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Research Article

The question of waste management in the commune of Malanville in Bénin: What strategies to reduce risk diseases?

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Abstract

The populations of Malanville produce various wastes whose management affects human health in the commune. This study identifies and analyzes the waste management options in the commune of Malanville and analyzes the health impacts. The methodology used includes desk research, direct field observations, interviews with resource persons and surveys 189 households identified from the method of Schwartz. The epidemiological, demographic data and sanitary socio collected have been treated and have been analyzed with the PEIR model. The gotten results show that the commune of Malanville is characterized by the insufficiency of points of regrouping, the non-existence of a final discharge site appropriate and of treatment of the garbage. About the populations, 18 % of the households investigated incinerate their garbage, 10 % bury them in the soil and 60 % reject their garbage in the nature. Only 12 % of the households investigated subscribed to the service of meadow collection of the garbage. Most households pour their worn-out waters in the courses of house and on the public roads and around. Also, 50 % of the populations investigated defecate in the nature. It comes from those modes of wastes management used by the populations of that the most are incompatible with the environment principles. The shortcomings of those modes are the cause of 65.92 % of case of malaria, 16.47 % of case of acute respiratory infections... Face this situation, it is urgent for the authorities and the populations of the Malanville to develop the transformation of solid wastes into energy usable and others goods and waste water treatment strategies for the maintenance and sustainable environment and the good health in the commune of Malanville.

Keywords: *Benin, Malanville, wastes management, unhealthy environment, diseases.*

Introduction

In the world, namely in many countries of Africa, the wastes management becomes very hard. This difficulty creates the proliferation of infections. Most of those infections affect and cause sometimes the death to human being are bound to the lack of hygiene of basis (Djossou, 2007). In fact, the insufficiencies in the solid wastes and wastes water and namely human excrements management and also in the urban environment maintain shock human being in Africa (AdéwietDubreuil, 2012). This situation becomes a challenge for politicians, stakeholders, organizations or scientific community who are thinking on the strategies that will be used to limit enormous ravages of pathogenic illness due to the bad wastes treatment (Dongo et *al,* 2008).

In Benin and particularly in the city of Malanville, some strategies were improved by projects or by NGO (BETHESDA/DECAM) to reduce the wastes proliferation in the city of Malanville. But those strategies as the construction of the public latrines and the collection of garbage were not conclusive due to the weak conscience of the population on the hygiene and also to the weakness in the politics used by the communal authorities in the salubrity way (Osseni, 2008). Those defects affect the water resources quality used by the populations. The bad quality of water is the main reason of the illnesses as: diarrhea, dysentery, cholera, typhoid fever, malaria worm of guinea, onchocerciasis, schistosomiasis, viral hepatitis, etc. (CREPA-Benin, 2011). Face this situation; it is indispensable to provide adequate sanitation in the wastes and feces management for maintaining the Malanville city in cleanliness.

Malanville city is located in Alibori department between 11°30' and 12°30' of north latitude and between 2°43' and 3°20' of east longitude. It is limited at the north by the Niger River, to the south by cities of Kandi and Ségbana, to the west by the city of Karimama and to the east by the Federal Republic of Nigeria (figure1). It covers 3016 km^2 and counts 20 villages and 12 districts distributed in the five precincts of the commune of Malanville: Malanville city, Garou, Guéné, Madécali and Tomboutou (Afriqueconseil, 2006).

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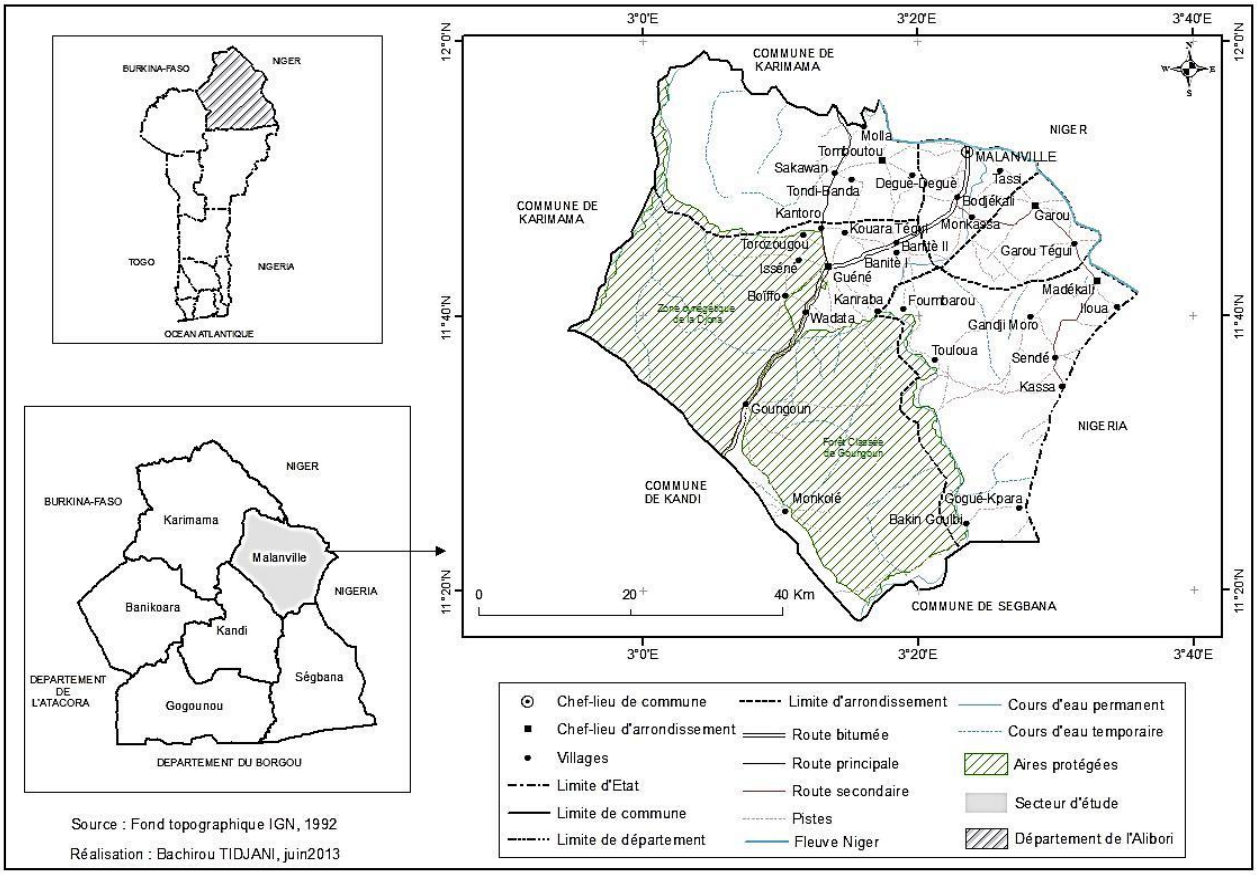


Figure 1: Geographical and administrative situation of the commune of Malanville

1. Data and methods

Several types of data have been used in the study. those data concern the state of salubrity of the environment: presence or not of the heaps of the garbage, the worn-out waters and the practices of hygiene of base in the household as well as the strategies developed by the populations to reduce the vulnerability to the pathologies; epidemiological data regrouping the main affections of which endure the populations in the city of Malanville and demographic data as well as the strategies developed by the populations to reduce their vulnerability to the pathologies; epidemiological data regrouping the main affections of which endure the populations in the city of Malanville and the demographic data of the last census of the population of the year 2013 of the city of Malanville.

Also, 189 households are investigated. The choices criteria are the following: to be chief of household or to have a household, understand the present system of management of domestic garbage, to be available to answer the questions, to have lived in the locality during at least the last ten years.

The number of households interviewed in every village has been determined by the formula of Schwartz (1995) from the following protocol statistical:

$$\beta = Z\alpha^2 \times pq/i^2$$

With: **β** = size of the sample; **Zα = 1.96**: this gap reduced correspond to a risk **α** of **5%**; **p = n/N** with **p** the proportion of the agricultural households of the city; **n** = number of agricultural households by locality; **N** = total number of agricultural household in the commune; **i** = precision wanted equal to **5%**;**q = 1 – p**; **β = (1.96)2 x p(1-p)/0,052**.

To complete the information gotten by investigation, 10 people resources (the mayor and the head of borough, the persons responsible of the management of the market and the station, the persons responsible of the DECAM-Bethesda) have been interviewed.

Also, the surveys of physical characterization of the wild solid wastes and domestic solid wastes were done on fifty households distributed on the five boroughs of the commune of Malanville. That has permitted to recover the garbage produced in order to determine the proportions of the various components.

The collected data were statistically and graphically treated and presented as diagrams or as table's crusaders under the software Excel 2007.

To make the diagnosis of the middle, the model Pressure, State, Impacts and Answers (PEIR) has been used. This model permitted to analyze the pressure of the demographic growth on the management of the garbage in the city of Malanville on the one hand and on the other hand to value their impacts on the health of the populations in order to bring some answers to

these problems. The gotten results present themselves as follows.

2.Results and discussion

In the city of Malanville, several types of garbage are produced by the populations in full growth.

2.1. The demographic dynamics, factor of production of the garbage

From 67387 inhabitants in 1992, the population of the city of Malanville has passed to 101628 inhabitants in 2002 and to 168 006 inhabitants in 2013 (INSAE, 1992, 2002 et 2013) either a rate of growth of 4.57 % in 2013 against 4.19 % in 2002. This demographic growth observed in the city of Malanville is also observed in others boroughs (figure 2).

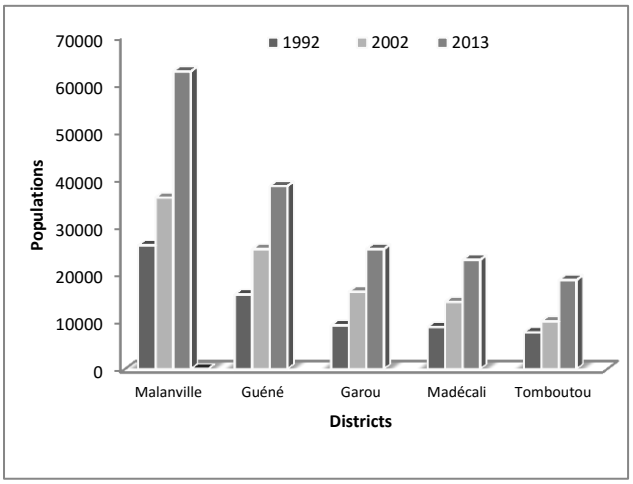


Figure 2: Evolution of the population by borough in the commune of Malanville from 1992 to 2013
Source: INSEA, 2013

The figure 2 presents the population growth in the commune of Malanville. From 1992 to 2013, the populations of the five boroughs of the commune of Malanville had an evolution. Malanville and Guéné boroughs were more populated than others. This demographic growth has some consequences on the management of the garbage in the commune and particularly in the city of Malanville.

2.2. Types of solid domestic wastes in the commune of Malanville

The most of solid wastes produced in the commune of Malanville come from the domestic activities, from the markets, from the two taxis stations and the solid wastes thrown in the commune (Vigninou*et al,* 2012). The component of those garbage are constituted of various matters (figure 3).

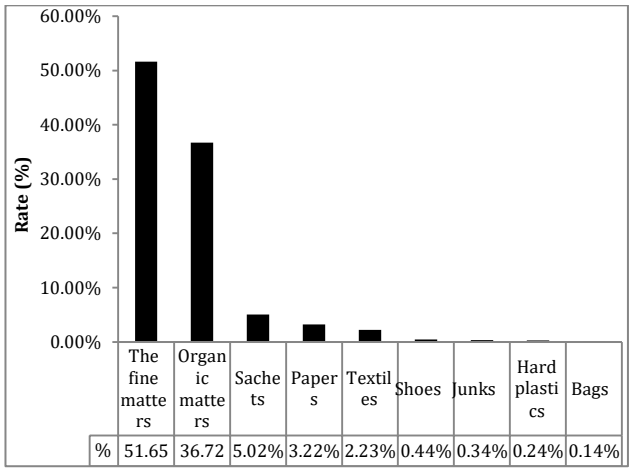


Figure 3: Composition of solid wastes wild and domestic in the commune of Malanville
Source: Result of investigation, December 2012

The figure 3 presents the composition of the wild and domestic garbage in the commune of Malanville. The fine matters (essentially of the sand) predominate with 51.65% of the total weight of the garbage received to the point of regrouping. The quantity of the gritty sand is important in the garbage; that fact is due to the techniques of sweep and of the pickup of the garbage used.

Afterwards, there are the biodegradable organic matters that represent 36.72%. So the garbage of Malanville is constituted of different matters that come from the households and from the different actors in the commune. It is noteworthy that the amount of garbage removed by the refuse collection service is less than the amount handled in the households of the commune of Malanville. But there are different techniques of solid wastes used in the commune of Malanville.

2.3. Methods of management of the domestic solid wastes in the commune of Malanville

There are many techniques used in the solid wastes management of the commune of Malanville. It concerns three traditional methods and a modern method: there are the rejection of garbage in the nature, the burning of the garbage, the burying of the garbage and the subscription to a structure of management of the garbage.

2.3.1. Traditional management methods of solid wastes in the commune of Malanville

- Garbage rejection in the nature

The shallows constitute the spaces of the rejection of the garbage. This method is used by 60% of the households investigated. The populations of the districts like Wollo use this method for filling their shallow spaces. The embankment of the marshes and the natural outlets blocks the drainage of the pluvial

waters toward the Niger River and the Sota River. It is important to add that those wild dumps of garbage of those shallows spaces are frequented by the children. There are thus exposed to illness (photo 1).

Photo 1: Heaps of garbage near homes in Wollo Shooting: Tidjani, December 2012

The photo 1 shows a dump plain around the habitations. That shows the weakness of the hygiene of base of the populations. But this fact exposes them to illnesses. It is important also to note that each district of the city of Malanville possesses of wild garbage dumps according to the availability of the empty space. Those wild garbages are used also as the place of ease for the households that don't have the latrine at home. The others methods are used also in the commune of Malanville.

- Burning and burying

The methods used here in the commune are the burning or burying in soil of the solid wastes. Thus, 28% of the households investigated burned their domestic garbage in a corner of the house. The rest of households usually buries their garbage in a hole dug in the concession. It should be noted that the practice of cremation is also observed in wild dumps. Thus, all garbage is burned mainly before and after the rainy season. These traditional practices are not appropriate for the environment principles because they contribute to polluting the shallow water table in the commune of Malanville. At those traditional practices waste management, it is important to management adds modern collection method. it is important to note also the modern technique used in the commune of Malanville.

2.3.2. Description of the modern system of solid waste management in Malanville

The current system for managing solid waste and household waste in the commune of Malanville is based on the traditional three steps namely pre-collection, collection and treatment. The method of waste management has emerged Malanville with the Municipal Association of Environmental Action (AMAE) in 2000. The principal activity of this association is the pre-collection of solid waste from houses with garbage carts through 300 FCFA/ household/month.

The garbage grouped by locations in neighborhoods are transported to Madécali for their incineration. After decentralization, AMAE equipments were transferred to the municipality. Several NGOs and associations have been created in this domain. It is the Association of Women Actions and Progress (AFAP) in 2001, the NGO-n'zéSabu in 2002, the NGO in 2004 Amabori, ...
All these structures have made their experiences in waste collection mules pulling carts or human, etc. But the results are not satisfactory because the piles of rubbish increased face their inefficient equipments. But since 2005, the NGO DECA-Bethesda settled in the commune of Malanville. The activities of the latter NGOs have evolved and in total 1,125 houses have subscribed. However this number hides more subtle and difficult realities. Indeed, only a part of the city of Malanville enjoys their performance. The subscription situation to the pre-collection in the districts arose in 2011 is shown in table I.

Table I: Situation of the houses subscription in Malanville city in 2011

District /sub district	Housesoccuped	House subcribers	Non subscriberhouses
Galiel	148	46	102
Tassi-Tedji 1	370	10	360
Tassi-Tedji 2	423	286	137
Tassi-Tedji 3	427	274	153
Tassi-Tedji 4	387	10	377
Tassi- zenon	92	70	22
Wollo	607	10	597
Woro-yessou	214	79	135
TOTAL	**2668**	**785**	**1883**

Source: DCAM, antenna Malanville, 2011

This table shows that a few house numbers were subscribed to the pre-collection system. This fact is due to the rural characteristics of a part of the city and but also to non arrangements of the ways between most houses. The portion of the city that is covered represents less the 2/3 of the total of the city. Besides, in the covered districts, the adherence is not even total as the shows the table II.

Table II: Situation of subscription by zone in Malanville

Zones	Housesinhabited	Housessubscribers	Houses non subscribers
Zone 1	315	263	52
Zone 2	768	320	448
Zone 3	528	420	108
Total	**1611**	**1125**	**608**

Source: DECAM Malanville, 2012

The table II shows the subscription situation in the commune of Malanville. Thus 2219 on all houses in the commune of Malanville are not in the system of the pre collection against 1125 houses that are in the system. On the three zones, only the zone 3 has the high number of subscribers. Many households resist to the subscription at the pre collect system. That is the main cause of the persistence of the proliferation of wild garbage dumps in the commune despite their destruction sometimes.

However, the solid wastes collected are regrouped. Three sites of point of regrouping are retained in Malanville. But, for the moment, only one is used. It receives the quasi-totality of the garbage removed of the households by the collectors.

The Town hall of Malanville has a tractor that served during some years to the evacuation of the garbage out of the city. But currently, this tractor is in breakdown. Consequence, the transfer of the garbage of the point of regrouping toward the discharge makes itself with the help of the trucks rented by the beneficiaries of service.

2.4. Methods for wastewater management in the commune of Malanville

In the commune of Malanville, the sewage systems suffer from shortcomings. These shortcomings are related to lack of sanitation. Only the most affluent households have wells for the disposal of wastewater. Most households dump their wastewater into being home and on roadways (photo 2).

Shooting: Tidjani, December 2012

Photo 2: Traditional drainage toilet system at ZenonTassi 1

The photo 2 shows the method of removing water from toilet at ZenonTassi. A hole is made in the bottom of the fence of the house to the evacuation of gray water outward. It is a unhealthy situation in the environment. In addition, the sedimentation of the wastewater residue is followed by putrefaction favored by aerobic conditions and the temperature of the locality. During warmer months, the temperature ranges between 37.63 °C and 38.60 °C. The dry months record temperatures between 18.20 ° C and 16.43 ° C. This thermal environment accelerates the decomposition of mostly biodegradable trash wastewater discharged into the streets ... It gives off foul odors, the proliferation of larvae and insects and mosquitoes, pathogens and toxic inorganic pollutants harmful to human body. This bad situation leads to examine the methods of managing faeces in the commune of Malanville.

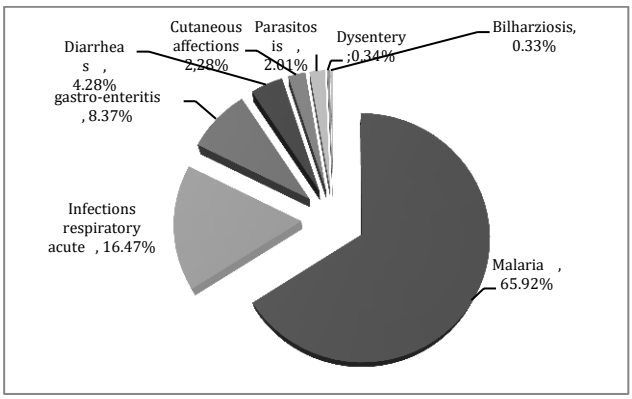
2.5. Methods of excreta management in the commune of Malanville

A survey conducted in 2011 by the NGO DECAM-Bethesda in Malanville city revealed that only 34% of the population has access to a latrine. Overall, the nature, the empty lands, the rice schemes are for the most lavatories used primarily in the old quarters of Malanville city. According to the households surveyed it appears that four modes of evacuation of faeces are used in Malanville commune.

So, the excreta management is traditionally. But, given the sandy nature of the soil and aquifer shallow groundwater (Vigninou *et al,* 2012), the latrines are filling up fast. Such excreta management has negative consequences on the health of the population users who use at 80% well water for household needs.

2.6. Impacts of waste management methods on the health of populations

In the commune of Malanville, households rely primarily water wells or rivers (Sota, Niger) for their needs. So when it rains, feces, household waste, waste batteries containing mercury and lead, which are highly toxic, sewage, etc. are carried by runoff and seep into the ground. This promotes the migration and dispersal of pathogens (bacteria and viruses) and toxic organic chemicals that contaminate groundwater (figure 4).



Source: Survey results, 2012

Figure 4: Frequency of affections recorded in hospital area in Malanville

Figure 4 shows that malaria dominates with 65.92% of cases. It is distantly followed by 16.47% of cases of

acute respiratory infections. It should also be noted that 92.02% of the cases of diseases recorded in Malanville area hospital in 2012 are inadequate basic sanitation. In short, poor waste management affects the health of populations. This situation is not unique to the Malanville commune. Odoulami (2013) showed that the production of waste in the city of Cotonou in Benin exceeds the capacity of waste disposal by those municipal authorities. The techniques used to diminish the increasing wastes in Cotonou city are the techniques recycling and recovery of waste shall be adopted by the people and the municipal authorities. Such a technique is also adopted in the city of Ouidah where recycling usable objects on assembly points and resale is also organized within the population (Odoulami *et al*, 2013).

In the commune of Malanville, waste recovery is not so much a reality. The local authorities should boost the sector of waste management in the commune in taking account of the prerogatives assigned to them by Act No. 97-029 of 15 January 1999 on the communes organization in the Republic of Benin, which stipulates in Article 93 that "the town is responsible for the collection and treatment of solid waste other than industrial waste."

2.7. Measures against the unhealthiness in the commune of Malanville

The solutions to the growth of the population must passed by their education to their subscription to services of the pre - collection of the solid wastes, the observation of the hygiene rules in the consumption of drinking water; the education of the people on the usual methods of disinfection of well water; the extension the network of SONEB and the households encouragement to subscribe to SONEB to avoid contraction of water borne diseases.

The best management of excreta disposal passes through the transformation of those wastes into the compost used in agriculture without any danger to human health. Also, communal authorities, the associations and NGOs may help in building public latrines like Ecosan latrines in sufficient numbers for the populations of the commune of Malanville. Those latrines are very adapted to floodable areas.

Also, those different wastes: domestic wastes, trading and others wastes, human and animals excreta, ... and the alga of phyto-epuration may be mixed for be a source of the energy usable in all households of Benin like that is done already in some households. Likewise, the solid wastes biodegradables are also transformed into the energy after their transformation in Benin. The non biodegradables solid wastes like items plastic are transformed to household goods, garment.

Conclusion

This study allowed describing and analyzing the current systems of waste management in the municipality of Malanville. The increase in the population of the municipality of Malanville causes multiplicity generating activities of solid and liquid waste. The increase in the population of the municipality of Malanville causes multiplicity generating activities of solid and liquid waste.

Despite the removal of municipal solid waste per household subscribers' structures pre-collection, solid waste is proliferating, are found in wild dumps, on public roads, dumped on empty lots, etc. For cons, the wastewater is discharged mainly on public roads. Thus, these wastes create unsafe in Malanville city and are a source of environmental degradation in general and affect the health of the population. To reduce these impacts, measures have been proposed. This is the subscription structures pre-collection and cleaning of excreta by the Ecosan latrine. This treatment purifies environmentally commune Malanville and better protects the components of the environment.

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