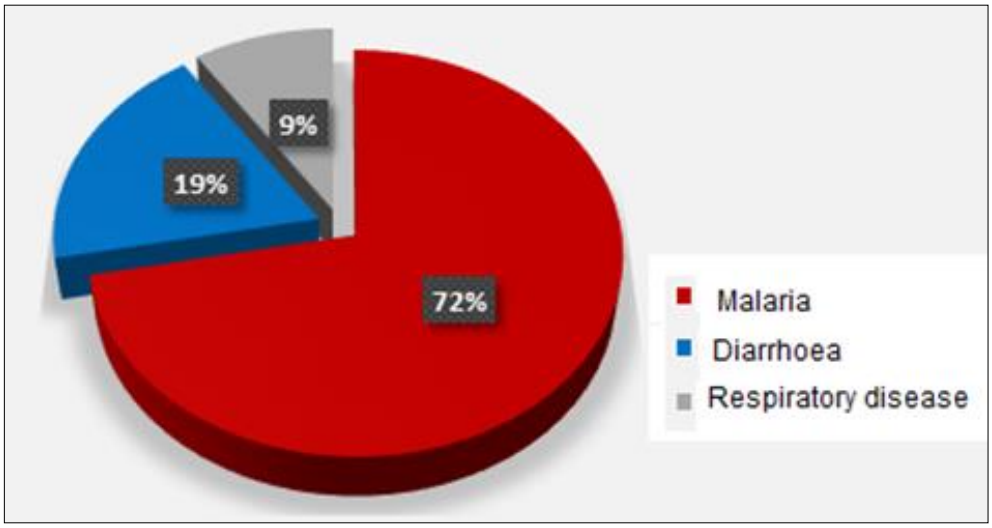
Table 2: Human toll and material damage following landslides and/or landslides

Period	Phénomène	Dégâts matériels	Bilan humain
30 to 31 May 1996	Landslides or landslides	Destruction of two houses	7 dead
3 and 6 June 2007	Landslides or landslides	Destruction of homes	6 dead and 4 injured
12 to 15 June 2009	Landslides and flooding	Destruction of homes	5 dead
June 2017	Landslides and flooding	Destruction of homes	3 dead and others missing
18 to 19 June 2018	Landslides and flooding	Destruction of homes	6 dead
June 2021	Landslides or landslides	Destruction of homes	4 dead
June 2022	Landslides or landslides	Destruction of homes	6 dead and 2 injured

***Source**: C. Hauhouot, 2008, p.80, Abidjan.net, 2022, Program ACP-UE, 2019, and our surveys 2022*

Almost every year, Santé 3 suffers losses of life ranging from 3 to 7 deaths, not to mention the injured and/or missing. The rainy periods are times of stress and desolation in the neighbourhood. Sometimes almost all the members of the same family die as a result of these disasters. When houses are destroyed, households lack the financial means to rebuild or find new premises as quickly as possible, so they build or rent makeshift dwellings made of planks or other salvaged objects. This approach makes housing even more precarious.

Apart from these dangers, which periodically cause loss of life, households in Santé 3 are regularly confronted with numerous cases of illness. In considering the last six months prior to the neighbourhood survey, only what the heads of household said was taken into account. As a result, when asked to identify the most recurrent types of illness, the figure below shows the answers given.



Source: Field survey, 2022

Fig 4: Distribution of types of illness in Health 3 households

Analysis of figure 1 above shows that three diseases are considered to be the most frequent. These are malaria, diarrhoea and respiratory illnesses, which are considered to be diseases caused by environmental problems. Malaria was the illness most reported by heads of household, affecting 72% of households. This was followed by diarrhoea, which was reported by 19% of households. Respiratory ailments accounted for 9% in this district.

The high proportion of people suffering from malaria is explained by the fact that in Santé 3, there is a lot of stagnant water in the streets. This is where mosquito larvae develop. Also, the presence of waste water in the streets, in open gutters, uncontrolled rubbish dumps everywhere and the inconveniences associated with latrines, the dumping of rubbish and black water in the lagoon encourage the development of mosquito larvae. This shows that the presence of these breeding grounds is not only linked to the presence of stagnant water, but is also influenced by environmental factors. Unsanitary living conditions sewage and household waste in the neighbourhood) increase the risk of contamination by diarrhoeal diseases. The proliferation of household waste and sewage outfalls in the streets and alleyways, and the use of water vendors as a source of drinking water, increase the risk of contamination by diarrhoeal diseases. Respiratory infections are caused by air pollution. These are still being felt in the neighbourhood, due to the lack of ventilation in the homes. The layout of the neighbourhood, its promiscuity and lack of air circulation mean that it's full of allergens, which are a frequent source of respiratory allergies.

People's palliative methods for solving environmental problems

Natural risk management

During the rainy seasons, run-off water attacks and undermines the foundations of houses on the slopes. The steep slopes increase their erosive force. Due to the lack of an effective drainage and channelling system, the inhabitants of Mossikro resort to all sorts of individual and futile means to protect themselves against flooding and erosion. In some courtyards, for example, residents would backfill in front of their homes to prevent rainwater from entering photo).

Photo: BAMBA Sidonie, 2022

Fig 5: Practices to protect homes from flooding and erosion

These embankments are made of rubble, old tyres, wood residues and sand.

Some people fill the thresholds of their homes with cement or store sandbags in front of their front doors to keep the water in the streets. Others, on the other hand, use sacks filled with sand, stones and old tyres, which they carefully arrange around their houses or in the middle of the alleyways to counteract or reduce the action of the rainwater. Sometimes, when the houses are flooded, the families wait on the roof or in the house for the rain to stop. After it has rained, they go downstairs to flush out the water with containers or by digging gullies. Or when the rainy days come one after the other, the families driven out by the water are forced to take refuge in the schools. To cope with flooding, people raise the foundations of their houses. However, it should be pointed out that these techniques are non-structural in that they do not put a definitive end to flooding problems. They merely provide relief for the population.

In the case of landslides or landslides, the first step is to raise awareness among the population through neighbourhood leaders. Indeed, the scale of the disasters is such that the Abidjan prefecture was forced to activate the ORSEC Emergency Response Organisation) plan in 2009. This plan is an immediate and coordinated response by the State to deal with exceptional situations that seriously affect the population. Its purpose is to identify the public and private resources likely to be deployed in the event of a disaster and to define the conditions for their use by the competent authority. However, this plan has not succeeded in reducing the number of deaths caused by natural hazards. The authorities in charge of natural disasters and public sanitation are reminding people to be vigilant. In particular, they are urging residents of at-risk areas to leave them, to avoid becoming victims of landslides and flooding that could be caused by the coming rains. At the same time, the residents themselves are trying to control the risk by planting trees or building terraces. Planting trees or grasses on the steep slopes will help to avoid solidifying the soil and stripping it. For them, grasses slow down the speed of run-off water on the slopes. Residents therefore create gullies or take advantage of the gullies created by erosion on the interfluves to drain the water. The trail continues as far as the valley slopes, where residents build terraces using used tyres or concrete photographic plate).

Photo: BAMBA Sidonie, 2022

Fig 6: Strategies for controlling landslides

Stairs made of cement or tyres slow down the speed of rainwater run-off. According to the residents, this prevents the water from washing away the soil from the slopes to the valley floor. These stairways are also places where people pass through to get around.

Management of man-made environmental problems

Household waste management

In Mossikro, the household waste management strategy is individual. In fact, each household tries its best to get rid of its rubbish. The results of our surveys show that households use individual bins to store household waste. Most of the households surveyed 95%) have them. The quality of the bins has an impact on the storage and disposal of waste.

As a result, it appears that household waste is mainly stored in solid containers 62,8%). However, some households 30,2%) use plastic bags, while the remainder 7%) dump their rubbish directly into the environment. 38,2% of households use the vicinity of their homes to dispose of their rubbish, 20% use drains and gutters, and 11% directly into the lagoon. These methods of disposing of household waste lead to pollution, which is a source of various nuisances and health risks. On the other hand, 30,8% prefer to put their rubbish in public bins bins and rubbish boxes), which are then removed by rubbish collection vehicles.

The rubbish bins found in homes during the surveys are old buckets and used bowls no longer used for washing clothes and dishes or for collecting water, or paint pots and cans cut up to store household waste and generally without covers photo plate).

Photo : BAMBA Sidonie, 2022

Fig 7: Household waste collection objects

Santé 3 has several rubbish bins and boxes positioned along the tarmac road. Rubbish is collected from the bins by the ECO-EBURNIE company, which has been assigned this task by the municipal authorities. However, 37% of households surveyed entrust their household waste to small pre-collectors. The latter ply the streets and alleyways of the neighbourhood with their wheelbarrows to collect household waste for a monthly fee of 1,53 Euro. On the other hand, a very small proportion 3%) incinerate rubbish in the open air. These techniques enable households to get rid of their rubbish.

Wastewater management

In terms of wastewater management strategies, Santé 3 has a large drainage channel, gutters and underground networks underpasses) installed by the authorities and residents to drain run-off water directly. However, some heads of household or homeowners create spaces in the courtyard for washing up and doing the laundry. These are manholes that are connected directly to the gutters. Others go further and connect their cesspits or septic tanks and their drainage pipes directly to the rainwater channels. Some people also let the water from their toilets run directly into the street, next to their home, causing odours, degrading the roads and increasing the number of puddles of stagnant water, which is ideal for the development of mosquito larvae, thus contributing to the risk of malaria.

42% of households connect their showers directly to a cesspool, 32% connect them to septic tanks, 20% of households discharge their shower wastewater into the street, 3% of households connect their wastewater directly to the gutter and 3% of households discharge it into the yard Plate).

Photo: BAMBA Sidonie, 2022

Fig 8: Waste water disposal site

In Santé 3, the households surveyed use trucks to empty latrines and toilets. As the town hall does not have any emptying trucks, households use the services of private companies to empty cesspools and septic tanks. The price of emptying varies from 15,29 Euro to 30,59 Euro per full tank. The lorries are hired by heads of household who have a large income, or a contribution is made by the residents of the courtyard to empty the latrines and WCs. When the toilets or latrines are full, the households call in traditional bouncers. They open the slab of the well or pit and use products grits, paraffin) to dilute the waste, a job that can take several hours. Once the waste has become liquid, the well-diggers empty the latrines using a bucket. The waste is transported in buckets to the nearest gully. Then they close the slab of the well or pit.

Discussion

In Santé 3 or Mossikro, during the rainy seasons, due to the lack of an effective drainage and sewerage system, residents resort to all sorts of individual and futile means to protect themselves against landslides, flooding and erosion. In some courtyards, for example, residents backfill in front of their homes to prevent rainwater from entering. These embankments are made of rubble, old tyres, wood residues and sand. Some people build up the thresholds of their homes with cement or by storing sandbags in front of the front doors to keep the water in the streets. Others, on the other hand, use bags filled with sand, pebbles and old tyres, which they arrange around their houses or in the middle of the alleyways to counteract or reduce the action of the rainwater. This situation is similar to that presented by Ngouaka M. K. and al 2021, p. 272) [9], in the city of Brazzaville. In this locality, to combat flooding and erosion, some households with very limited means stack sacks filled with sand on top of a bank of household waste, wrecked cars and out-of-use tyres to counteract or attenuate the action of rainwater 35%), while others with less acceptable financial means take the liberty of enclosing their plots with fairly high walls 12%). In this way, they only have to manage the water that falls on their plots. According to Bouly S. and al. 2019, p. 327) [1], the rainwater drainage methods used by households are traditional. They state that, for most households faced with flooding, their water drainage techniques are temporary. The results of these surveys show that the main solution adopted in the event of flooding is evacuation using buckets or basins 12.5% of households surveyed faced flooding). Some 9,6% of flooded households) filled their houses with gravel or shells. This gravel sucks up stagnant water and reduces infiltration when the ground is saturated at some point. These households sometimes buy the gravel and transport it with carts. Backfilling is the third solution adopted by flooded households 7.5%). Sandbags account for 4.9%. Some households 15,3%) are forced to remain under water because they have no way of coping. For Ngouaka M. K. and al 2021, p. 277) [9], the coping strategies put in place are almost the same in all developing countries, and are highly uncertain. When floods occur, people are forced to abandon their homes for a long time. Household waste and sewage are also a threat to the health of people living in precarious neighbourhoods, and residents use a variety of strategies to dispose of their waste. The results of this study are confirmed by Sy I. 2013, p.33). Households close to roads accessible to collection trucks use public collection services. Unlike others who do not have access, due to the lack of a good structure and the degraded state of the alleyways, the latter dispose of their rubbish in unauthorised dumps, in the streets or use carters. Mouroufie K. V. and al 2020, pp. 11070 and 11071) [8] add that residents in these types of neighbourhoods organise periodic sweeping operations to clean up the neighbourhood.

From a health point of view, malaria, diarrhoea and typhoid fever are recurrent pathologies linked to unsanitary conditions, as are respiratory difficulties Mouroufie Kouassi V. 2020, p. 11072) [7, 8]. Also, when landslides and floods occur, they are always catastrophic, causing loss of life and major material damage. Cadier and al 1996, p. 423) [2] confirm this. The collapse of an entire section of the Parquilima mountain in the city of Cuenca caused the death of at least 35 people and destroyed a vital and unique road.

Conclusion

The study shows that the people of Santé 3 face a number of environmental problems. The geological context of this district is highly conducive to natural hazards such as landslides, landslides, erosion and flooding. The lack of infrastructure also means that household waste is poorly managed and wastewater is difficult to purify.

To cope with these environmental problems, the consequences of which are catastrophic, sometimes resulting in death, households use strategies that are still precarious, rudimentary or temporary. The rainy season is a time of anguish for the population. Torrential rains undermine the resilience of households.

References

1. BOULY S, CISSE A, FAYE C. Rainwater management in cities in developing countries: the case of Santhiaba and Belfort Ziguinchor, Senegal), *Larhyss Journal*, ISSN 1112-3680, n°39, 2019, 313-331.
2. CADIER Eric, ZEVALLOS Othon, BASABE Pedro. The Josefina landslide and flood disaster in Ecuador, *Bulletin de l'Institut Français d'Etude Andines*, Tome 25, n°3, consulted online : https://horizon.documentation.ird.fr/, 1996, 421-441.
3. COULIBALY Moussa, TUO Péga, AKE-AWOMON Djaliah Florence. Insalubrity and infectious diseases in the precarious neighbourhoods of Yopougon Gesco-Attié: the cases of Judé, Mondon and Ayakro Abidjan, Côte d'Ivoire), *Revue Espace Territoires Sociétés et Santé*,2018:1:1:48-65.
4. DJATCHEU Martin Luther. Precarious housing in the city of Yaoundé, a source of multiple defences and risks, *EDUCI), Revue de Géographie Tropicale et d'Environnement*, n°1, 2018, 110-125.
5. National Institute of Statistics. General Census of Population and Housing INS-RGPH), *Implementation report and presentation of the main results*, Republic of Ivory Coast, 2014, 49.
6. National Institute of Statistics. General Census of Population and Housing INS-RGPH), *Global results*, Republic of Ivory Coast, 2021, 37.
7. KOUASSI Patrick Juvet. *Environment and health in the slums of Abidjan*, unique doctoral thesis, Université Félix Houphouët-Boigny, Department of Geography, 2015, 325.
8. MOUROUFIE Kouassi Vincent, KAMAND Oleh, KOUASSI Marie Laure. Environmental profile and

health risks in precarious urban neighbourhoods: the case of Koumassi camp and Boribana in the district of Abidjan ivory coast), *International Journal of curent Research*,2020:12:11066-11073. https://doi.org/10.24941/ijcr.38309.04.2020,.

9. NGOUAKA Massouangui-Kifouala Martin, Cyril Chriche Moutakala MOUNSOUNOU, Achille Patrick BATCHI MAV. Benjamin MICHELLON, Vulnerability and resilience of precarious neighbourhoods in Brazzaville Republic of Congo) to climate change: the case of Soukissa and Moukondzi, 2021, 257-281. *Rev. Ivoir. Sci. Technol.* ISSN 1813-3290, http://www.revist.ci.
10. Ibrahim SY, KEITA Moussa, TRAORE Doulo, KONE Brama BA, Khadijatou WEDADI Ouldboilil, FAYOMI Benjamin, *et al*. Water, hygiene, sanitation and health in precarious neighbourhoods in Nouakchott Mauritania): contribution to the ecohealth approach in Hay Saken, *VertigO - la revue électronique en sciences de l'environnement* [En ligne], Hors-série 19 | août 2014, mis en ligne le 11 août 2014, consulté le, 2022, 02. URL : http://journals.openedition.org/vertigo/14999; DOI : https://doi.org/10.4000/vertigo.14999
11. Ibrahima SY, KOITA Mouhamadou, TRAORE Doulo, KEITA Moussa, LO Baidy, TANNER Marcel, *et al*. Health and environmental vulnerability in the disadvantaged neighbourhoods of Nouakchott Mauritania): analysis of the conditions for the emergence and development of diseases in an urban Sahelian environment, *VertigO,* 2011, 11. *N°2*. URL: DOI: https://doi.org/10.4000/vertigo.11174
12. TRAORE Kassoum. Living conditions and health risks in the slums of Abidjan, *Revue de Géographie Tropicale and Environnement,* n°2, 2007, 39-56.
13. YAPI-Diahou Alphonse. *Barracks and power in the Abidjan conurbation*, Paris, l'harmattan, 2000, 456.