



Potable Water Scarcity and Options for Effective Provision in Limbe Municipality, Southwest Region, Cameroon

Emmanuel Nong Buh^{1*}, Roy Lyonga Mbua¹ and Ukah Bonaventure Ngong¹

¹Department of Environmental Science, University of Buea, Cameroon.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JGEESI/2021/v25i630290

Editor(s):

(1) Dr. Pere Serra Ruiz, Universitat Autònoma de Barcelona, Spain.

Reviewers:

(1) Abdul Hameed M. Jawad Al Obaidy, University of Technology, Iraq.

(2) Nikola Kranjčić, University of Zagreb, Croatia.

(3) Abuzar Ghafoor, Sichuan Agricultural University, China.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/70429>

Original Research Article

Received 02 May 2021

Accepted 08 July 2021

Published 14 July 2021

ABSTRACT

Continuous potable water scarcities in Limbe municipality if not well manage and ensure a regular provision of it may lead to many disastrous consequences to the massive growing population of this municipality. Lack of safe drinking water is a severe crisis in Limbe and Cameroon due to poor management strategies employed by the water management bodies involved. The study investigated the implications of water scarcity in Limbe municipality and the options for effective provision of potable water. A questionnaire survey was carried out. About 300 questionnaires were administered in three localities of Limbe to investigate the present status of water scarcity and its impacts on the local communities. The results show an increasing rate of potable water scarcity in the municipality. About 51% of the respondents indicated that inadequate storage facilities are the main caused of water scarcity in the town. In contrast, 26% and 23% of the respondents indicated that inadequate technology and low level of education are other reasons contributing to potable water scarcity in Limbe municipality. Many people in the municipality depend on untreated water sources, resulting in the contraction of many diseases like dysentery and diarrhea as prime waterborne health risks. We suggest options like installing large water safety tanks in all the localities of Limbe municipality. Furthermore, implementing a joint monitoring team to ensure that

*Corresponding author: E-mail: emmanongbuh@gmail.com;

effective potable water treatment and supply is being done and the bodies involved in water management like the Cameroon Water Utilities Corporation (CAMWATER) need to initiate a platform for multi-stakeholder dialogue, networking and social learning essentially for building trust on how to manage potable water supply in the municipality better.

Keywords: Potable water scarcity; implications; storage facility; options for effective provision.

1. INTRODUCTION

Although water covers the highest percentage of the whole world, global fresh or potable water supplies are coming under increasing pressure causing many to resort to untreated water sources. This situation in Limbe south west region of Cameroon is getting worst as potable water scarcity remains a greater problem with the continuous influx of people in the town. Couple with the increasing diseases like corona virus, dysentery, and typhoid fever, an improvement in the increasing diseases like coronavirus, dysentery, and typhoid fever, potable water management is urgently needed. They were, taking into consideration the sustainable development goals as another option for better management, and supplying potable water to all without compromising the future needs, educating, training and sensitizing the public on the importance of potable water resources in the town.

Increasing water scarcity could have a major impact on the world's ability to feed its growing population [1]. One resource that directly impacts human community sustenance is water for the multifunctional role it plays in human metabolism and dynamic ecological equilibrium. Ancient civilizations may have dispersed or collapsed under extremely dry conditions. There are indications that the same may hold for modern societies [2] and even those emerging within the Western Highland areas of Cameroon.

About 3 million people die from water-related diseases every year, the majority of whom are Children under the age of five [3]. Shaw and Thaitakoo [4] reported that approximately 1.1 billion people in the world do not have access to safe water.

Currently, some 30 countries are considered to be water-stressed, of which 20 are absolutely water scarce. It is predicted that by 2025, the number of water-scarce countries will likely approach 35 [5]. It has been estimated that one-third of the population of the developing world will face severe water shortages by 2025 [6].

The threat to water resources has brought into focus the urgent need for planned action to manage water resources effectively as it is widely acknowledged that water is a major limiting factor in socio-economic development. The United Nations (UN) in their Millennium Declaration draws attention to the importance of water and water-related activities in supporting the development and eradicating poverty [7].

Inadequate water supplies for drinking, bathing, and farming are not only a current problem but also would accelerate difficulties for the world's growing population in the future [8].

This situation is particularly distressing for the coastal population because they rely heavily on surface water (ponds and rivers) and groundwater (tube wells) for drinking [9]. As a consequence, the coastal inhabitants are victims of an enduring crisis of water resources for drinking and domestic uses (Abedin et al., 2014). Today, water scarcity is a global phenomenon that affects close to 2.8 billion people worldwide, especially in developing countries [10].

Also, in Cameroon and specifically in Fako division, due to acute piped drinking water shortage, the population uses alternative sources (springs and boreholes) [11]. As a result, water diseases are the second and third leading weekly epidemiological diseases under surveillance in Fako. Therefore to find out some predisposing factors of waterborne diseases in Fako, and to meet up with Sustainable Development Goal (SDG) 6.1, by 2030, we sort to start with an assessment of the drinking water catchment in Fako, as we found a paucity of studies [11]. This same situation is happening in Limbe municipality with increasing problems of potable water scarcity.

In the Buea municipality precisely, potable water supply has become an increasing problem due to increasing population, climate change stressors and poor management [12]. There has also been encroachment into water catchments especially in areas like Mile 18, Mile 16, Koke and at Soppo

where the rate of population increase is highly witnessed with a lot of uncontrolled construction of houses, some near water catchments, leading to frequent water shortages every year [12]. This same scenario is happening in Limbe town and needs to be addressed immediately to overcome potable water supply challenges.

Potable water scarcity has become an increasing problem in Limbe municipality due to inadequate storage facilities, poor management and increasing population in the municipality. There has also been encroachment into water catchments, especially in Mile 4, Mile 1 and 2 and New Town areas in Limbe. And the rate of population increase is highly witnessed with a lot of uncontrolled construction of houses near water catchments, leading to frequent water shortages every year. Besides, potable water distribution is uncoordinated with old water preservation and supply facilities, characterized by heavy water loss due to leakages of some pipes. There has been a resulting lack of sustainability in these community multiple water use projects whose planning is top-down and constructed infrastructure linking water catchments is cast off on the local community areas of Limbe with a near zero involvement, and capacity building in this town. As a result, some localities only receive water in the late hours of the night when most people are sleeping, while within the day, they lack a water supply. The study aimed to investigate the implications of potable water scarcity and exploit the options for effective provision of potable water in the municipality.

2. MATERIALS AND METHODS

2.1 The Study Area

The study was carried out in Limbe a town in Fako Division, South West Region of Cameroon. Located in an active dynamic coastal zone, situated between longitude 90° and 130° east and latitude 40° and 90° north of the equator, with a surface area of about 674km² (Limbe Town Planning Office, 2000). With an elevation of 150m at the foot of Mount Cameroon, Limbe is bounded to the West by Limbe II settlement up to Debuncha and the Atlantic Ocean to the South West. To the north, it is bounded by Moliwe, East by Tiko Sub-Division and South East by confines of Limbe III Municipality. It is also located within the coastal lowlands of Cameroon with an estimated population of 118210 (Limbe council, 2020). Limbe is made up of 3 sub-division namely; Limbe 1, Limbe 2, and Limbe 3. The

main settlements here include; Mbende, Limbe Camp, Unity Quarter, Animal Farm, Church Street, Motowoh, Limbe 2 and 3. From the 3 sub-divisions in Limbe, we randomly selected three catchments as follows; CAMWATER catchment in Wotutu Mile 4 and Communities water catchments like the Makoka catchment in New Town, and the Towe catchment at Mile 2 all found in Limbe. Climatically, it has two seasons - the dry and rainy season with moderate temperatures of about 20 to 28^oc, and with high rainfall of about 3000 to 5000mm [13]. The vegetation is generally green almost throughout the year, having the Limbe Botanic Garden, with a tropical forest on the slope of Mount Cameroon, having several water sources currently more or less exploited [13]. The map of Limbe is shown on Fig. 1.

2.2 Socio - economic Characteristics of Limbe

Data obtained from Limbe Municipal Council on May 6th 2021 shows that the population of Limbe is estimated to about 118210 inhabitants. It has one of Cameroon's largest companies known as Cameroon Development Corporation (CDC). The head office is at Bota, Limbe, the only oil refinery company SONARA is also found in Limbe with a non-operational natural sea port. Limbe has several tourist attractions such as Limbe wildlife center, the Limbe Botanic Garden and private beaches. There are several small inns and hotels, including the LK Hotel, Musango Beach Hotel, Atlantic Beach Hotel, Guest House, Savoy Palms and First International Inn as was observed from the field. However, the respondents equally indicated that there are only a few educational and health facilities with limited numbers of qualified staff. Also, about 51% of the settlements are connected to the national electricity grid with frequent blackout and pipe-born water is available in 57% of the villages. Still, the standard is very low [15].

2.3 The Study Approach

The depth and extent of the problem related to water scarcity, and the health impacts on households were conceptualized through literature review and preliminary field investigation. A questionnaire was prepared following the objectives of the study. The questionnaire focused on people's perceptions of potable water scarcity and its impact on different sectors. Three hundred questionnaires were administered to the community members within



Fig. 1. Map of Limbe city showing the settlement and study area adapted from Melle Ekane Maurice [14]

the Limbe municipality to identify the causes of potable water scarcity, the extent of waterborne diseases, and the expected options for an effective supply of potable water sources. Using a random sampling method, one hundred questionnaires were administered each in all the 3 localities that are; Mile 4, Mile 1 and 2, and New Town in the Limbe municipality. The questionnaires used for collecting data were divided into sections. Section (A) targeted the causes of water scarcity (B) was based on the level of technology employed in the management of potable water. Also, section (C) of the questionnaire indicated the level of education employed while section (D) targeted the implications of potable water scarcity.

2.4 Data Analysis

Both primary and secondary data were used in this study. Primary (Quantitative) data was obtained from the field using a questionnaire survey and were analyzed scrupulously by a research team of porters, facilitators, moderators,

and a statistician. Data from the field survey were coded and entered into a Microsoft Office Excel version 2016. Analysis was done using the statistical package for social sciences (SPSS) version 16. Secondary data obtained from the literature review have also been reported in the results.

3. RESULTS

The data obtained were represented in tables, figures, pie charts, line graphs, and text. Results of data analysis are presented sequentially, accompanied by discussion to facilitate coherency and understanding.

3.1 Causes of Water Scarcity in Limbe Municipality

After administering the 300 questionnaires, the following results were obtained as the major causes of potable water scarcity (Table 1).

Table 1. Causes of water scarcity in Limbe municipality

Causes of Potable Water Scarcity	Percentages
Inadequate storage facilities	50
Poor management	35
Increasing population	15

50% of the respondents indicated that inadequate storage facilities are the major cause of potable water scarcity in Limbe municipality. This result shows that the bodies involved in potable water management face the challenges of inadequate capital to purchase enough storage facilities. Meanwhile 35% and 15% of the respondents were of the opinion that poor management and increasing population in the municipality are another causes leading to severe and continuous potable water scarcity.

3.2 Level of Technology Employed on Potable Water Management

As far as technological development is concerned, the bodies involved in potable water management like the Cameroon Water Utilities Corporation (CAMWATER) and the Limbe community water management bodies still lack the necessary technology to develop more potable water facilities in the municipality. As such, there is the persistent problem of potable water scarcity, causing the local population to always resort to untreated water sources (Fig. 2).

Also, 51% of the respondents stated that there is low level of technology being employed in potable water management in Limbe municipality. Besides, 27% and 22% of the respondents believed that the bodies involved in water management depend on foreign technology which is very expensive to afford. Finally, there is the problem of inadequate trained personnel to exploit and better manage the available water resources in the municipality.

3.3 Level of Education Employed in Potable Water Management

Going by facts gotten from the field, one can be tempted to make allusions that the government of Cameroon and the bodies involved in potable water management does not understand that water is life and one cannot live without the use of it. Therefore there is the need to have knowledge on sustainable management of potable water resources even though only few schools teach students how potable water can be managed in the Limbe municipality. The government of Cameroon is expected to open up schools in all its regions that would teach and train students purposely on potable water management (Fig. 3).

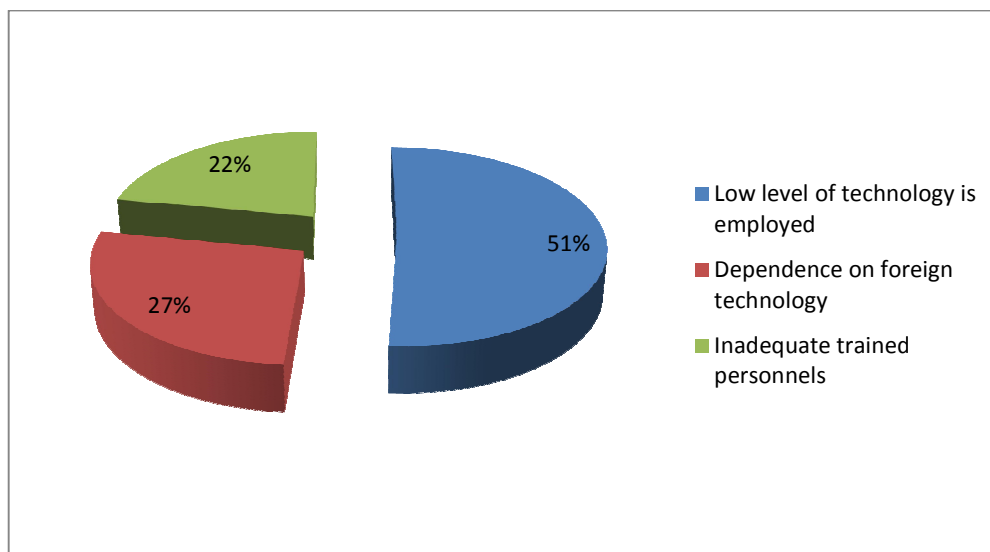


Fig. 2. Level of technology employed on potable water management

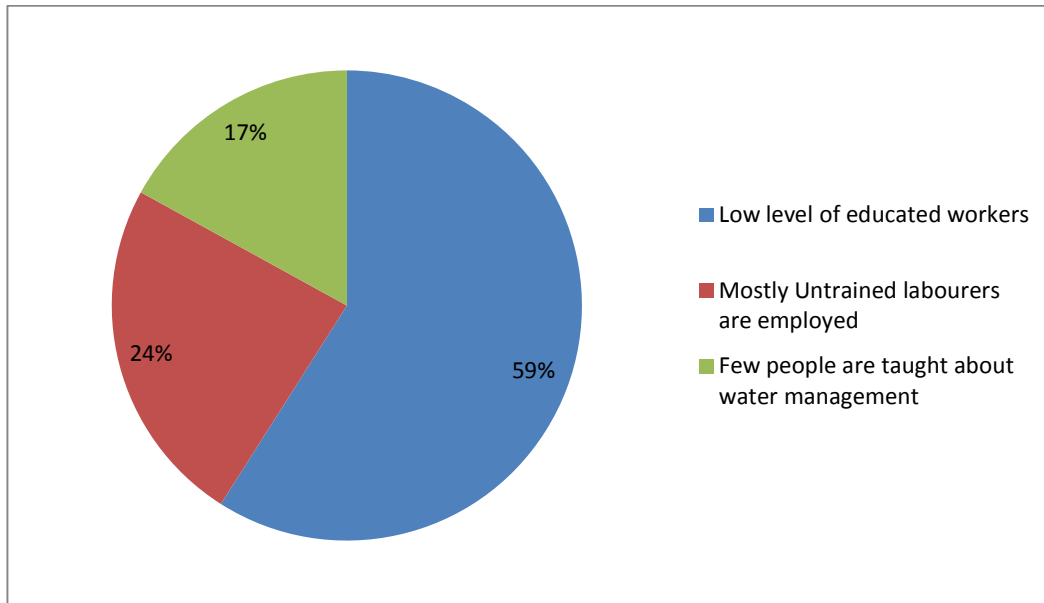


Fig. 3. Level of education employed in potable water management

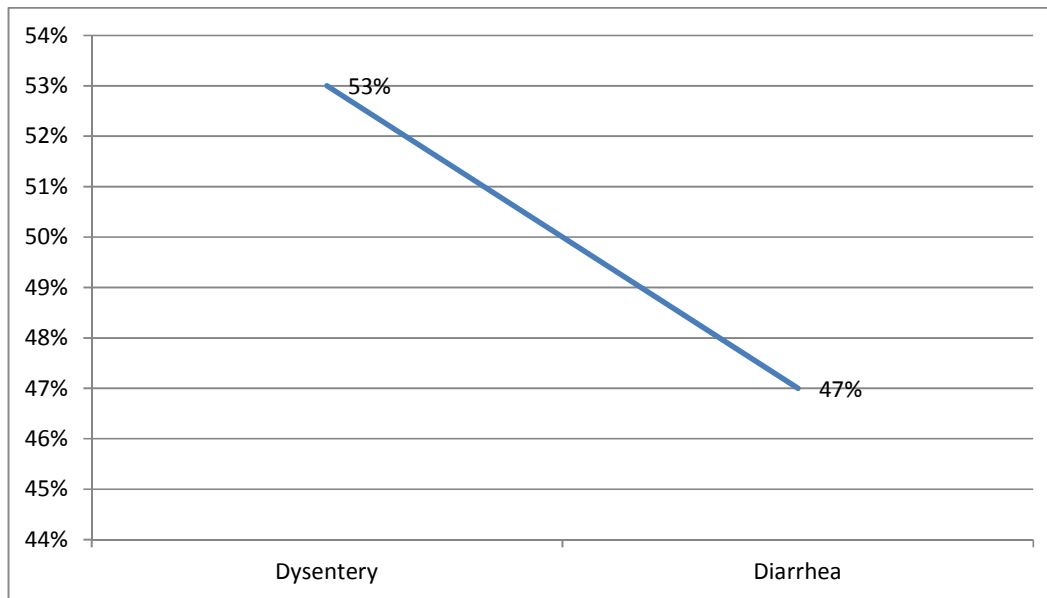


Fig. 4. Health implications of potable water scarcity in limbe municipality

59% of the respondents indicated a low level of educated workers employed in the potable water management sectors in Limbe municipality. Also, 24% and 17% of the respondents stated that mostly untrained laborers are employed in potable water management sectors. Only a few people are being taught in schools about the treatment, recycling and management of water resources.

3.4 Health Implications of Potable Water Scarcity in Limbe Municipality

Mile 1 Regional Hospital of Limbe stated that continuous potable water scarcity is leading to increasing health challenges to the entire municipality. More to that, the Limbe Municipal Council revealed that the shortage of clean drinking water has resulted in the use of

untreated water sources like Wells and rivers. This, as a result, is leading to the contraction of diseases like dysentery and diarrhea (Fig. 4).

Data gotten from the Mile 1 Regional Hospital of Limbe on May 2021 indicated that more than 600 patients suffering from dysentery and diarrhea every year due to the use of untreated water sources. Furthermore, 53% of the respondents stated that dysentery is the highest disease contracted. In comparison, 47% of the respondents believed that diarrhea is the second disease highly contracted by the population as a result of the use of untreated water sources due to continuous potable water scarcity.

4. DISCUSSION

After collecting data through a questionnaire survey, the data and results were analyzed. The discussion is assessed in the following subsections;

4.1 Assessment of the Causes of Water Scarcity in Limbe Municipality

After analyzing the 180 questionnaires and results to obtain reliable data about potable water scarcity in Limbe municipality, this study revealed that there is frequent water shortage. Besides, the highest percent of the respondents indicated that inadequate storage facilities are the major cause of potable water scarcity in Limbe municipality. In a 2005 report of the World Health Organisation (WHO) and United Nations Children Education Fund (UNICEF) titled - Water for Life: making it happen- it was revealed that the costs of installing water supply systems in sub-Saharan Africa are still far higher than is necessary [8]. This report is true because storage facilities needed for preserving and supplying potable water to the increasing population of Limbe municipality are still inadequate. Such potable water scarcity remains the major problem for most of the population of the town. More to that, the bodies involved in potable water management like the Cameroon Water Utilities Corporation (CAMWATER) and the community water management schemes face the challenges of inadequate capital to purchase enough storage facilities.

Meanwhile the other respondents believed that poor management and increasing population in the municipality are other causes leading to severe and continue potable water scarcity. Moreover, wastewater management in the

disadvantaged areas of Yopougon is generally inadequate. Almost three-quarters of all surveyed households reported discharging their wastewater onto the street (nature and draining channel). Previous studies in 2004 in precarious areas of this municipality revealed that those same practices lead to the emergence of diseases (Dongo k et al., 2008), suggesting that more than 10 years later, there is still much to be done for better wastewater management. This same situation is true in Limbe municipality as no attention is given to wastewater management or the proper management of potable water in a coordinated approach.

The government has also, consistently failed to improve water and sanitation in Abidjan because of the accelerated population growth and the rapid urbanization rate (Dongo k et al., 2008). The government of Cameroon and those particularly in charge of potable water management in Limbe have equally failed to improve on persistent water scarcity even with the current increasing population growth rate in the town. And it is of great importance that increasing population in any town or country need to be back by an improvement in the production of its goods and services to satisfy or meet the needs of human wants.

4.2 Assessment of the Level of Technology Employed in Potable Water Management

The level of technology employed on potable water management in Limbe municipality in managing storage facilities and potable water equipment is very low compared to that of developed countries. The current practice of building water supply systems for communities without adequately understanding their needs and including source water protection is counter-productive for water system sustainability [16]. Most of water systems built in Limbe like CAMWATER manage by the government and community water catchments are not sustainably manage because of the low level of technology employed. There is the need for the municipality to improve on their level of technology employed in managing potable water sources in a sustainable way in order to overcome the problem of water scarcity. Besides, improve techniques will be needed to create more water storage facilities, work in water factory machines that can ensure the pumping and processing of wastewater to help provide the increasing population with potable water resources.

Besides, the respondents indicated that the municipality depends mostly on foreign technology. Some indicators of technical capacity in source water protection and watershed literature include: Reliable data such as water quality, hydraulic gradients and geochemistry of the watershed, Source water monitoring programs to provide baseline data [17]. These indicators are lacking as far as potable water management is a concern in Limbe municipality due to inadequate finances, collaboration and lack of data management policy. As such the challenges of potable water scarcity remain the order of the day since the municipality depends on foreign technology. Furthermore, the respondents believed that inadequate trained personnel are another caused of potable water scarcity in the Limbe municipality. The presence of individuals with suitable training, access to necessary training opportunities and education materials are some examples of indicators for the human capacity needed for potable water management and protection [18]. Potable water scarcity remains a call for concern in Limbe town because individuals with suitable training and access to training opportunities and education are very limited. The municipality and Cameroon as a whole prefer to bring in expensive trained consultants from outside instead of opening schools that could facilitate the training of personnel's from within the country on potable water management.

4.3 Assessment of the Level of Education Employed in Potable Water Management

The level of education employed in managing potable water in the Limbe municipality is another key factor that can greatly contribute to the development of many potable water facilities and the provision of abundant potable water resources only if attention is given to this factor. According to the respondents, there is a low level of educated workers employed in potable water management. An individual's educational achievement would mean more opportunities to get good salaried employment and enough financial resources for greater access to improved water [19]. This statement is true in that if many schools are created purposely to teach and train people on the processing, recycling and management of potable water resources in Limbe municipality. The persistent issues of water scarcity will be reduced in the municipality.

It was also indicated that mostly untrained laborers are employed in the potable water management sector. And according to Mahama et al., [19], nowadays, because of the increase in the unemployment rate, higher educational achievement does not ensure a well-paid job. This statement is true in that, most urban dwellers in the town of Limbe, south west region of Cameroon, prefer to depend on untrained labor and only a few people are being taught about potable water management. And as such the increasing problem of water scarcity in the town can only be overcome once the government has decided to take up immediate action by creating schools purposely concerned with the teaching and training of personnel on managing potable water resources.

4.4 Assessment of the Health Implications of Potable Water Scarcity in the Limbe Municipality

The health implications of potable water scarcity are increasing in this town and region as a whole even though endowed with many water sources like rivers, streams and sea. Data collected from the Mile 1 Regional Hospital of Limbe, in May 2021 indicated that more than 600 patients suffer from dysentery and diarrhea due to the use of untreated water sources. The respondents stated that dysentery is the highest disease contracted in the town. In contrast, others were of the opinion that diarrhea is the second disease highly contracted by the population as a result of the use of untreated water sources due to continuous potable water scarcity. This is in line with World Health Organization who stated that, a complete lack of water, humans can only live up to 3 to 5 days on average. This often forces those living in water-deprived regions to turn to unsafe water resources that contribute to the spread of water-borne diseases like cholera, diarrhea, dysentery and typhoid fever [8,20]. Therefore, an improvement in water management facilities both in education and technology will equally tend to reduce the challenges of water scarcity and the implications brought about by potable water scarcity in the Limbe municipality.

5. CONCLUSIONS

Access to improve on potable water supply remains a challenge for the poor urban population of Limbe municipality, particularly those living in poor peri-urban areas and some African countries like Eritrea and Uganda, faces

severe situations as lack of basic water and sanitation remains the order of the day. These challenges can only be reduced by implementing the United Nations Sustainable Development Goals (UN-SDG). And options for effective provision of potable water by increasing the storage facilities for potable water supply, upgrading the level of technology employed in potable water management. Creating many educational facilities to teach and train workers on how to manage potable water resources. Also encouraging Christians and Muslim communities to create manage and own storage facilities of potable water to increase supply and reduce the problem of potable water scarcity in Limbe. Implementing a joint monitoring team to ensure that effective potable water treatment and supply is being done and the bodies involved in water management like the Cameroon Water Utilities Corporation (CAMWATER) need to initiate a platform for multi-stakeholder dialogue, networking and social learning essentially for building trust on how to manage potable water supply in the municipality better.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Suweis S, Rinaldo A, Maritan A, D'Odorico P. Water-controlled wealth of nations. *Science for Environment Policy*, European Commission DG Environment News Alert Service, The University of the West of England, Bristol. 2013;327.
2. Pande S, Ertsen M, Sivapalan M. Endogenous technological and population change under increasing water scarcity, *Hydrol. Earth Syst. Sci. Discuss.* 2014;18:3239–3258.
3. DFID (Department for International Development), EC (European Commission), UNDP (United Nations Development Programme), and WB (World Bank). *Linking poverty reduction and environmental management: Policy challenges and opportunities*. Washington, DC: World Bank; 2002.
4. Shaw R, Thaitakoo D. Water communities: Introduction and overview. In *Water communities*, ed. R. Shaw, and D. Thaitakoo, 1–13. Bingley, UK: Emerald Publishers; 2010.
5. Rosegrant MW, Ximing C, Sarah AC. "Averting an Impending Crisis" *Global Water Outlook to 2025*, Food Policy Report, International Water Management Institute (IWMI), Colombo, Sri Lanka; 2002.
6. Seckler D, Upali AA, David JM, Radhika de Silva. *World water demand and supply, 1990 to 2025: Scenarios and issues*. Research Report No. 19. Colombo, Sri Lanka: International Water Management Institute; 1998.
7. UN. "Millennium Development Goal", United Nations, New York, USA; 2003. Available:<http://www.developmentgoals.org/Education.htm>
8. WHO/UNICEF. Meeting the MDG drinking water and sanitation target , The urban and rural challenge of the decade. *World Health Organisation and United Nations Children's Fund*. 2006;41.
9. Khan A, Scheelback PF, Shilpi AB, Chan Q, Mojumder SK, Rahman A, Haines A, Kovats S, Vineis P. Salinity in drinking water and the risk of (pre)eclampsia and gestational hypertension in coastal Bangladesh: A case-control study. *PLOS One*, Article e108715. 2014;9(9).
10. Mbua L. Water supply in Buea, Cameroon: Analysis and the possibility of rainwater harvesting to stabilize the water demand. *Brandenburgischen Technischen, Universität Cott us-Senftenberg, Senftenberg, Germany*; 2013.
11. Malika E, Rene N, Ndefon P, Kamgno J. Assessment of drinking water catchments in fako division, South West Region, Cameroon. *International Journal of Tropical Disease & Health*. 2019;38i330189.
12. Buh EN, Mbua L Roy, Fang Zeh A. Increasing challenges of potable water supply, Buea municipality, Cameroon.

- Asian Research Journal of Arts & Social Sciences. 2021;13:430220.
13. Lambi CM, Kometa SS. An evaluation of the water resources on the eastern slopes of Mount Cameroon, J Hum Ecol, Kamla-Raj. 2009;28(1):47-55. Accessed 14/10/2011.
 14. Melle EM, Nkwatoh AF, Tim KL. The influence of some ecological factors on drill monkeys. International Journal of Biodiversity and conservation. 2017 ;9(7):256-264.
 15. Tanjong E. Socio – economic survey of the villages of Mount Cameroon National Park (MCNP). Program for Sustainable Management of Natural Resources Cameroon - South-West Region, Buea, Cameroon; 2014.
 16. IRC. Water supplies managed by rural communities country reports and case studies from Cameroon, Colombia, Guatemala, Kenya, Nepal and Pakistan. International Water and Sanitation Centre, Delft. The Netherlands; 1997.
 17. Trimmer DK, De Loe RC, Kreutzwiser RD. Source water protection in the Annapolis Valley, Nova Scotia: Lessons for building local capacity. Land use policy. 2007 ;(24):187-198.
 18. Folifac F. Integrated watershed management in Cameroon; Institutional aspects, problems identification and solution strategies: Case of the Mount Cameroon Region. Master thesis, Universität Stuttgart, Germany; 2003.
 19. Mahama AM, Anaman KA, Osei-Akoto I. Factors influencing householders' access to improved water in low-income urban areas of Accra, Ghana. Journal of Water and Health. 2014;12(2):318–31. Epub 2014/06/18. Available:https://doi.org/10.2166/wh.2014.149 PMID: 24937226.
 20. Elimelech M. The global challenge for adequate and safe water. Journal of Water Supply: Research and Technology—AQUA. 2006;55(1):3-8.

© 2021 Buh et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

*The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/70429>*