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WATER DEVELOPMENT SHORTAGES IN URBANISING COMMUNITIES OF THE WESTERN HIGHLANDS IN CAMEROON

Zephania N. Fogwe and Gideon Muwah Njong

[1]Laboratory of Environment, Hazards and Sustainable Development, Department of Geography, Faculty of Letters and Social Sciences, Box 3132, Douala, University of Douala
[2]Department of Geography, Higher Teachers Training College, Bambili, Box 63, The University of Bamenda

ABSTRACT: *Exploring and using water resources provided by nature for alternative purposes has been an age-old human enterprise. Though water is perpetually renewable and ubiquitous, its utilisation is a sustainable challenge for quality and quantity. This study probes into the water development transition from village community status of the 1980s to that of an ever increasing cosmopolitan status recently accelerated by an upshot of educational establishment-pulled stakeholder population in the second decade of the 21st century. Primary and secondary data collected and processed indicate a devastating pressure on the current water development constructions of the communities in Tubah that have been startled by the population inflow which the village water schemes did not project nor consider at the outset. Water consumption has become number and option-altered triggering water scarcities that past and present developments cannot adjust to. Current and even future trends in water shortage and quality degradation hold no hope for this community destined to develop thanks to the diversification of its educational offers. Averting this hopelessness is not discretionary but obligation in this irreversible development drive that must hand-stretch for succour mindful of intrinsic flaws.*

KEYWORDS: Community, Population Influx, Tragedy of the Commons, Tubah, Village Water Scheme, Water Shortage

INTRODUCTION

One resource that has a direct bearing on human community sustenance is water for the multifunctional role it plays in human metabolism and ecological dynamic equilibrium. Water development should make it readily available in not too much or little amounts. This requirement, primordial as it is, is determined by the level of human civilization and technology index which conditions the usability and sustainability propensity. Ancient civilizations may have dispersed or collapsed under extreme dry conditions. There are indications that the same may hold for modern societies (Pande et al 2014) and even those emerging within the Western Highland areas of Cameroon. Global fresh water supplies are coming under increasing pressure, making it increasingly difficult for water-stressed nations to manage water resources. Water scarcity could have a major impact on the world's ability to feed its growing population (Suweis et al 2013).

The Western High Lava Plateau is reported to be a high population cluster and one of the highest population density areas in Cameroon since independence in the 1960s for reasons of a long dating civilization and soil fertility amongst others. Most Cameroonian towns are not only faced with water scarcity (quantity) especially during the dry season, they are equally

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faced with water quality problems. Batello et al (2006) established that continuous increase in human population together with uncontrolled and unsustainable harvesting of water resources within the dry Sahelian zone for irrigation of cropped fields had a negative impact on the environment such as erosion of sediments into water sources, pollution of surface and underground waters through the use of agricultural pesticides, the deterioration of water quality and the proliferation of undesirable substances due to new chemical components.

Communities like those in Tubah before the advent of higher educational institutions were where hand-hoe and rainfall-dependent agriculture-based livelihoods that depended in many ways upon water (van Koppen et al 2009). This study seeks to examine the link binding population increase to water resource utilization in Tubah since the start of the 21st century considering that a population pressure momentum is the main culprit negatively exacerbating on rural water resource characteristics through a utilization and management in watershed milieus that is poorly planned. There has been a consequential lack of sustainability in these community multiple water use projects whose planning is top-down and constructed infrastructure is cast off on the Bambili and Bambui village communities with a near zero involvement, capacity building, and a reciprocal feeling of ownership from the villagers. This contravenes the water services paradigm prerequisite necessitating sustainable provision of water of an agreed quantity, an agreed quality, at a given time, with agreed reliability, and at an agreed site. Such services have both hardware (infrastructure or technology including issues such as technology availability, spare parts, engineering skills, or water resources assessments) and software components (support for institution building-leadership, rule setting and enforcement-, water allocation and conflict resolution) in a continuity of services that is not time- and location-specific.

METHODOLOGY

This study in Tubah is an expo-factor research using three approaches being historical, descriptive, and exploratory/analytical approaches. Tubah Sub-Division was created in 1992 within Mezam Division, Cameroon between longitude 10º15.25´and 10º16.05´East and latitude 5º 54.95´ and 6º 09.56´North. Tubah Subdivision is located on north-western slopes of the Western Highland Plateau. The study requires a historical analysis of the past trends of population characteristics and water resource use relationship. By the descriptive approach a geographical description of how population colonized space in the varied altitudinal zones linking to water resource shortages. The exploratory and analytical approaches revealed factors of population increase and its ramifications on water resources shortages. These approaches necessitated varied methods of data collection and analysis. Data was both secondary and primary analysed quantitatively and qualitatively. Field observation was made of types of building infrastructure, agricultural and domestic activities in the expanding quarters of Bambui and Bambili alongside group and personal interviews of stakeholders of water supply and water consumption. Inventory was made of water catchment sources and spatial characteristics of public stand taps and springs. This also permitted the identification of the processes and areas of catchment degradation as farm, grazing and construction land. Secondary data based on the Sobowale, (1983) approach was obtained from published and unpublished sources of the Tubah Council, the Divisional Delegation of Regional Planning and Development, and the District Health Centres in Bambili and Bambui.

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RESULTS AND DISCUSSION

A water abundance taken for granted, treated with scorn

The worldwide water crisis has been recognized by well-established agreements and agreements which include:

1. International Conference on Population and Development (ICPD) Programme of Action

   All countries should give priority to measures that improve the quality of life and health by ensuring a safe and sanitary living environment for all population groups through measures aimed at avoiding crowded housing conditions, reducing air pollution, ensuring access to clean water and sanitation, improving waste management…(para 8.10). ICPD+5

   Governments of developing countries…should continue to support declines in infant and child health programmes that emphasize improved prenatal care and nutrition, including breastfeeding, unless it is medically contraindicated, universal immunization, oral rehydration therapies, clean water sources, infectious disease prevention, reduction in exposure to toxic substances, and improvements in household sanitation…(para 18a).

2. Millennium Summit

   We resolve…by the year 2015…to halve the proportion of people who are unable to reach or to afford safe drinking water (para 19).

   To stop the unsustainable exploitation of water resources by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies (para 23).

3. World Summit on Sustainable Development (WSSD)

   Increase access to sanitation to improve human health and reduce infant mortality, prioritizing water and sanitation in national sustainable development strategies where they exist (para 6m).

   The provision of clean drinking water and adequate sanitation is necessary to protect human health and the environment…we agree to halve, by the year 2015, the proportion of people who are unable to reach or to afford safe drinking water and the proportion of people who do not have access to basic sanitation…(para 7).

   Provide access to potable domestic water, hygiene education and waste management at the household level…that give priority to the needs of the poor…(para 60a).

The Tubah community that existed on the north western margin of this Highland was a relatively small agrarian community where the population growth and density was held in a steady check and balance between demographic policies and rural resource ratio. As other communities community water needs for domestic and other ends permitted a self-reliant community development mobilization towards the harnessing of underground water into pipe-borne water for common good. The Tubah communities are complex social realities in which it may be impossible to separate out the management of the water supply from other concerns, yet such management capacities can only be built successfully with a clear understanding of the social, economic and cultural characteristics (Lammerink et al. 1999). The Bambili and

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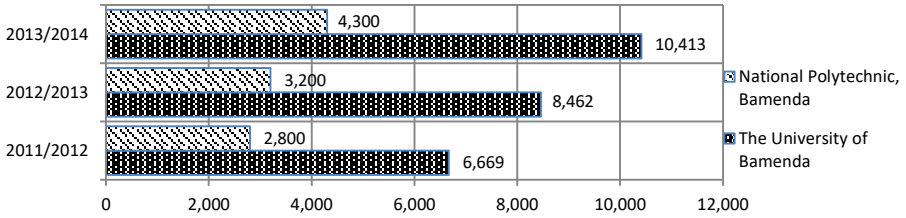
Bambui water management committee and the population on the whole at the time had only for ambition the wish that water should flow in the pipes and taps, and in as much as this happened, everything worked. No assistance was sought or thought to be required even from well-established international donors in this domain (Lochery 2013). And truly things worked out rather so well for the inhabitants and few schools in the region. According to the Sub-Divisional Office, Tubah, the population of Tubah villages by 2014 was 65250 inhabitants being Kedjom Keku: 15,286 inhabitants, Kedjom Ketingoh: 17,433 inhabitants Bambui (including Fingi and Barforkum): 17,083 inhabitants, Bambili: 15,448 inhabitants. History proofed them wrong as not only the quantity has reduced significantly until there are weeks and areas where taps run dry but the quality lost its originality as more and more degradational inputs have emerge from recent development circumstances.

Ironically, Tubah is sited on the north western flanks of the Western High Lava Plateau, an emblematic geo-hydrological centre or local water towers laden with volcanic mountains as water sponge which needs the aptitude backed by positive political will to bring water to the people. It is long established that volcanic rocks and ground water are intimately related in a variety of complex and contrasting associations used for portable water in addition to irrigation, manufacture, mining, geothermal energy, as well as producing economic brines and mineral deposits (Wood and Fernandez, 1988). Of everything else the most prominent of what has triggered an excessive upshot of the population of this educational capital of the North West Region is certainly the creation and functioning of educational institutions especially those of the Higher Education Ministry with two giants: The National Polytechnic, Bamenda in Bambui running six Schools and The University of Bamenda running two (as of 2014-2015) Faculties and five Schools (Fig. 1)



Source: UBa and Polytechnic Central Services, 2014.

Figure 1: Evolution of student enrolment in the main Higher Institutions in Tubah

These have in less than three years attracted a large population of partners and affiliates who not only use space but daily depend on the water resources that were harnessed not with them in consideration.

Sowing germs of a water shortage hazard community in the making

The Cameroon Water Corporation vested with powers to provide this social facility has regrettably not been paralleling the population demand with pipe-borne water with neither supply nor quantitative special improvement of water facility infrastructure in Bamenda over time. Even the town Councils that Law No. 2004/017 and Law No. 2004/18 of 22 July 2004 on Decentralization in Cameroon gives it clear attributes on regional planning and provision of community social facility like water have within the Tubah area are unable to breakthrough into this area where self-reliant development has taken precedence with established existing water management committees of the people for the people with the blessings of the people under the supervision of traditional institutions vested with ancestral and mystical powers

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known, accepted and respected by all and sundry. Even non indigenes that migrate into these areas have a protest/disobedience zero option to this traditional status quo. Change and innovation can only be centripetally outwards with obvious limitations of inability to revolutionize water supply with rising demand at short and medium term as is the case called for now for the dearth of adequate planning.

By the close of the 20th century, an estimated population of 56,567 inhabitants in Tubah exerted little or no pressure on its available water resources especially around water catchment areas. Community water supplies have often proved costly and ineffective in the long-term, driven by a supply-side, top-down approach, and led by technical experts unfamiliar with local needs and conditions (Leete *et al* 2003). The flow pattern of the streams together with efforts of the Community Water Committees of Tubah have been surprised by the post-2000, unprecedented population growth that creation of Higher Institutions in triggered with the massive influx of people into the Subdivision meant on water consumption for infrastructure, agriculture and commercial activities. Considering only infrastructure alone, what appears as a necessary modernization indicator in this region is the building of student residences commonly called mini-cites. These are single room student dwellings where students live alone or in pairs for their school period. These are invisibly the highest and most water wasting outlets of community water that was never thought of, let alone considered in the community development plans and policies that made no use of experiences elsewhere. Mindful of the large and certainly increasing number of catholic Christians in Bambili and Bambuil, the Catholic Churches here through the Bamenda ecclesiastical province could aptly borrow ideas from the planning, implementation and sustainability phases of the policy and planning framework for activities funded by USAID under the Title II (Food for Peace) Program and by other donors using the same guidelines for the development of small-scale rural water supply and sanitation projects applicable in East Africa (Warner and Abate, 2005).

Water resource community gainfulness and a common tragedy paradigm

Self interest in is setting the pace for our common tragedy because rural poverty and the wrong development fight is yielding poverty accentuation and not alleviation. This is a typical rural water resources alleviation not poverty alleviation that gives a make belief of development but rather deepens the rural setting into more under development. An appreciable amount of water is diverted away from the community expected usage that was considered at inception as detailed household and commercial end uses, including sanitation, faucet use, cooking, bathing and laundry, dishwashing, clothes washing, leaks, and outdoor landscape and garden demands. Not have these functions been reduced to mini-cite individual room level that has by far beaten the number of indigenous households at the time of the creation of the water projects, and even continues to grow unabated for the quick economic returns it makes for the owners. Most owners have become economic men essentially non-natives who have paid dearly to acquire the building plots and so invest in high-density houses that are increasingly in storey buildings. Since students' rooms equipped with internal toilets are priced more and earn higher returns over a short-term such economic men land lords have resorted to building rooms that are equipped with this type of facility. The quarter development water development fees upon start of development of bought plots are invariable of the type and size of the building to eventually emerge on the plot. The most logical of the landlords therefore would logically go for returns maximization by high rise buildings of individual students rooms equipped with toilet systems. Each room occupant whether single floor of multiple floors pays an annual 8000 FCFA fees to the landlord who is supposed to channel to the community water development committee.

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Though the landlord may pay a building fee for using water and the room tenant pays an annual usage fee even when effectively has and cannot been rationally of service to the survival of the community water system on the whole. The building fees and tenant usage fees are agreed by village development general assemblies based on estimates that do not reflect the reality and are far from the reality. To the common man the sums are high enough in their perception. When they consider the total of what they had paid over the years as water development fees they are tempted to think that their levy is gainfully representative and compensatory enough for the financial, material and labour sacrifices they had put it to bring water into their communities.

From field work conducted in 2014, there were 30 and 38 houses are constructed in Bambui and Bambili respectively and this trend is on an increase considering the rising demand as more students are called in for the increasing and ever diversifying courses offered by the institutions of learning. The building material used are 59% mud bricks and 4% cement blocks and 37% both. The type of mortar used is cement or mud which are have water as the major component of mixture. Being generally carried out in the dry season, mud brick construction constitutes a strong stressor on pipe borne water since there is no rain water harvesting in the dry season. Despite the alarm raised by water shortages during dry season builders and landlords are indifferent and adamantly hold to their traditional and local material sun dry construction for reasons of lower cost and supposed greater structural stability to cement blocks. The volume of community water used in these constructions vary in water consumption.

Estimates during fieldwork established that it took 400 litters of community pipe borne water to produce 100 mud bricks, and 100 litters of water to produce 100 cement bricks. For an average student room to be built, it requires about 400 mud bricks (1200 litters of water) or cement blocks (300 liters of water). Sun dry constructions using mud consume water community water four times more than cement buildings yet all landlords building pay the same flat rate for the community water building fee. The mud constructions once started in the dry season must be carried on to the end in the dry season else the rainy seasons would destroy them unlike the cement constructions that can span unhurt into the rainy season. The gradual overlap of the Bamenda urban front into Bambui and Bambili respectively will worsen this situation in the near future.

The Bambili and Bambui communities consider the water flowing from their taps as an achievement that has come to stay. Regrettably, the irregular (trellis) piping system that was put in place from the beginning, rather than the regular or branch piping system does not permit a regulated system of rationing especially in the dry season. Therefore any available water during the dry season period only benefits the immediate neighbours connected to the tanks. The situation is worsening as more connections are done. The water systems in Tubah are gravity pull rather than pump or pressure. Therefore with the gravity system, those quarters located on elevated slopes hardly get water especially during periods of shortages in the dry season.

Lots of the indigenes, even a good literate part do not perceive the consumption rate of the water and even their technical expertise hired do hot give them the threshold population the water supply can handle. Even when this is done, it is at community level and cannot be implemented at individual level as people who inherited and owned plots would at a point in time need money and so sell them. Even then they sell they do not eventually determine its number of future occupants who are potential water consumers. It becomes difficult and almost impossible to implement a threshold limit to water using population even if the figures exist.

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This is about the concept of "peak water" being an additional impetus for a new "soft path for water" paradigms to emerge. Results for Tubah here reveal that peak water is a reality, so community water managers have to recognize and manage water as a valuable and precious resource. True limits on this community water availability should stimulate innovations and behaviours that can reduce water use and increase the productivity of water. This must shift the users in the direction of protecting and preserving precious water resources—a necessary step for a sustainable water future (Palaniappan and Gleick (2009). Never has it been thought of nor even imposed upon the said builders and landlords to affix unto each room and eventually each house or compound, a metering system as operates Ontario and Sofia from which consumption limits could be set so that any consumption above that level becomes progressively taxable as analysed in Singapore by Makropoulos et al (2012). From an economic perspective, water use should be metered, and a volumetric rate charged for consumption. When water consumption is not metered, as in Tubah where there Community Water Committee charges a flat annual fee for the privilege of connection to piped water supply. The fee is not based on the size of the pipe delivering water to a house or compound and it does not otherwise vary with the quantity of water consumed. Such flat water fees are equivalent to imposing a zero marginal water price and when annual charges for water consumption are not linked to the quantity consumed, households have an incentive to use the resource until their own marginal benefit of water consumption is driven to zero. This provides no incentive for conservation, and unless the marginal cost of water supply is equal to zero, it will be inefficient (Olmstead and Stavins, 2007). This was never done and it may be too late to do so now because the buildings have not been constructed this far with this measure in mind. Even if it were, the tragedy is already there and very present, technically irreversible at short term measures and not a mere water myth as held by MaUn Falkenmark and Cati Whdstrand (1992).

The building fees and annual water consumption rates channelled to the Community Water Committees perhaps over the years have been seen and considered by the stake holders in-charge of the management of such funds as a source of income–compensatory income for the community. Perhaps with no proper accountability such income has been redeployed for other purposes other than reinvestment into new catchment tanks and water networks. Like in most communities those in the water committee are not unqualified. In Tubah, election into top managerial positions of water authority organs is always by the village traditional councils. People who do not have sound knowledge of water management are voted into office and logically cannot innovate, take or implement the suggestions and advice of technicians and engineers for obvious reasons. As in most communities, it goes for water maintenance justified by paying monthly allowances to people within and at times outside the chain of community water supply without purchasing even the most basic equipment for the water maintenance technician on the field. Such financial entries are considered as some sort of wind-fall that owes no explanation to the development general assemblies but to a selected few by virtue of some rights that cannot be challenged by status or tradition. For this misappropriation over the years, the general community would pay the price of water shortage that becomes a tragedy sparing none.

The landlords and user tenants consider these levies as derisory. Even when they see it as exorbitant, they are not faced with a democratic option of their decision to pay. Pay smiling or grumbling, what matters would be the nature of using that is to follow. The water committees after bagging their levies, backs off provided there is no blatant incidence of water wastage noticed and reported. Ironically, in this scenario, a tragedy of the commons triggered. The building landlords and user tenants are not indigenes and would not weigh enough what it cost

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the community to have harnessed the water and what it would mean if the water were misused. The "after all …" syndrome sets in at all levels. The builders would use the water in all the facets of the construction from the manufacture of blocks and bricks as the case may be to the building proper. Hardly has an estimate been done to evaluate the volume of cubic meters of community water that it takes to construct a single average student room, let alone a building that may go many floors. Such estimates would even meet with the foolishness of the fact that the periods of such building corresponds to the dry seasons when the water recharge significantly drops and the storage tanks are greatly deprived of the liquid input.

In this study, the water balance was conducted between July and September 2014, and February and May 2015 to determine the difference between inputs to a water system (amount of water from spring sources) and outputs (water demand of the community). This permits the study to establish the sufficiency for the population (Table 1). It measure clearly exposes reasons for the water deficit in Tubah especially in Bambili and Bambui which have had the highest influx of student population.

Table 1: The seasonality of water input in Bambui, Tubah

Source	Location	GPS location	Month measured (m3/day)	
			July and August	February and May
Water Treatment Station	Filie	N: 06º01.933′ E: 010º16.500′ H: 1523m	583.29	566.8
Quini Hills 1	IRAD	N: 06º00.123′ E: 010º16.803′ H: 1716m	439.53	192.6
Quini Hills 2	IRAD	N: 06°00.236′ E: 10°17.052′ H: 1749m		
Quini Hills 3	IRAD	N: 06°00.498′ E: 010°16.623' H: 1563m	298.03	211.0
Quini Hills 4	IRAD	N: 06°00.535′ E: 10°16.514′ H: 1542m	200.8	60.5
Upper Monku 1	Monku Hills, IRAD	N: 06°00.972′ E: 010° 16.977′ H: 1817m	112.32	148.7
Upper Monku 2	Monku Hills, IRAD	N: 06°00.974′ E: 010° 16.992′ H: 1784m		
Upper Monku 3	Monku Hills, IRAD	N: 06°00.962′ E: 010° 16.994′ H: 1789m	16.76	16.3
PMUC	Monku Hills, Ntambang	N: 06°01.346′ E: 010° 17.363′ H: 1764m	71.37	100.5
Nju	Ntambang	N: 06°01.085′ E: 010° 16.632′H: 1610m	106.48	93.9
Lower Monku 1	Monku Forest, Ntambang	N: 06°01.466′ E: 010° 16.949′ H: 1669m	135.65	76.2
Lower Monku 2	MonkuForest, Ntambang	N: 06°01.458′ E: 010° 16.950′ H: 1601m	345.00	185.1
Lower Monku 3	Monku Forest, Ntambang	N: 06°01.308′ E: 010° 16.853′ H: 1631m	89.86	45
		Total inputs	**2,399**	**1,696.6**

The data reveals a strong deficit for the dry season from February to May (being almost half of the rainy season input) symptomized in the community by acute water shortages.

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Yet this is the time of building boom paradoxically diverting the community water objective away from the indigenes to the foreigners, from domestic use to construction use, from social capital to monetary capital, from judicious use to abusive misuse. As the villagers grapple with the little available water that can drip from the taps for a conscious use, the builders develop tactics of all-night tank filling as taps are left permanently open to harvest the possible little that might drip from the taps. After all, they would say, if they do not do, others would and they would not have water to work with. Extreme capitalism of individuals primes over social capitalism of the community as a whole that was at the very basis of the construction of the water projects. This becomes a construction infrastructure generated tragedy that would be replicated in acute water shortage.

When the builders have triggered the tragedy, the tenants would facilitate and fine-tune the tragedy in their day-to-day use and misuse of the community water. Daily multiple water uses occur in bathing, dry-cleaning, cooking, laundry, and worst being the water from the toilet closets (generally more than five litters) with water chased away for as many times and purposes that the toilet is used. The water quantities used in these purposes are directly proportional to the number of room occupants and visitors. Some landlords may regulate and impose single dwelling in hostel rooms but it is common knowledge and practice that this is so done to slightly increase the monthly rent returns. Such double dwelling is certainly not paid double to the community water committees and if the case wrong data would be expected. Where it becomes impossible to regulate is the number of room visitors and visitor duration and purpose who would certainly have the same privileges and access to water use. What is most impossible to regulate is the water overspills during usage and the timeliness in repairs of disrupted water connections because to most of these student tenants (especially where landlords do not reside in the same buildings, as it is most often the case), the "… after all I have paid for the water, and so … " leaks out water from the community network system in a way unnoticed and unreported to the maintenance committee. The student users often have too many other academic pressing preoccupations than maintaining water that is leaking. Individual misuse and neglect ultimately opens another facet of the tragedy of the commons because shortage would be bound to occur. Such shortage comes earlier as the aggregate wastage and misuse pools increase.

In this study water wastage was measured from the drip away losses from the taps. The outflow of water from taps were measured during fieldwork to determine the quantity of water wasted in each scenario (Table 2).

Table 2: Relative water wastage volumes per flow method over time.

Flow modes	Quantity of water produced		
	per second (Litters)	per hour (m^3)	per day (m^3)
Drip	0.000417	0.00115	0.036
Dribble	0.01	0.036	0.864
Small flow	0.03	0.108	2.592
Normal flow	0.12	0.432	10.368

Source: Fieldwork, 2015.

It was observed that half way closed taps were dripping. This may appear as a negligible loss. Estimating the numerous taps dripping behind closed doors in the students' rooms and houses

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it was projected to some $36m^3$ per day and all such taps would amount to 864 liters being enough for approximately 17 to 25 person's daily usage. If only 5% of taps are constantly dribbling (which is definitely much higher), this adds $173m^3$ per day to the demand. Stand-taps left permanently open (when people especially children are filling containers) or damaged (in many of the schools and during road constructions) can waste as much water as $10.35m^3$ per day. Should only 5 taps are left open all day, between $52m^3$ and $181m^3$ of water is lost amounting to the daily demand of 726 people. This study therefore notes that population density and per capita resource use have increased dramatically such that the Tubah watershed, volcanic rock aquifers and associated ecosystems are undergoing significant modifications that affect the vitality, quality and availability of the resource as asserted by UNESCO (2013)

Of these Bambili and Bambui have emerged as the growth poles of Tubah and pressure causes water shortages. It is thus estimated that about 326 m^3 (326,000 litters) of water is wasted daily from public stand taps. The population that can be watered can be estimated using the water supply divided by individual water requirements formula of Cohen (2002). Basing on this alone and mindful that the dry season input of 1,696,000 litters (divided by the population of Bambui being 29000 inhabitants) the average daily volume of water per inhabitant in this community is 58.48 litters. The clear implication here is that the water shortage tragedy does not result from low water input but from wastage, poor management and leakages. Water pricing to non-indigenes on the basis of levies is a wrong measure in the long run. There exist strong empirical evidence that using prices to manage water demand is more cost-effective than implementing non-price conservation programs (Olmstead and Stavins, 2007). It may give a rapid unset community investment returns but it is a medium and long term hazard for all and sundry that lives within the Tubah community.

The conclusion may be alarming but the indicators are there for verification. The average water consumption and misuse by the capitalist landlords and tenants far exceeds by four to five times the average of the native indigenes. Considering that the community water project and committee had set its upper work limit to a certain tank and piping capacity that cannot be immediately doubled by an equal four to five times excess use, then the scarcity of shortage should logically be expected to come four to five times faster and four to five years earlier and worsen four to five years earlier. By implication, should current rate of use and misuse continue unabated and if no new reinforcement projects are put in place immediately, there would even be water scarcity and shortages even in the rainy season. A generalized all-year-round water crisis should be expected come 2020. The World Economic Forum's *Global Risks 2015 Report* (WEF 2015) lists water crises as the top global risk in terms of impact and eighth in terms of likelihood as water resources, which are essential for human development and environmental sustainability, are coming under intense pressure (Kalpana Kochhar *et al.* 2015) The 2020 dooms year may even come earlier with more new institutions (Oxford University Polytechnic, Bambili), Faculties (Arts, Economics and Management Sciences, Law and Political Science, Departments (HND and Agriculture of the HTTTC, Custom, ship maintenance and others of HITL) coming of age with its pull of students into this community. Increase in student numbers would not only directly use and misuse the community water but would spill into more catchment areas that ought to serve as the natural water recharge zones with buildings and tarmac, waste pollutants apart.

This has exerted much pressure on water resources such that in the dry season especially between January and June, water is scarce. Indicators of this scarcity are generally in the form of the drying up of the taps, the partial water stoppage in the lower altitude residential quarters

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and the complete stoppage in the upper slope residential quarters. This is worsened by the about 31% inhabitants involved in market gardening (20% being full-time and 11% part-time) deviating stream and spring sources into their farms (Photo 1). The high and perfectly inelastic demand for vegetable and celery in Bambili and Bambui has but triggered the extensive use of chemicals rather than organic manure in such market gardening activities in Tubah.

Source: Fieldwork, 2015.

Photo 1: Market gardening and water channeling upslope

Waste and farm chemicals from this activity flows back into the valleys to contaminate the streams. The challenge of clandestine use of drinking water for irrigation during the dry season per se does not directly cause shortage but it is rather the continuous great usage of chemical farm inputs upslope of Tubah that poses an irreversible menace to the water quality than quantity traits of the community water supply system. There is therefore a serious and rising call for concern on the part of the stakeholders.

Water shortage user responses of community stakeholders: releasing the pressure in Tubah

Three dimensions characterize water shortage or scarcity in Tubah being: a physical lack of water availability to satisfy demand; the level of infrastructure development that controls storage, distribution and access; and the institutional capacity to provide the necessary water services. The population response to this water scarcity and stoppage appears to be directly proportional to the degree of usage and misuse that triggered the shortage. The indigenes feel the shortage and adjust their demand management by resorting to short distance trekking and fewer times to the nearby raffia palm bushes. The water harvested from such brooklets and brooks serves them relatively well for the fewer domestic chores they carry out. Alternatively, they resort to the intensive use of the volcanic Lake Bambili (Photo 2) to the extent that it is quickly becoming a victim of eutrophication as indicated by the algal blue eating up from the lake banks.

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Photo: Fieldwork, 2015

Photo 2: Indicators of algal bloom on the banks of Lake Bambili

Other pollutants join with fertilizers and chemical trace elements used in upland agriculture being washed by overland flow into the lake. The feeder lake at the fore of the main lake is rapidly colonized for crop cultivation and cattle rearing. This is causing rapid sedimentation and shrinking of its waters though the natives allude this to mysticism and superstition. Should this continue unabated water table will only be lowered further thereby increasing the water scarcity equation of Tubah. Alternative sources of water like boreholes can be produced in the crystalline Bambui and never on Bambili sited volcanic rock slopes.

A water management of misplaced priorities is seen that before the year 2000, there was no talk about catchment protection of watersheds in Tubah because they were regarded as a common property. The numerous spring sources then, provided enough water for usage blinding the eyes of the indigenes seeing what the future holds in terms of water resources. The dearth in awareness of catchment protection and believe in common property use, encouraged them to plant eucalyptus trees, graze and cultivate on water catchments. After the year 2000 an awareness was raised inviting protection and conservation by management authorities of the various villages. Population and water need rise rapidly, whereas, water availability is decreasing due to inefficient management and deterioration (Shadananan Nair, 2010)

It is the foreigners who inhabit the hostels who have no choice but adopt to the water crises in a more radical manner. Many trek long distances in the early hours of the morning to fetch water from the brooks that they may know. When they do not know and cannot find such water saving brooks in the dry season, they cut down on their water using activities in a highly rational rationing greatly reducing the number of times of chase water toilets, many resort to the use of pit latrines, many migrate to other areas just to do laundry, bathing is reduced to essentials number of times and in strictly required number of times, water recycling in the rooms becomes the order of the day. At the other extreme, multi-floor buildings in up-slope sites become less pleasurable as not only are they not in the potential high demand for rent but the occupants seek to quite to lower slope and single floor buildings. The number of uninhabited hostel rooms thus increases proportionately upslope. The tragedy of the commons becomes a shared responsibility and so even those who significantly contributed to the water mess have to pay somehow.

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Institutions that emerged in the community and had depended on the water for common use like the university adapt to the dry season shortage by ferrying in huge quantities of water to foster construction works and for cleaners to do their job, water harvesting for cleaning or the use of essential toilets, closure of toilets considered as non-essential with staff and students resorting to use the nearby bushes to keep comfortable, abandonment of essential buildings like the university restaurant and students' hostel for many years after construction completion, widespread dependence on mineral water even for some laboratory experiments. This has eventually pushed The University of Bamenda to embark on a construction of a separate water network for the university community.

CONCLUSION

This study shows that the cause of acute shortages of water in Bambui and Bambili is the technical as the water piping system not permit water support rationing and the gravity pull system disadvantages upslope residences without which there could have been enough water in Bambui and Bambili even in the dry season for everyone. This would require that the issue of leakages, water wastage and an unequal distribution storage tanks be urgently reviewed to avoid the 2020 dooms year. Since unaccounted water still amounts to about 44% of the available water resources the 14% wastages and 20% leakages hot spots should be reversed to general welfare hope spots of the human communities in the Bambili and Bambui acdamic clusters of Tubah area without which a disease outbreak is by the corner. Where and how it comes cannot be accurately predicted but the 2020 year may be a sufficient indicator for now as the MDG water-provision targets reducing by half the proportion of the population without sustainable access to drinking water by 2015.

Redoing the piping system completely to give chances to a systematic rationing would cost several millions that the current water management committees do not have in their coffers and cannot raise in a short term because the water management committees were not equipped with the proper and sustainable tools and information to build management capacity in the target communities. Since providing water to an urban community in the making in Tubah is a social facility that must be met, this study suggest that the water authorities with the assistance of the Cameroon government that should consider this Tubah communities to have over-lived their purely village status, should apply for foreign aid from international institutions to remedy the situation. This study identifies that CARE has carried out water, sanitation and hygiene and WRM (referred to collectively as water+) work for over 55 years and is currently managing approximately 181 projects in both emergency response and long-term development in over 40 countries. In fiscal year 2012 (July 1, 2011 – June 30, 2012) over 1.5 million people benefited directly from CARE's developmental work in water+ and over 9 million from its humanitarian (emergency) water+ work. During the 1960s CARE focused on water hardware installations in poor rural communities in the developing world.

Meanwhile emergency requires they start installing water meters in heavy consumer institutions like storey building hostels, mini cities, hotels and schools at the same time stepping up catchy sensitization campaigns to managing demand and water supplies through more desirable patterns and levels of water use. This would ensure the right level of water governance and institutional capacity is in place. As demand management takes increasing importance, stronger institutions are needed to guarantee equitable distribution of water, definition of roles and responsibilities, empowering of local institutions, review of policies, adaptation of laws,

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and the use of incentive mechanisms as water scarcity builds up. A new water management culture is required including public awareness campaigns, educational programmes, capacity building and training at all levels, including water users groups. Proven successful options include reallocating water away from agriculture, increasing irrigation efficiency, instituting voluntary conservation measures, involving communities in water management plans, and finding more effective distribution mechanisms.

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