

Water Resources Management and Health Related Problems in the Commune of Bonou

GONZALLO Germain

Laboratory for the Study of Urban and Regional Dynamics (LEDUR)

Résumé : Dans la vallée de l'Ouémé, le problème d'eau se pose en termes de faible couverture en eau potable et la mauvaise qualité des eaux des sources non conventionnelles auxquelles la population a recours. La présente étude vise à identifier les modes de gestion des ressources en eau et les problèmes sanitaires qui en sont liés dans la commune de Bonou. Les données utilisées pour cette étude sont obtenues à travers la collecte des données, leur traitement et l'analyse des résultats obtenus. Les résultats obtenus montrent que la pluie, les puits, le fleuve et les forages constituent les sources d'approvisionnement en eau dans la commune. En 2012, sur une population totale de 35 556 habitants seulement 10 471 habitants sont desservis en eau potable, soit un taux de desserte communale de 29,5 %. Environ 68 % de la population utilise l'eau du fleuve Ouémé pour les usages domestiques. Cette situation, ajoutée à l'inondation fréquente provoquée par la crue du fleuve Ouémé, expose les populations à plusieurs maladies hydriques.

Mots clés : Bonou, eau, ressource, approvisionnement, santé et maladies hydriques

Abstract: In the Oueme Valley, people do not have adequate access to safe drinking water and the quality of the waters from the non conventional sources is bad. This survey aims to identify the ways water resources are managed and the health related problems that occur in the commune of Bonou.

The data used for this survey has been collected and treated, and the results are analysed.

The results show that rain water, wells, rivers and boreholes are the water supply sources in the commune. In 2012, out of a total population of 35 556 inhabitants, only 10 471 people had access to safe drinking water, i.e. a communal rate of 29.5%. About 68% of the people use the Oueme river water for domestic purposes. This situation together with frequent floods in the Oueme River exposes the local people to several water borne diseases.

Key words: Bonou, water, resource, provision, health and water borne diseases

Date of Submission: 19-12-2017

Date of acceptance: 16-01-2018

I. INTRODUCTION AND JUSTIFICATION OF THE TOPIC

Water is the most crucial natural resource. It makes life possible and sustains the ecosystems and human endeavours. Therefore, water is a strategic resource as well as a fundamental element that is necessary for healthy living (Odoulami, 1999). It is also an essential element for living organisms, especially human life. An adequate provision of quality water contributes to healthy living (WHO, 1992). Only 1 percent of the 1.4 billion square kilometers of water available on the earth is accessible to man (Djidji, 2007). Approximately 3.5 billion people do not have access to sanitary services and waste water treatment (Boko, 2008). The International Community meeting in Mar Del Plata, Argentina, in 1977 decided that the 1981-1990 decade would be the International Decade for safe drinking water and sanitation.

In Benin, an objective was fixed to provide safe drinking water to 80 percent of the population with 60 liters per day for every individual in urban areas and 10 to 20 liters per day for every individual in rural areas (Gaitou, 2010). At the end of that decade, this objective was not reached: only 58 percent of the people were provided with safe drinking water in rural areas against 24 percent in urban areas (Djidji, 2007). Water borne infections, diseases and parasites were still prevalent at the end of that international decade. These diseases are still the main causes of morbidity and mortality in many regions in Benin, especially among the children.

While industries and agriculture are the main causes of water pollution in Northern countries, in sub-Saharan Africa, the risks are mainly due to household and biological factors (Amoussou, 2002). As a matter of fact, in the commune of Bonou as a whole, the management of water resources is inadequate. In that commune, there are severe water shortages during the dry season with a negative impact on the people. Given that surface waters and wells are drying up and that boreholes are not many, people queue up around a few water supply places, which leads to conflicts among them. Thus, the management of natural resources including water is problematic. This study tries to analyse the various ways water resources are managed and their impact on the health of the local people in the commune of Bonou.

II. THE DATA AND METHODS

The methodology consists in gathering data and information, processing the information and analysing the results. The data used within the framework of this survey is:

- Physical data (rainfall levels, types of soil, hydrographic network, landform type, etc.);
- Socio-geographic data (the information gathered on the ground);
- Demographic data (evolution of the population between 1979 and 2012).

2.1 Data Collection Method

Document retrieval and on site investigations are the main stages of data collection. Document retrieval led us to make investigations in specialised institutions documentation centres as well as in libraries, on Internet and other organisations likely to provide information on the topic under review. It made it possible for us to be updated on existing knowledge on issues pertaining to the management of water resources and health problems.

To carry out socio-anthropological investigations, several techniques and tools were used. The itinerary method made it possible to identify the main players, namely peasants, resource persons, etc. Direct observation and interviews made it possible to understand the various ways water resources are managed. MARP (Active Method of Participatory Research) made it possible to gather information from the people and the facilitators as well. This technique was also used to gather information on the people's points of view and the strategies they have developed to overcome the effects of water shortages and health problems. Focus groups of 8-10 people made it possible to check and complement the information gathered during the surveys based on questionnaires. The tools used to collect the data include interview guides, observation checklists, questionnaires and a digital camera. The surveys are carried out in the five administrative divisions (i.e. *arrondissements*) of the commune (namely Bonou, Damè-Wogon, Atchonsa, Affamè, Hounviguè). The villages were selected taking into account available hydraulic works and surface waters. Altogether 23 villages were visited and 276 households were taken into account.

2.2 Data processing and analysis of results

Survey forms were processed manually. The statistical analysis of the data gathered was made with Excel. It was used to consolidate some daily data into monthly and annual data, and then to turn it into tables and graphics. The following formula made it possible to calculate some average parameters.

$\bar{X} = \frac{\sum x_i}{N}$ with \bar{X} : arithmetic average; N : total number of modalities; x_i : the modalities of the feature under review.

The software atlas Gis was used to draw up the maps. The results were analysed with the SWOT model (i.e. Strength, Weaknesses, Opportunities and Threats).

1- Presentation of the area under review

The commune of Bonou is located between 6°72' and 6°95' north latitude and between 2°15' and 2°40' east longitude (figure 1). The size of the land is 250 sq km.

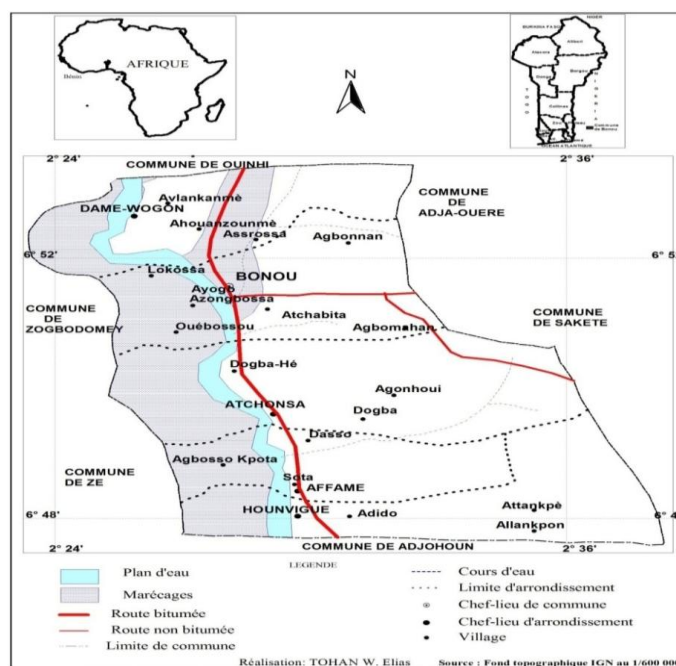


Figure 1: Geographic location of the commune of Bonou

Given its geographical location, the commune of Bonou has a subequatorial climate. The average annual rainfall recorded during the period from 1980 to 2010 is 1134 mm. The maximum monthly rainfall is recorded between June and July. The rainfall can be very low certain years, while it can be abundant in other years. The average temperature varies between 25 and 30°C. The rainfall regime is of the bimodal type with two peaks in June and October. Figure 2 shows the pluviometric variation over several years.

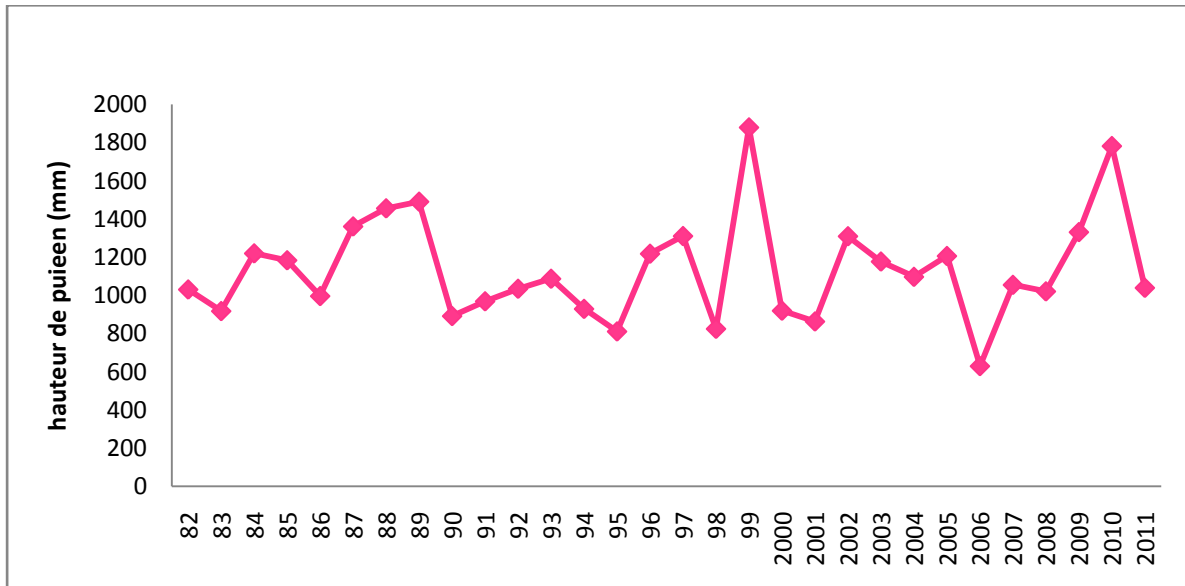


Figure 2: Annual variation of rainfalls in the commune of Bonou from 1982 to 2011

Source: ASECNA, 2012

An analysis of Figure 2 reveals that the evolution of overall annual rainfalls from 1982 to 2011 shows an average of 1134.89 mm. Over this 30 year period, overall pluviometric data is lower than the (17/30) average with a noticeable shortage in 2006 (630 mm). These pluviometric variations seriously hamper the recharge of ground water. This annual rainfall pattern with ups and downs is a matter of concern because rainwater contributes to a large extent to the provision of water to the people.

The Ouemeriver runs through the commune from North to South over 40 km. Its main affluents are Gba, Djougoudou, Gnanhoui, Wovi. These water courses are the main water supply sources in the commune. The commune is made up of various landscapes including flood prone plains and 80 m high plateaux as well as dry and humid depressions (Donou, 2007).

The ferralitic soils on top of the plateau are favourable to annual and perennial crops. The clayish and sandy soils in the alluvial plain are quite rich because of the organic materials that are brought in when the Ouemeriver is flooded. Hydromorphic soils which are difficult to work on are favourable to crops such as rice. These soils have a vegetation made up of herbaceous savannas and savanna trees as well as areas of sacred forest (*gbévozoun...*) (Gaïtou, 2010).

The commune of Bonou is part of the geological unit called coastal sedimentary basin in Benin. In hydrogeological terms, this basin comprises four aquifers including two main ones (continental terminal and cretaceous) and another two (quaternary and paleocene) (Slansky, 1954). The aquifers found in the commune of Bonou are paleocene type calcium, a sheet below the clayey marls lying 2 m underground, and continental terminal sands lying more than 5 m underground.

III. RESULTS AND DISCUSSION

Several types of water supply infrastructures are found in the commune. These include hydrants, the official water supply network, boreholes, wells and superficial waters.

3.1- Safe drinking water supply source

The water supply services have been functional in the commune of Bonou since 1995, the year in which an elevated tank containing 75 m³ and a water distribution network were installed. Water is distributed through hydrants and service pipes. SONEB (the national water company) has put in place only three hydrants in the central part of Bonou in addition to its network which is restricted to the administrative area of the commune. From an initial number of 128 subscribers, the number reached 172 in 1996 and 241 in 2010. In

2012, the number increased to 358. The water supply network is restricted to four areas, namely Bonoucentre, Ayogo, Lokossa and Azongbossa.

In the commune of Bonou, there are two types of FPM. These are AFRIDEV pipe, which is between 10 and 30 meters long, and VERGNET pipe which is between 40 and 70 meters long. There are two artesian boreholes (pictures 1 & 2).



Picture 1: Artesian boreholes with a tap at Atchabita

Picture 2: Simple artesian borehole at Gbefagie

These pictures were taken by Gonzallo in March 2012.

These artesian boreholes provide hot water. At Atchabita, measures have been taken to ensure free flow of water (picture 1), while at Gbefagie, water flows uninterruptedly (picture 2). As a result, the surrounding area is flooded and there are plenty of mosquitoes which cause malaria.

In addition to these safe drinking water sources, there is a village water carriage system (AEV). An AEV is a system comprising an elevated tank, a power generator and hydrants. Figure 3 shows the geographic location and the various places where hydraulic infrastructures are located in the commune of Bonou.

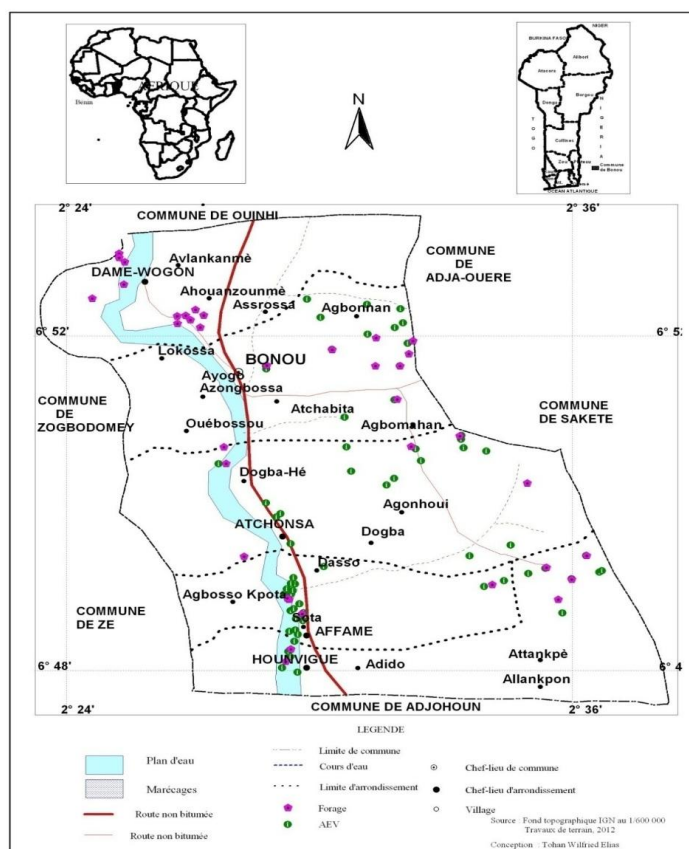


Figure 3: Geographic location and places where hydraulic infrastructures are located in the commune of Bonou.

Figure 3 shows that the commune of Damè-wogon does not have any AEV apart from a few boreholes. Therefore, the local people have limited access to safe drinking water and rely on the river water which is close but not safe. As a result, the rate of water borne diseases is high in the commune. This finding is in conformity with the one that was publicised by Dossa (2013) in the commune of Gangban. Table I shows the rate of the provision of safe drinking water services in the commune of Bonou in 2012.

Table I: Provision of safe drinking water in the commune of Bonou

Districts	Total population	Number of beneficiaries	Service provision rate
Affamè	8 715	2 005	23 %
Atchonsa	7 202	1 153	16 %
Bonou	9 336	4 295	46 %
Damè-Wogon	5 881	1 824	31 %
Houinvigüé	4 422	1 194	27%
Total	35 556	10 471	29,5 %

Source : Water works office in Ouémé, 2012

This table reveals that in 2012, out of a total population of 35, 556 inhabitants only 10, 471 people were provided with safe drinking water, i.e. a communal rate of service provision of 29, 5%. This rate shows that the people of Bonou have difficulties in getting safe drinking water. These difficulties are more noticeable in the districts of Atchonsa (16%) and Affamè (23%) which are not adequately provided with safe drinking water.

3.2 Other sources of water supply

The lack of safe drinking water supply sources in the commune prompts the local people to use well water and surface water to meet their domestic needs (drinking, cooking, washing, etc.). Table II shows the places where wells are located in the area under review.

Table II: Location of wells in the commune of Bonou

Districts	Traditionalwells	Autonomous Water Spot (PEA)	Modern wells
Affamè	3	14	00
Atchonsa	16	3	1
Bonou	9	7	2
Dame wogon	4	16	00
Houinvigüé	00	4	00
Total	32	44	3

Source : Field work, March 2012

This table shows that the districts of Atchonsa and Bonou have 50% and 28.1% of available traditional wells respectively. There is a proliferation of private PEAs in the rural districts of Bonou because they do not have enough safe drinking water works. The private PEAs and the three modern wells contribute to some extent to meeting the rural people’s water needs.

In Bonou, surface waters comprise only the Oueme River and swamp waters which are currently called “*Tohé*”. These are found in Bonoucentre (Tovo, Agbonan and Houebossou), Affame and Dame-wogon. These water resources are free of charge. They are an important source of provision of drinking water. As a matter of fact, in Bonou, local people use the Oueme River water to meet their various needs including drinking, washing, etc. This is due to the fact that there is a lack of safe drinking water spots in the commune and particularly in rural districts. The river water is responsible for diarrhoea cases in the commune.

It was obvious that the behaviour patterns of local people pollute the river water that they use for drinking and cooking purposes. Since the people know that the water that they use for cooking purposes is boiled at a high temperature, they do not worry about its quality. In Bonou, the people do not mind cooking with river water which is currently called “*Wogbo*”. However, even in the areas like Bonoucentre where there is a safe drinking water carriage system, the peasants still use river water which is polluted and not proper for human consumption. Kossou (2011) also indicated that the people of Ouinhi use Oueme River water to meet household needs (i.e. drinking, cooking, washing, etc.) although boreholes are available. According to Zannou (2009), this behaviour is due to sociological habits.

3.3 – Purposes for which water resources are used

3.3.1 – Water is used for household chores

In Bonou, every household gets water from a source that is affordable and most appropriate, according to them. Figure 4 shows how often some water resources are used to meet household needs.

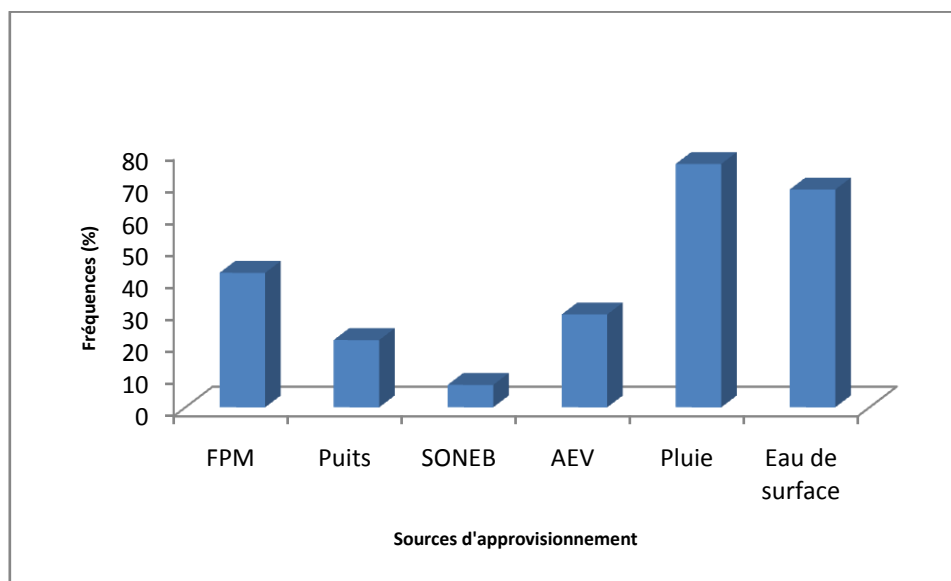


Figure 4: How often the various safe drinking water supply sources are used

Figure 4 shows that rain water, surface water and FPM are used by 76%, 68% and 42% of respondents respectively. Only 29% and 7% of respondents use both AEV and SONEB water for domestic purposes. Thus, access to safe drinking water is a challenge in the commune. This finding confirms that of Olyinde (2012) who showed that the rate of access to safe drinking water is very low in the Oueme Valley. This prompts local people to use river water to meet their needs. Therefore, they are exposed to several water borne diseases. River water is abundantly used by the people. They wash clothes and dishes, and bath in these water sources(board 1).



Board 1: (a) people washing clothes on the bank of the river in Bonoucentre(b) a woman is caught defecating in the Oueme River at Adokota (Bonoucentre).

Picture taken by: Gonzallo, May 2012

These pictures show clearly that these women pollute the water that would soon be used for cooking and drinking purposes.

3.3.2 – Water used for economic activities

Water is not only used to meet domestic needs but also and more importantly to develop economic activities. Agricultural production is the main economic activity in the commune. In the alluvial plains, tomato, pepper, okra and groundnut are grown. In November when the water recedes, the river banks are prepared and ridges are formed for crop production (picture 4).



Picture 4: Agricultural activities on the banks of Oueme River in Bonou

Picture taken by: Boko, 2008

As shown in picture 4, this practise accelerates the filling and the pollution of water courses and exposes the banks to erosion.

Fishing is an important activity in Bonou. Fishing techniques and the engines used expose the river to pollution. During the dry season, some fishermen collect river sand in a bid to increase their incomes. The sand is collected in a traditional manner in the river bed. This activity is on the increase because it is forbidden to collect marine sand.

Palm oil production is an activity which requires a lot of water. Thus, in order to overcome the water shortages, some palm oil producers go directly to the riverside to fetch water more easily. That's what you can see in picture 5.



Picture 5: A woman carrying out an activity on the bank of the river at Damè-wogon

Picture taken by: Gonzallo, March 2012

It was noticed that in the course of their activities, women throw debris of palm nuts in the water course. In the end, they wash their containers in the river. These practises pollute the water courses in the commune of Bonou. It is clear that economic activities contribute to polluting water courses.

Adjadjo (1998) studied the management of water resources and the sanitary problems in Bantè, and noted that the main source of water pollution is the development of economic activities as is the case in the commune of Bonou. The use of this water by the people exposes them to water borne diseases.

3.4- Water related pathologies in the commune of Bonou

Water borne diseases are the causes of infant mortality in the commune. There are two kinds of water borne diseases in the commune. There are some diseases which are related to the water they drink and other diseases that are due to the fact that they are too close to the river water.

Diarrheal diseases are a major public health problem in tropical areas and are among the main causes of infant mortality. Diarrhoea is transmitted when people drink water contaminated by human feces, dirty hands or unprotected containers. Diarrhoea can also be transmitted to people who eat food that was contaminated while it

was being cleaned or watered. Figures 5 and 6 show the evolution of cases of fever causing diarrhea and cases of diarrhea resulting in dehydration in several districts in Bonou from 2007 to 2011.

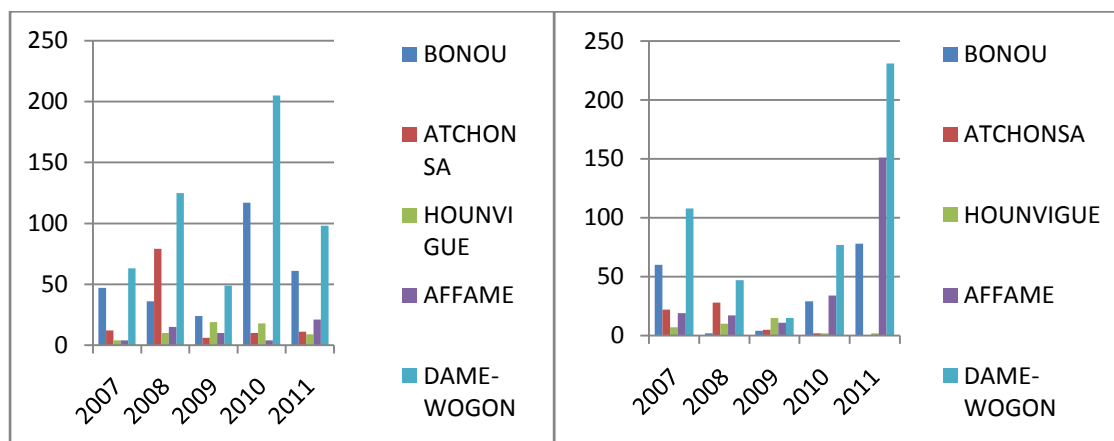


Figure 5: Evolution of fever causing diarrhea at Bonou **Figure 6:** Evolution of cases of diarrhea causing dehydration

Source : DDS/OUEME, 2012

Damè-Wogon and Bonoucentre are the districts where there were more cases of diarrhoea in five years because they are close to Oueme River.

Guinea worm disease is an infection that is caused by parasites. It is transmitted to people when they drink water infected with cyclops and larvae. Figure 7 shows the evolution of the disease in the districts of Bonou.

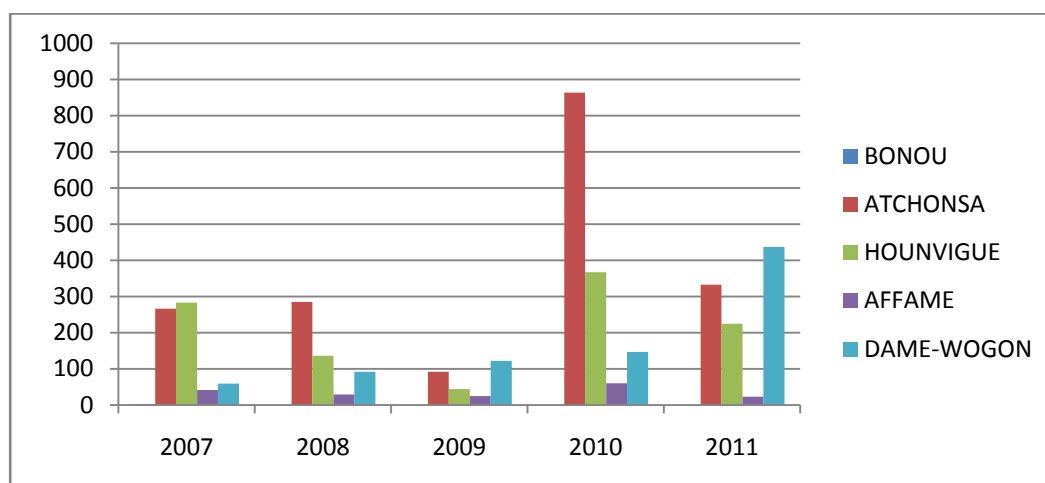


Figure 7: Evolution of guinea worm cases

Source: DDS/Ouémé, 2012

This figure reveals that this disease is more prevalent in the districts of Atchonsa, Hounvigue and Damè-wogon. The villages located alongside Oueme River are the most exposed. From 2007 to 2011, the district of Damè-wogon recorded more and more cases of guinea worm, i.e. 59 cases in 2007, 92 in 2008, 122 in 2009, 147 in 2010 and 437 in 2011.

Skin diseases (dermatosis) are due to a skin allergy. The main one is (buruli)ulcer which is caused by an infection by *Mycobacterium ulcerans*. This disease is widespread in the commune of Bonou because the local people wash themselves in the river water. Table III shows cases of (buruli) ulcer in the commune of Bonou.

Table III: Evolution of cases of (buruli) ulcer in the commune of Bonou

Years	Ouemeregion	Commune ofBonou
2007	170	71
2008	154	59
2009	106	44
2010	80	31
2011	86	30

Source: CDTUB/Pobè, 2012

From 71 cases of (buruli) ulcer recorded in 2007, the commune of Bonou noted that 30 people suffered from buruli ulcer in 2011. The decrease recorded since 2007 in the commune is due to the presence of the CDTUB (Centre for testing and treatment of buruli ulcer) – Raoul & Madeleine Follereau in Pobè. This centre not only provides free treatment but it also carries out sensitisation activities among the people. Board 1 shows the manifestations of buruli ulcer on the human body.



Board 2 : Manifestation of Buruli Ulcer on the human body

Source : Centre for testing and treatment of Buruli Ulcer in Pobè

The commune of Bonou is exposed to several water borne diseases. This situation is due to several factors including a lack of access to safe drinking water by the people, frequent floods of the Oueme River, the use of river water for several purposes (including drinking, cooking, toilet, washing, etc.). These water borne diseases have adverse consequences on the socioeconomic conditions of the people.

IV. CONCLUSION

Water management in the commune of Bonou depends on the various needs of the local people. Water is used for two main purposes, namely domestic (drinking, washing) and non-domestic (agricultural, breeding and others).

The places where people have access to water are diverse and are not many in the commune of Bonou. These places are poorly managed. The lack of places where people can have access to safe drinking water prompts them to use water courses' water for domestic purposes. This causes various diseases recorded in the commune. More than 50% of the diseases recorded in this commune are water borne, according to the Bonou health centre's statistics. These results are in conformity with those achieved by Gaïtou (2010) and Dossa (2013) who studied the problems related to safe drinking water consumption in Bonou district as well as the socioeconomic impacts of floods in Gangban district.

These evils have an adverse impact on the meagre incomes of the people. Thus, water borne diseases are serious constraints which threaten the socioeconomic development of the commune. It is necessary to take prevention and control measures within the framework of an integrated system of water management to curb diseases and risks related to water.

BIBLIOGRAPHY

- [1]. ADAM K. S et BOKO M. (1983) : Le Bénin. Edition EDICEF, Cotonou SODIMAS, 95 p.
- [2]. ADJADJO A. J-M. (1998) : Gestion des ressources en eau et problèmes sanitaires dans la sous-préfecture de Bantè. Mémoire de maîtrise de géographie, DGAT/FLASH/UAC, 110 p.
- [3]. ADJAMONSI P. (1994) : Qualité de l'eau et problèmes de santé à Cotonou. Mémoire de maîtrise en géographie, FLASH/UAC, 107 p.
- [4]. AMOUSSOU C. J. (2002) : Gestion des ressources en eau en pays Ouatchi : genre et approvisionnement. Mémoire de maîtrise de Géographie, FLASH/UAC, 92 p.
- [5]. ANATO L. (1983) : Approvisionnement en potable et assainissement de base dans la commune de Comé en RPB. CRDS, UNB, OMS, 86 p.
- [6]. AZONNAKPO O. (2005) : Approvisionnement et gestion des ressources en eau dans la commune de Pobè. Mémoire de maîtrise de géographie, FLASH/UAC, 92 p.
- [7]. BOKO S.Y.W. (2008) : Gestion communautaire des ressources en eau et conflits d'usage dans la basse vallée de l'Ouémé. Mémoire de DESS option environnement- Santé - Développement, UAC/CIFRED/PROJET OUEME-2025, 106 p.
- [8]. COULIBALY M. A. (2005) : Gestion des ressources en eau et risques pathologiques dans les Dallol, Maouri et Fogbha (Niger). Mémoire de DEA, FLASH/UAC, 107 p.
- [9]. DGH (2005) : Stratégie nationale d'approvisionnement en eau potable en milieu rural du Benin, 2005-2015. Cotonou, 20 p.
- [10]. DJIDJI D. (2007) : Problèmes d'approvisionnement en eau potable des populations dans l'arrondissement de Toviklin. Mémoire de maîtrise en Géographie, FLASH/UAC, 95p.
- [11]. DONOU B. T. (2007) : Dynamique pluvio-hydrologique et manifestation des crues dans le bassin du fleuve Ouémé à Bonou ; Mémoire de maîtrise de géographie, FLASH/UAC, 106 p.
- [12]. DOSSA A. M. (2013) : Impacts socio-économiques des inondations dans l'arrondissement de Gangban (commune d'adjohoun). Mémoire de maîtrise de Géographie, FLASH/UAC, 78 p.
- [13]. FAGNON B. (2003) : La question de l'eau potable et la gestion des équipements hydrauliques dans la commune de Djacotomey. Mémoire de maîtrise, DGAT/FLASH/UAC, 120 p.
- [14]. GAÏTOU J. Y. (2010) : Problématique de la consommation d'eau potable dans l'arrondissement de Bonou commune de Bonou, Mémoire de Maîtrise en géographie ; UAC/FLASH, 94 p.
- [15]. IDIETI M. E. (2004) : Les ressources en eau et leur gestion par les communautés rurales de la commune de Boukoubé (Nord-Ouest du Bénin). Mémoire de maitrise, FLASH/UAC, 116 p.
- [16]. ODOULAMI L. (1999) : Approvisionnement en eau potable dans les grandes villes du Bénin : Quelles politiques pour l'avenir ? Cas de Cotonou, Porto-Novo et Parakou ; Mémoire de DEA, FLASH/UAC, 56 p.
- [17]. OLIYIDE F. (2012) : Problématique d'hygiène et d'assainissement en milieu lacustre : cas de la commune des Aguégoués. Mémoire de maîtrise en Géographie, FLASH/UAC, 82 p.
- [18]. OMS (1992) : Directives de qualité pour l'eau de boisson. Volume 1, recommandation, Genève, 192 p
- [19]. OPKEICHA O. (1981) : Le problème de l'alimentation en eau de la ville de Pobè. Mémoire de maitrise de géographie. ENS, Porto-Novo, 84 p.
- [20]. SLANSKY M. (1954) : Etude géographique et hydrologique du Bas-Dahomey, DFMG Gouvernement Fédéral de l'AOF, 270 p.
- [21]. ZANNOU S. (2009) : Gestion endogène des ressources en eau dans la commune de Sakété. Mémoire de maîtrise de Géographie, FLASH/UAC, 79 p.

GONZALLO Germain "Water Resources Management and Health Related Problems in the Commune of Bonou." IOSR Journal of Humanities and Social Science (IOSR-JHSS), vol. 23, no. 1, 2018, pp. 36-45.