

## *Water Resources Exploitation practices and challenges. The Case of River Meme, Cameroon*

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### **Abstract**

The exploitation of water resources, an ~~old ageaged old~~ practice, continue to attract significant research and policy development attention. For the most part, this subject has eluded geographical literature in the context of the River Meme. We contribute to provide empirical evidence, by exploring water resource exploitation practices, challenges and implications, taking the case of four exploitation sites in Mbonge. The study employed a random sample of 270 respondents draw from the four study communities to generate primary data, which was complemented by interviews. The data was analysed descriptively and inferentially, using the ANNOVA. The results reveal that three resources were identified as key to include sand, fish and domestic water. The study further revealed that the exploitation of resources of River Meme is important for Socio-economic development, sand to construct local and modern structures, employment creation, ~~and?ad~~ household income. Key exploitation challenges include inadequate capital, poor management, rudimentary tools, climate change, fear of attacks and conflict among others. The study concludes that, as a result of the challenges faced in the exploitation of water resources, River Meme should be developed as a recreational site – this will serve as a source of income generation to the local population-

Keywords(make it :bold) resources, exploitation, challenges, practices, Cameroon

### **Introduction**

Of all the planet's renewable resources, water has a unique place. It is essential for sustaining all forms of life, food production, economic development, and for general well-being. It is impossible to substitute for most of its uses, difficult to de-pollute, expensive to transport, and it is truly a unique gift to mankind from nature. Water is also one of the most manageable of the natural resources as it is capable of diversion, transport, storage, and recycling. Water resource exploitation has been on the international spotlight for the past three decades. From the first International Conference on Water (Mar de la Plata, 1977), followed by the ~~the~~ first World Water Forum (Marrakech, 1997). At the Second World Water Forum of 2000, the UN pledged to conducts periodic assessments on the state of the world's freshwater resources in the form of the World Water Development Report (WWDR), with which FAO is associated closely (FAO, 2003).

The demand for water resources like sand is growing around the world, particularly in the developing countries such as India, China, and Kenya where the rapid economic development causes strong growth of construction industry. The global sand harvesting concerns about environmental impacts is increasing, report from other countries for example China (Wu et al., 2007), Ghana (Mensah, 2002) and India (Padmalal et al., 2008). Consequently, it has been argued that because of this globalizing extent and the magnitude of its impacts sand harvesting should be considered as an aspect of global environmental change (Sonak et al., 2006). Most countries in Sub-Saharan Africa continue to develop and benefit from the use of natural resources such as sand and gravel for economic development. Lawal (2011) indicated that Nigerians also benefit a lot from sand and gravel mining which results in the construction of permanent structures from aggregates. This led to better socio economic life for rural people. In Kenya, soil mining had led to development of better infrastructure (Mwangi, 2007). This was supported by Mbaiwa (2008) as a positive impact of sand mining in Botswana where more land

had been used to develop infrastructure in form of shopping malls and residential areas. Zimbabwe is not an exception in benefiting from sand and gravel through infrastructural development (Lupande, 2012). Some of these materials are obtained along river courses. Water resource exploitation refers to the extraction of water for human consumption. This shows a connection with agricultural, industrial, recreation, transport and tourism development (FAO, 2003). Operationally, water resource exploitation as used in this research refers to the **extraction of sand, fish, and for domestic use in River Meme in Cameroon.** *better if you write it in the title*

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Cameroon is blessed with abundant water resources but rapid population increase, unplanned urbanisation, growing industrial and socio-economic development have led to poor and unsustainable management of these resources (Andrew *et al.*, 2010). One of these resource sites is the River Meme which is replete with sand, fisheries and other resources. So far, knowledge gaps exist with regards to the exploitation practices, their implications and challenges in the context of the River Meme. Resources exploited here are sand, fish and water for domestic use. There is therefore a need to examine how these resources are exploited, the impacts of the exploitation of these resources on the socio-economic lives of the exploiters, the challenges faced and the management options put forward.

### Problem Statement

Freshwater species and habitats provide a wealth of goods and services to humanity. Nearly a billion people worldwide rely on fishes as their primary source of protein. (Lawrence *et al.*, 1998). The United Nation Development Programme (UNDP) explained the 17 Sustainable Development Goals (SDGs) and those concerned with water include goals 6 and 14. The SDG 6 talks about the need to ensure availability and sustainable management of water and sanitation for everyone on earth. Water scarcity affects more than 40% of people around the world, and that number is projected to go even higher as a result of climate change. If present trends continue, by 2050 at least one in four people are likely to be affected by recurring water shortages (Derek *et al.*, 2015). Mbonge Subdivision is blessed with different sources of water like, streams, boreholes, and rain. This study is based on Exploitable Water Resources (EWR). It focuses on River Meme being the highest producer of resources like fish, sand, and water for domestic uses and serves other environmental functions. It is worth knowing that, River Meme is the main source of transportation of goods and services from one village to another and from Mbonge to Nigeria. Therefore, the exploitation of this resource (River) is a point of interest. So, assessing the importance of it will be of great assistance in solving the challenges so as to better manage the water for sustainable development of Mbonge. Previous research efforts in the context of the study area have focused on climate, agriculture, transportation and water, around Meme. For example, Kimengsi and Tosam (2012) examined the agricultural development policy implications of climate variability and cocoa production in Meme division of Cameroon. Mukete *et al.* (2015) analyzed the technical efficiency of smallholder cocoa farmers in Mbonge Municipality, Tosam and Njimanted (2013) explored the socio-economic determinants of cocoa production in Meme Division, Cameroon, while Balgah and Kimengsi (2011) investigated the sustainable management options linked to the declining water resources of the Lake Barombi Mbo. A fairly recent study by Atiekum (2015) focused on water quality assessment in Mbonge Marumba. These studies, however, did not focus on issues on water exploitation, socio-economic implication, challenges and sustainable management strategies which represents the motivation for the current research. Considering the fact that, these aspects have not received due research attention, this research seeks to examine the exploitation of the resources of River Meme: its

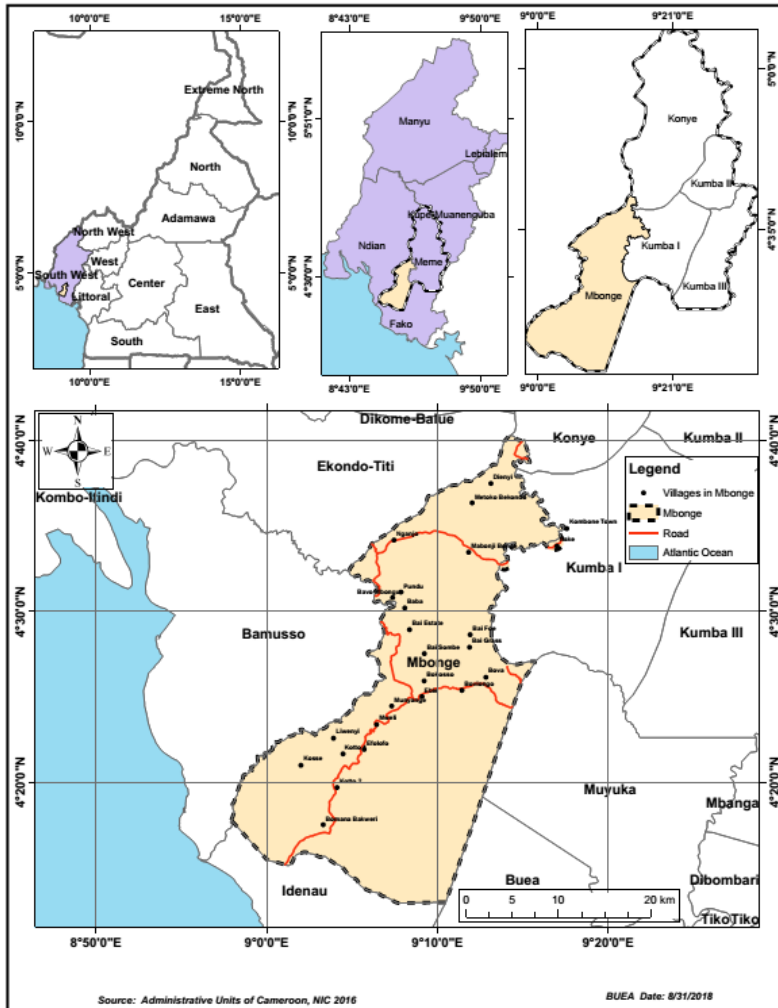
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impact on the socio-economic development, challenges and management strategies employed. This is necessary against the back drop of increasing population, competing uses and increasing dependence on their resources. **Studies of this nature have a global significance, especially when linked to the SDGs.** SDG 6 talks about the need to ensure availability and sustainable management of water and sanitation for everyone on earth, while the SDG 14 indicate targets of managing and protecting Life below water. Meeting these targets require sound scientific knowledge at all scales.

Methodology(give title)

**Study Area**

Mbonge Municipality (Figure 1) stretches (4° 32' 11" N; 9° 6' 40" E) located in the Meme Division of South West Cameroon (Mukete *et al.*, (2016). It is bounded to the North by Kumba 1 council, to the South by Bamusso council, to the West by Ekondo Titi council, and to the East by Muyuka and Idenau councils (Mukete *et al.*, (2016). The main water courses in this area are Rivers such as the Meme (the longest river in the South West Region) which cuts across many of the villages interspersed with streams and springs. **River Meme** is located at Latitude 4 30' 20" North of the Equator and Longitude 8 54' 43" East of Greenwich Mean Time. It takes its rise from the Rumpi Hill in kumba and runs into the Atlantic Ocean also linking with River Ndian serving as a river port town important for goods and services. The water volume of River Meme, springs and streams increases significantly during the rainy seasons. Another major water body in this area is the lake Disoni which flows out and joins the Ube River and then further to the Meme in another part. The area of study falls within the delimitation of River Meme in the four selected villages of Mbonge Subdivision such as Mbonge Marumba, Bole Bakundu, Ngongo and Bai Kuke. Water courses are used in many ways mainly for farming, fishing, home use (drinking, laundry), catchments and recreational activities like swimming. The water courses can be harnessed and used for large scale irrigation, transportation, hydro-energy, potable water and large scale fishing.



**Figure 1. location of Mbonge Subdivision**

Where is the Source of the map?is it your work ?or taken from other sources?

Unlike most regions in Cameroon, the Mbonge Area has a typical equatorial climate with two major seasons which are the rainy and the dry seasons. Annual temperature stands at  $25^{\circ}\text{C}$  and annual rainfall at 2210 mm (Kumba City Council, 2005). The Climate is hot and dry, meanwhile in the rainy season; the climate is cold and humid. The area has been experiencing drastic changes as rains have come earlier and the dry season has also experienced some unexpected rains. For instance, rainfall was experienced right up to December in 2010 instead of October as was the case in the past. The implication here is that, it has altered the flow of River Meme, springs and other water sources. The relief of the area is generally level while some areas are undulating with even small hills that can be spotted here and there, although very few in numbers. However, the topography in some areas is hilly with steep and gentle slope like in the

cases of Marumba. The total population for the entire municipality is however, estimated at about 230,000 inhabitants. The main indigenous and migrant ethnic groups include Mbonge, Bakundu, Balue, Ngolo, Bamilike, Batibo, Kom and the Efiks and Ibos from neighbouring Nigeria. The study is based on the 4 villages of Mbonge Subdivision with the total population of 14,310 (NIS, 2005) (Table 1).

**Table 1. Distribution of 4 villages, their total population and homes of Mbonge subdivision.**

Number	Village	Population	Male	Female	Household
1	Mbonge Marumba	6128	3069	3059	1586
2	Ngongo	2178	1093	1121	526
3	Bole Bakundu	4356	2154	2202	922
4	Bai Kuke	1648	906	742	365
	<b>TOTAL</b>	<b>14310</b>	<b>7222</b>	<b>7124</b>	<b>3399</b>

**Source:** NIS, do not abbreviate, write the full name 2005

### Research Methods

The design for this investigation is based on a mixed methods approach. The survey combines both quantitative and qualitative methods to better increase the overall strength of the study. Qualitatively, information from respondents pertaining to water resource exploitation, the socio-economic implications, challenges faced and management put forward was obtained with the use of observation, open and closed ended interviews. Quantitatively, data on the water exploitation and socio-economic implications was obtained through the use of semi-structured questionnaires. Why you choose it? Reason out.

There are four exploitation sites chosen on the River Meme from upper, middle and lower stream. There are two exploitation sites in the upper stream, one in middle and lower respectively. Within these exploitation sites, four villages were chosen based on the nearness to these four sites. The study population involved the exploiters who have been engaged in the exploitation of the resources of River Meme from the four sites for at least five years from four different communities of MSD. The communities include: Mbonge Marumba found in the lower stream, Bole Bakundu and Ngongo found in the middle stream and Bai-Kuke in the lower stream. There are about 500 exploiters in these localities (sand committees, 2017). The number of exploiters in the different localities are as follows Mbonge Marumba (238), Bole Bakundu (136), Ngongo (86) and Bai-Kuke (60). Therefore, the total population here for research is 520.

How and why you fixed the numbers? Explain in detail This however, served as the base in which a sample of the target population had been drawn. The target population are the 520 exploiters from the four exploitation sites chosen from upper, middle and lower stream. Within these exploitation sites, four villages were chosen based on the nearness to these four sites. Hence, the target population is 520 exploiters. 270 questionnaires were administered randomly in the four study sites as follows (Table 2).

**Table 2. Sample of the study sites**

Village	Number of exploiters	No of questionnaires	No retrieved	Percentage
Mbonge Marumba	238	124	124	46

Bole Bakundu	136	71	71	26
Ngongo	86	44	40	15
Bai Kuke	60	31	25	9
<b>Total</b>	<b>520</b>	<b>270</b>	<b>260</b>	<b>96%</b>

Source ?

Data analysis (give title)

Data obtained were analyzed using descriptive statistical tools (tables, charts, percentages, and figures) and inferential statistical tools (ANNOVA). better to writ the software name with its updated version to make ANOVA(SPSS,V....? OR SAS) .say something about Likert scale. The ANNOVA calculated value was compared with critical or table value to validate the results with a degree of freedom of one and the level of significance of 0.05.

## RESULTS AND DISCUSSION

### Nature of Exploitation of Resources of River Meme

River Meme is the main source of transportation of goods and services from one village to another and from Mbonge to Nigeria. Therefore, the exploitation of this resource is a point of interest. There are four exploitation sites (Figure 2). Two sites in the upper stream, one site in the middle and Lower stream respectively. Villages closer to the exploitation sites are Mbonge Marumba, Bole Bakundu, Ngongo and Bai kuke. These sites provide resources for sand exploitation, domestic use and local fishing.

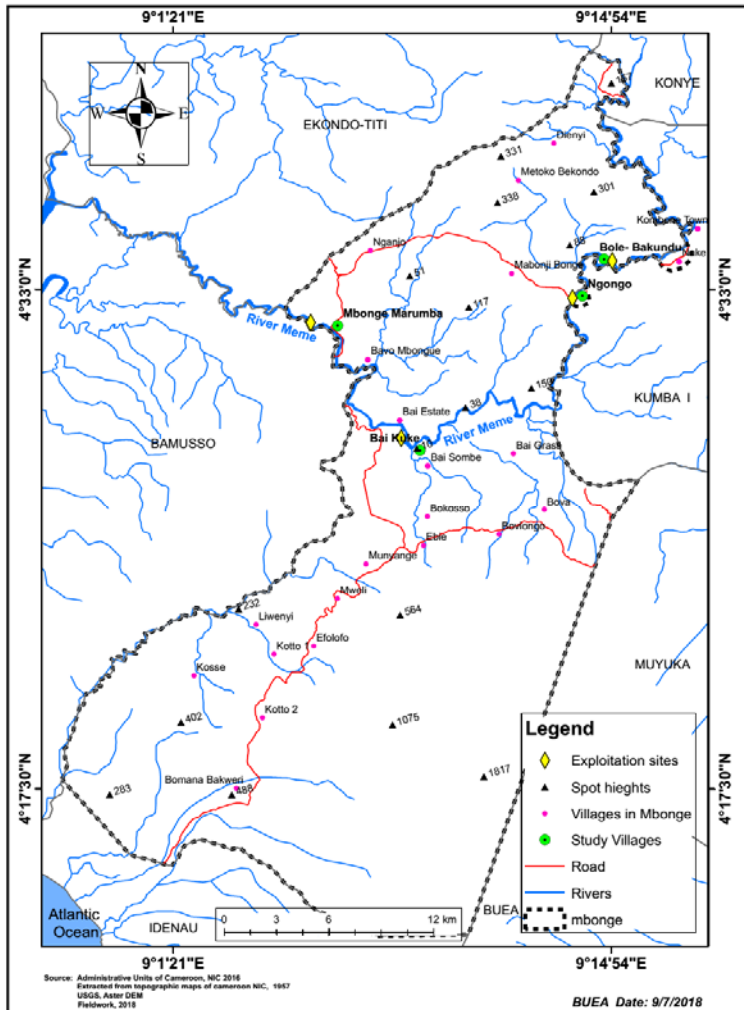


Figure 2. Exploitation Sites [source ?](#)

Water used in households of the four villages were was gotten from myriad sources (Table 3). Well was ranked the 1<sup>st</sup> source as 232 respondents accepted that they got the water they use at home for domestic activities from the River Meme, indicating that it is not used for drinking, rather for other domestic uses. Also, it is seen that, the highest respondents (104) of the uses of River Meme at home came from Mbonge Marumba and the lowest came from Bai Kuke with 21 respondent.



**Table 3. Sources of water in households in Mbonge Riverside localities**

Locality	Sources of water for households										
	River			Tap			Well			Spring	
	Yes	No	NR	Yes	No	NR	Yes	No	NR	Yes	No
Mbonge Marumba	104	20		81	43		98	26		25	99
Bole Bakundu	48	18	5	31	35	5	66		5	43	23
Ngongo	33	7		27	6	7	34	6		27	13
Bai Kuke	21	4		11	14		25			14	11
<b>Total</b>	<b>206</b>	<b>49</b>	<b>5</b>	<b>150</b>	<b>108</b>	<b>12</b>	<b>223</b>	<b>32</b>	<b>5</b>	<b>109</b>	<b>146</b>
<b>Ranks</b>	<b>2<sup>nd</sup></b>			<b>3<sup>rd</sup></b>			<b>1<sup>st</sup></b>			<b>4<sup>th</sup></b>	

**Method and tools used in the exploitation of resources**

Various methods are used in the exploitation of water resources. It ranges from local to modern methods. There must be the use of man's labor in the process of exploitation. From the fieldwork, direct observation and photographs taken, it was seen that the exploitation of water, sand and fish in River Meme were done locally in the four exploitation sites. The different tools and methods of used in the exploitation of the resources were the same in all the four sites. From field observation and photographs taken, the tools of sand exploitation are Buckets, Containers, Canoes, Head pans, piece of cloth and Spades as seen in plate 1 below. Stick boat and canoes are used when exploitation is done far from the shore. The methods of harvesting sand is local since local tools are been used. Hill and Kleynhans (1999) discussed various methods of mining sand and gravel. Dry pit mining is a method used when sand is extracted above water table from a dry stream bed and exposed bars using conventional bulldozers, scrapers and loaders. While wet pit mining involves extraction of sand and gravel from below water table stream channel or a perennial river using hydraulic excavator or dragline. As seen, two methods exist which are the dry and wet pit mining. [It is another paragraph ,separate it.](#)

It was realised that, sand harvesting from River is a wet pit mining though it is done locally. The methods begin with exploiter holding the heap pan (plate A), diving into the water (plate B), filling and lifting of the head pan of sand from beneath the water, (plate C), then the carrying of the head pan of sand on the head with the piece of cloth by the exploiter while still in the water (plate D and E), later, exploiter gets to the land while still carrying head pan of sand (plate F and G), pouring of sand on the land to make a mount (plate H) and lastly, making mounts of sand of sand by the exploiter after about 10 rounds of harvesting of sand (I and J). The most important instrument needed in sand harvesting here is head pan and piece of cloth to help carry the pan on the head as seen in (plate K). The sand exploiters either exploit sand with bare bodies or they wear nylon dresses which are light so that water cannot stick on them. It is worth noting that, sand harvesting is done for a day as many times as the exploiters want. It all depends on his strength. Some were found making 5-6 mounts daily.





[sources?](#)

**Plate 1. Sand instruments and methods of exploitation in River Meme**

A=exploiter standing with the head pan, B=diving, C=lifting of the head pan of sand, D and E=exploiter carrying head pan of sand in water, F and G=exploiter carrying head pan of sand on land, H=pouring of sand, I and J=mounds of sand, K=head pan and piece of cloth.

**Reasons for exploiting water resources**

Exploitation is carried out for myriad of reasons. This could be as a result of poor level of education, limited jobs, large family sizes, leisure and an inadequate income. The highest number of responses was 180 exploiters who agreed that, water exploitation especially sand was done for the purpose to raise income in in order to feed the large family size (Figure 3). The

exploitation of water, and fish from River Meme has brought development in the area by the Alleviation of poverty, increase Living standards, provide self-employment, and increase household sanitation, aid in construction activities and increase communication among others (Table 4).

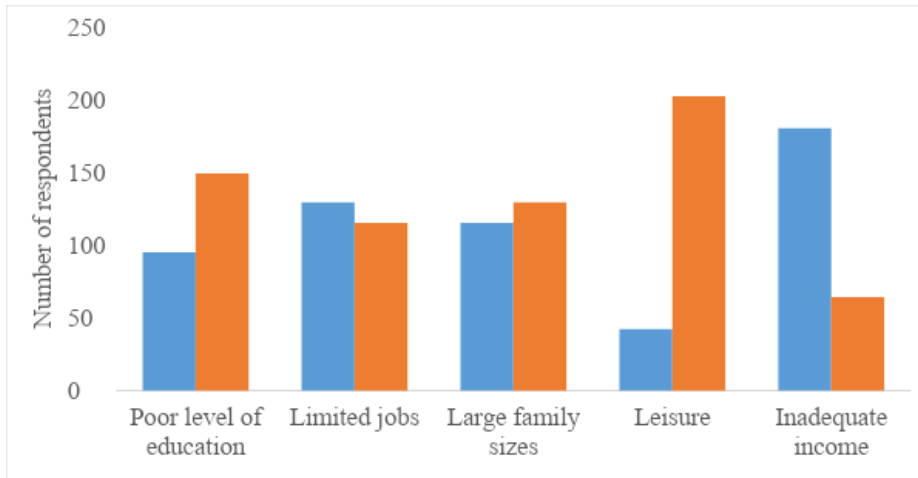


Figure 3. Reasons for exploiting water resources

Table 4. Assessment of the extent of socio-economic contribution of exploitation to communities

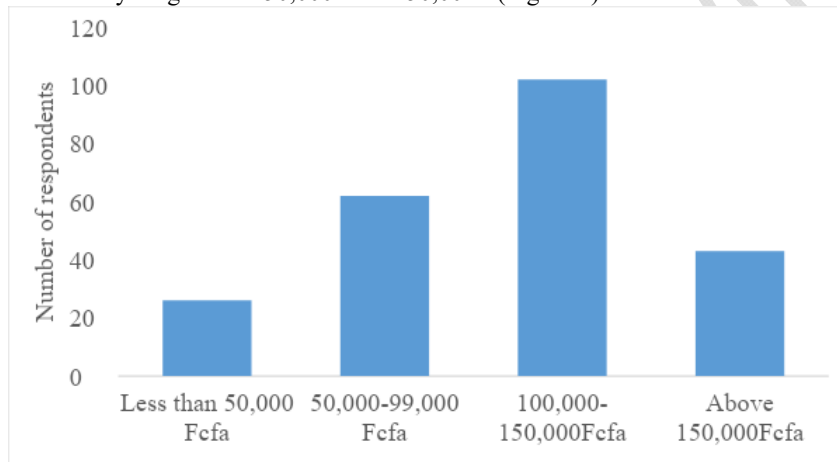
Contribution of Exploitation to community livelihood	Mean Responses of Exploiters at Mbonge Marumba	Mean Responses of Exploiters at Bole Bakundu	Mean Responses of Exploiters at Ngongo	Mean Responses of Exploiters at Bai Kuke
Alleviation of poverty	1.67	1.31	1.39	1.17
Increase Living standards	1.55	1.58	1.73	1.39
Provide self-employment	1.56	1.56	1.39	1.43
Increase Household sanitation	1.98	3.37	3.17	1.78
Aid in construction activities	1.6	3.04	1.24	1.52
Increase communication	1.66	2.92	1.9	2.52

It should be written in the methodology part. The F-Test was employed to test whether there is any significant difference in the mean responses of exploiters on the extent of socio-economic contribution of the activity within the Mbonge area. Here four main samples which represent the communities and their mean responses related to each hypothesised factor or socio-economic variable (Table 5).

Table 5. F-Test results

Source of variance	Sum of squares (b)	Degree of freedom(a)	Variance of estimate (b/c)	F
Between samples	1.68	3	0.56	= 0.56/0.40= 1.4
Within samples	7.93	20	0.40	

With a degree of freedom of 3 and 20, the table F-value at a 0.05 level of significance is 3.10. Since the calculated F- value (1.4) is less than the critical F-value (3.10), it was observed that there is no significant difference in the extent of development within the four selected villages in Mbonge Subdivision as a result of exploitation of the resources of River Meme. Therefore, development is the same. As a contribution to household development, monthly income from this activity ranges from 50,000frs to 150,00frs (Figure 4).



**Figure 4. Estimated monthly Income from Exploitation of Sand and Fishing activities at River Meme**

#### Challenges faced in the Exploitation of Resources in River Meme

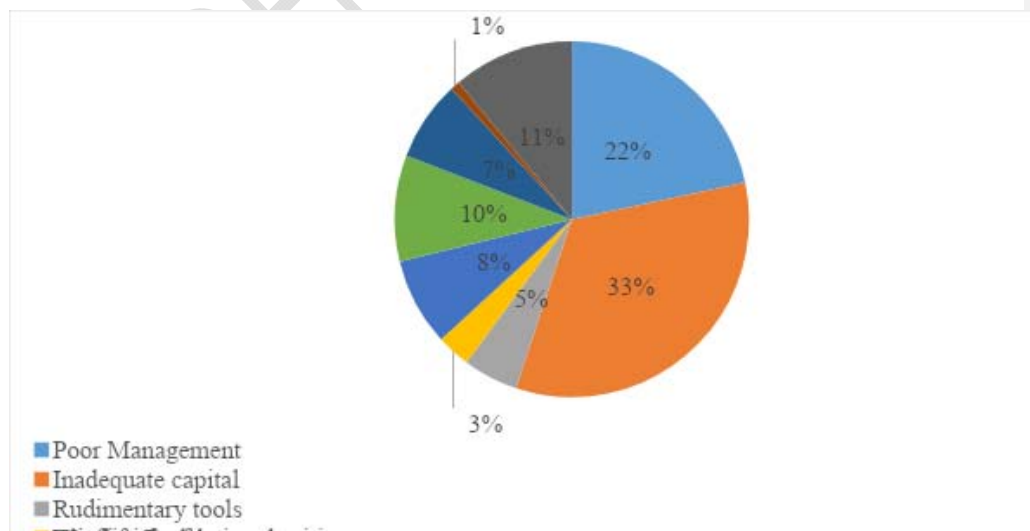
The IPCC (2007) holds that all the regions of the world show an overall net negative impact of climate change on water resources and freshwater ecosystems. The future effect of climate change on water resources in the world will depend on trends in both climatic and non-climatic factors. There are climatic and non-climatic challenges affecting the exploitation of the resources of River Meme as seen in Table 6.

**Table 6. Challenges in the exploitation of resources of River Meme**

Challenges Faced in the exploitation of Sand in River Meme by communities	Mean Responses of Exploiters at Mbonge Marumba	Mean Responses of Exploiters at Bole Bakundu	Mean Responses of Exploiters at Ngongo	Mean Responses of Exploiters at Bai Kuke
Poor Management	1.38	1.4	1.3	1.4

Inadequate capital	1.09	1	1	1
Rudimentary tools	1.75	1.91	2.35	2.2
Climate change	2.03	2.13	2.13	2.48
Fear of attacks	1.72	1.93	1.65	1.76
Witchcraft	1.81	1.6	1.68	1.84
Restrictions from authorities	2.63	1.74	2	3.05
Conflict	2.26	2.09	2.35	2.32
Increase Population	2.23	2.39	1.65	3.4

Noting is written about Likert scale in the methodology part, please incorporate it. Results based on Likert scale responses of respondents on the challenges (Four point Likert scale). A Mean score of below 2 indicates a high tendency towards agreement and an indication that the factor is significant (is a challenge) while a mean score of more than 2 indicates a high tendency towards disagreement and an indication that the factor is not significant (it is not a challenge observed). Looking at Mbonge Marumba which is found in the lower stream of River Meme, challenges facing the exploitation of resources are inadequate capital, followed by poor management, rudimentary tools, fear of attacks and witchcraft. These are the perception of the people on the type of challenges they face in exploitation. Climate change with a mean of 2.3 can be seen as a challenge since it's not too far from the range of 2. With respect to the challenges faced in Bole Bakundu, inadequate capital, poor management, witchcraft, restriction from authorities, rudimentary tools and fear of the attacks of crocodiles and water tortoise and conflict. Furthermore, the challenges faced in the exploitation of the resources of River Meme in Ngongo include inadequate capital, poor management, fear of attacks and increase population, witchcraft and restriction of authorities. The exploitation of the resources also faces challenges in Bai Kuke. They include inadequate capital, poor management, fear attacks and witchcraft. From the explanation given above, it is concluded that, the challenges facing water resource exploitation vary from one exploitation site to another (Figure 5). The third challenge are the used rudimentary tools among others. From this, one can say that, the challenges faced are as a result of inadequate capital.



**Figure 5: Challenges in the exploitation of resources of River Meme**

### **Conclusion and recommendations**

Mbonge Subdivision is blessed with an exploitable water resource known as River Meme. 95% of the people exploit this River and 95% of the exploiters are adults. River Meme is the highest producer of resources like fish, sand, and water for domestic uses and serves other environmental functions in that area. It is worth knowing that, River Meme is the main source of transportation of goods and services from one village to another and from Mbonge to Nigeria. Mainly crude tools and methods are used to exploit sand, fish and water for domestic purposes. The exploitation of these resources raise income and improve on the livelihood of the people thereby bringing development. But challenges some challenges are encountered in the exploitation of resources such as climate change leading to the reduction in the level of the River, inadequate capital, poor management, fear of attacks of water animals like crocodiles and water tortoise among others. From the foregoing, the following recommendations are proposed:

- Policy makers and water managers like the Council, Custom Office including community leaders should also be encouraged and motivated to take the necessary steps needed for resource exploitation for sustainability to ensure that exploiters receive and take advice given seriously.
- There should be the creation of committees and projects like the River Meme Project (RMP) and the River Meme Exploitation and Management committee (RMEMC). The RMEMC should be in charge of collecting money from the exploiters and individuals in the form of community fund raising so as to develop the River. Also, funds should be gotten from NGOs to carry out the RMP for the provision of potable water.
- The use of sand drilling machine is needed to drill the sand even once so that other uses of the River can be boosted. The research recommend that, River Meme should be developed by the creation of recreational sites there. From field observation, it was realised that there were unfinished buildings of the German and Mbonge beaches around the River in Mbonge Marumba and the people still made use of it. If these beaches are fully developed, it will act as a source of income generation which can help to provide capital to better manage the River.

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