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Water consumption embedded in its social context, north-western Benin

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Abstract

"All peoples (...) have the right to have access to drinking water in quantities and of a quality equal to their basic needs" (UN Water Conference, Mar Del Plata 1977). According to *Population Action International* the West African country of Benin has not suffered from either water stress or water scarcity in the past nor will it belong to water-short countries by 2025 [PAI (Population Action International), 2000. Available from: <http://64.224.182.238/resources/publications/peopleinthebalance/downloads/people_balance.pdf> (accessed 23.08.04)]. The national average daily water consumption is given as 20 l [World Water Council, 2003. Available from: <http://www.worldwatercouncil.org/Vision/Documents/WestAfrica2.PDF> (accessed 23.08.04)]. This interdisciplinary micro-study of patterns of water consumption in the north of the country shows, however, that in some cases at the level of the household, per capita consumption is much less than the minimum standard quantity of 20 l published by the WHO. The average per capita consumption in the households investigated is 18.7 l. If one deducts consumption by visitors (5%), the value comes to 17.2 l per person. The lowest consumption occurred during the dry season, at only 5.2 l. This discrepancy with national consumption is caused largely by the great influence of the following indicators: seasonality, size of household, access to resources and differences between urban and rural areas. The latter relates not only to differences in the quantities of water consumed and their purposes, but a marked role is also played by the differing consumption of poor and rich households in the urban units of investigation.

The correlations identified here between local influences and water consumption show that the scientific investigation of water management and the search for approaches to finding solutions, will in future require more interdisciplinary approaches combining hydrological, climatological, economic and anthropological findings.

1. Introduction

> Water is the originating principle of all things; everything is made out of water and to water everything returns. Thales von Milet (Heyn, 1981)

Water, the basis of human existence, is being called 'blue gold' ever more frequently in the current debate over resources in the 21st century which are becoming scarcer (Barlow and Clarke, 2002). The explosive nature of this subject can be seen not least in the implementation of this year's 'International Year of Freshwater.' In addition, numerous studies prophesy an increase in associated conflicts, especially in connection with rising urbanisation. Sustainable conflict prevention requires not only knowledge of water resources and, for example, climatological phenomena, but also of consumption habits and strategies of the affected persons in their own everyday situations.

This interdisciplinary study describes a unit from the research project IMPETUS (*Integratives Management Projekt für einen Effizienten und Tragfähigen Umgang mit Süßwasser*, "An integrated approach to the efficient

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management of scarce water resources in West Africa'')[1]. See also Boremann and Mbarek in this issue. It was carried out in northern Benin (West Africa), with the aim of observing water consumption embedded in a case-specific context and everyday life. The analysis concentrated on the following research questions: How great is the actual amount of consumed water at the household level, and which indicators does it depend on? How is water collected and brought into the home (import)? What purposes is water used for, how much, and from which sources? How well do urban and rural patterns of consumption correlate, or to what extent do they differ? How can the water access situation at local level be categorised – for example, is there seasonal water stress?

At the national level, Benin has not been suffering either acute water scarcity or water stress to date (PAI, 2003). Gleick (1996) relates the ''basic water requirement'' (BWR) to ''basic human needs: drinking water for survival, water for human hygiene, water for sanitation services, and modest household needs for preparing food.'' He puts a human being's BWR for daily consumption at 20–50 l. The national mean per capita consumption in Benin is given as 20 l (WWC, 2003). According to this study the mean per capita consumption was 18.7 l, the lowest value measured being 5.23 l (in the dry season), which is far below the national average.

2. Methods and definitions

Seasonality is a major factor influencing farming and the use of resources in West Africa, resulting in wide variations in the patterns of water consumption and behaviour throughout the year. In northern Benin there is one dry season and one rainy season every year. As a result availability, quantity and quality of water are subject to severe variation. Consequently water consumption has to be recorded longitudinally. A comparative, long-term study including social structure at the local micro-level, covering a period of six months was conducted between August 2001 and January 2002. The sample comprised 40 households in four villages (Dendougou, Sérou, Bougou, Pélébina) and one small town (Djougou). The selection of the residential units defined as households in the sense of ''most important economic and social units'' (Gregory and Altman, 1989) was made by the local councils of elders[2] in each setting, that is, decided by local knowledge. They were asked to identify the

- two most prosperous, polygamous residential units
- two most prosperous, monogamous residential units
- two least prosperous, polygamous residential units
- two least prosperous, monogamous residential units.

This was done with a view to a possible correlation between prosperity, family status and water consumption. The identified households were visited once every month from 6 a.m. to 9 p.m. Water consumption in the home was investigated with the help of twenty local assistants[3]. In the case of exception—household members returned home late and did not have their shower or dinner just up to 9 p.m.—the assistants stayed even longer until all major water consuming activities were completed. Through the technique of continuous monitoring—''[...] you watch a subject, or group of subjects and record their behaviour as faithfully as possible'' (Bernard, 1994)—all water-related activities were recorded along with the time of day, information about the person and the purpose, as well as the storage of rainwater. The amounts of water remaining in the morning and in the evening as well as import and export of water (ml/action) were measured and recorded.

Due to the high mobility of the population, lists of all present household members were made regularly, including which ethnic group and religion the actors belonged to, their occupation, gender, age, marital status and origin. A general distinction was made between consumers who belonged to the household and those who did not. In view of the fact that visitors represent an integral part of the household economy, the total water consumption within the household by all consumers was recorded, including guests.

The definition of per capita water consumption used here is based on that used by the United Nations: ''Domestic consumption of water per capita is the amount of water consumed per person for the purposes of ingestion, hygiene, cooking, washing of utensils and other household purposes including garden uses. Where it is customary for domestic animals to be kept at or in the living environ their needs are also included in the assessment'' (UNITED NATIONS, 2003). Other case-specific components of household consumption are washing clothes outside the dwelling in rivers and wells, and water consumed by visitors and neighbours. We focussed on all water-related activities. The design of the study and the analysis paid particular attention to the following indicators: seasonality, size of household,

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[2] Each village and each city quarter in the region has its own ''chef de village/de quartier'' with a council of elders as the smallest political unit.

[3] Local assistants were chosen with respect to working hours and feelings of disturbance by the observed families. Thus assistants were considered most of the times as neighbours and not as intruding outsiders.

access to resources, gender, marital status, family status (e.g. son of the head of the household), the subjects' religion, and a comparison of urban and rural settings.

The data were analysed on four levels: (1) individual, (2) household, (3) village and town, (4) regional generalisation. The material evaluated includes background data from a total of 42 months of field work.

3. Socio-geographical background and conditions of access to water

The survey was conducted in the sub-prefecture of Donga, in the small town of Djougou (Madina district) and the villages Dendougou, Sérou, Bougou and Pélébina (Map 1). The area under study is characterized by a high degree of heterogeneity of the population with profound cultural, religious and linguistic differences. Even though the sample population comprised of 40 households and 683 persons belonged to 25 different ethnic groups, the Yom ethnic group predominates in most of the households. The majority of the heads of households are subsistence farmers, and of these, 31 men indicated that they were Moslems, four were Christians and five belonged to 'traditional' religions (which occur in syncretistic forms in all 40 households). Demographically the 683 individuals were classified according to the following age groups: men, 18%; women, 24%; girls, 29%; boys, 27%; no data, 2%. The age of 'reaching adulthood' was determined by the age of the youngest women and men in the sample population who were married (both 18 years old). The mean size of the households investigated was 13.05 persons.

As there is a great heterogeneity of the population there are also diverse types of access to water due to settlement patterns, ground quality and economic situation (Table 1).

In the urban households the dominant sources of accessible water are public wells and private wells. There are also some pumps, private public piped water and *marigots* (French: water holes in dried-up riverbeds or marshy areas). Despite the broad range of sources, access is problematic in some cases in the dry season because some of the wells dry out.

In Dendougou, a village ten kilometres north east of Djougou, there were 59 residential units (KLEIN, unpublished census 2001) sharing two village wells and five *marigots* during the period of study. Four of the households investigated lie on the edge of the village, and they obtain all their water from *marigots* (which are 600 m away by a direct line). In January 2001 a

Table 1
Water sources in the settings investigated

Source setting	Private well	Public well	Pump	*Marigot*	Rain	Private connection
Djougou	X	X	X		X	X
Dendougou		X		X	X	
Sérou		X	X	X	X	
Bougou	X	X			X	
Pélébina		X	X	X	X	

Map 1. Investigation area.

new well was completed, and another was under construction. The newly accessible water source led as a result to an increased water-consumption at the height of the dry season. Still, in comparison to the other three villages and Djougou the population of Dendougou had the poorest access to water.

The village Sérou is located six kilometres south east of Djougou. Access to water sources proves to be problematic for the 46 residential units, because there are only four wells, whose water capacities vary widely with the seasons, and which also exhibit severe variations in the quality of their water (SCHOPP, unpublished survey 2001). De facto only two of the four wells are used to a significant extent, since one well is in private ownership and another is extremely salty. The village pump was repaired at the beginning of the dry season.

The large village of Bougou, lies 50 kilometres south of Djougou and has numerous private wells and village wells, plus one defective pump and a functional one. The inhabitants evaluate the general water situation primarily as "satisfactory." During the period of investigation the village consisted of 402 residential units (HADJER, unpublished census 2001). The eight households investigated had direct access to a well.

By contrast, the neighbouring village of Pélébina suffers acute problems with the water supply, especially in the dry season. Owing to the poor quality of the ground, there are hardly any functional private wells, and inhabitants of 79 residential units share two village wells and one pump (HADJER, unpublished census 2001). At the village level, the greatest distance to these sources of water was 1180 m, while the lowest was 40 m. The members of the households investigated had to cover an average of 215 m to a water source. In surveys (HADJER, unpublished survey 2001) the inhabitants evaluated the water access situation as "poor" to "deficient."

The access conditions of the households investigated can be classified according Howard and Bartram (2003) as follows (see Table 2). The amount of water collected by households on a daily basis "is largely determined by how far the source of water is from the home. If it is outside the home, but within around 1 kilometre (or 30 minutes collection time) a "basic" level of service – then about 20 l per person per day will typically be collected" (WHO, 2003).

However, at the core of the dry season in particular, the distances for each household can change considerably if the wells dry out. In Sérou households formerly depending on well water had to fetch *marigot* water or had to buy pumped water from November on. The population of Pélébina started in December to fetch pumped water in addition to well water. In the preceding year, the wells of Dendougou fell dry in January, forcing the entire population to collect water from distant *marigots* with very poor water quality (personal observation Klein, 2000). Thus situations can develop which the World Bank describes as follows: "In rural areas... many women and children spend hours – in extreme cases up to six to eight hours – each day hauling water from rivers or wells" (World Bank, 2003). This is particularly true of Pélébina and Dendougou, where the villagers have to share a few public wells. The fewer the sources shared by a group, the greater the conflict potential concerning water in the dry season. Quarrels among women collecting water are frequent during dry season. In Dendougou the village well is frequently blocked during dry season for several hours a day by the council of elders. This allows the water supply to recover. After liberating access, the right to use is first given to women who had to collect water at the *marigot* in the morning due to the lack of water in the well.

In each of the villages investigated there are households which fall into the WHO's category of "no access" during the dry season, because they either have to use distant *marigots*, or have to wait for extended periods at the wells. The households investigated in the town of Djougou that had a private water connection are classified as having "intermediate access."

4. Results

In Northern Benin, drawing drinking water is a female domain. In every village public wells and pumps provide a forum for social interaction, where women exchange news about politics, village gossip, etc. and where men go only rarely. Fig. 1 presents the percentage of water collected by actor (family status).

Interestingly, 8% of the total quantity of water was collected by males, although the activity of water fetching is usually considered as women's work due to the strict division of work. The remaining 92% was collected by female household members with the following frequency: wives of heads of households, 32%; wives of

Table 2
Service level in the settings investigated

Service level setting	Djougou	Dendougou	Sérou	Bougou	Pélébina
No access (More than 1 km or more than 30 min round trip)		X			X
Basic access (Within 1 km or 30 min round trip)	X	X	X	X	X
Intermediate access (Water provided on-plot through at least one tap)	X				
Optimal access (Supply of water through multiple taps within the house)					

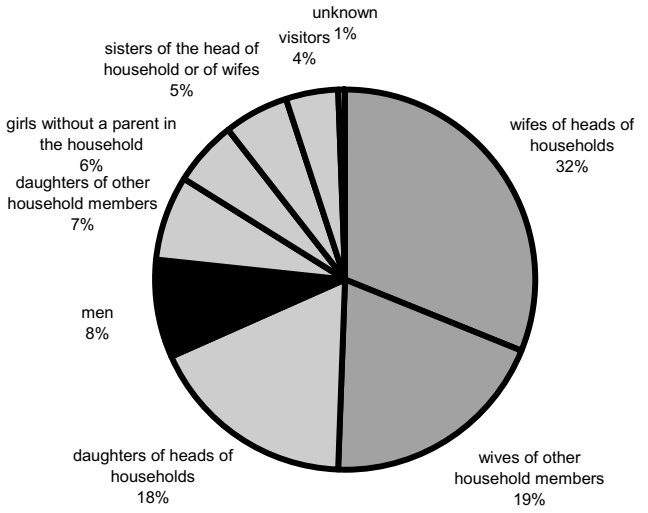

Fig. 1. Percentage of water collected (breakdown by actor).

other household members, 19%; daughters of heads of households, 18%; daughters of other household members, 7%; girls without a parent in the household, 6%; sisters of the head of the household or of wives, 5%; visitors, 4%; unknown, 1% (see Fig. 1). Only in Bougou (the biggest village) and Djougou (the town) some heads of households were observed fetching water. All of them owned a private well and 94.5% of the water collected was used for personal needs and men related activities as washing a car. In only one case was the small amount of 18 l poured into the household water container.

Almost all female household members are involved in collecting water, including girls under the age of ten. One of a daughter's duties is to help her mother collect water; the lower age limit for this activity was two years. Exactly 50% of the unmarried girls surveyed are 10 years old or younger, while 75% are under the age of 16. People may go to draw water at any time of day, although depending on the household, activities peak between 7 and 10 a.m., and 2.30 to 6 p.m.

As mentioned in the *Introduction*, the mean per capita consumption comes to 18.7 l, with a minimum measured value of 5.2 l (in the dry season). Over the whole period of investigation, 50% of the village households consumed less than 16.6 l per head, and 50% of the town households consumed less than 18.6 l per head.

A possible influence on water consumption by the indicator 'family structure' (polygamous/monogamous) can be classified as 'not significant.' On average monogamous households consume only 0.7 l less water than polygamous households. Looking at the indicator 'religion,' it was found that Moslems' consumption of water for religious washing rituals amounted to 3.65%. In the strongly Islamic village of Bougou, almost 7% of total water consumption was used for religious washing (maximum value), while in Dendougou it was only 1.7% (minimum value). There are four other indicators with much more influence on water consumption, which are described below: seasonality, differences between urban and rural areas, access to resources, and size of household.

Over the course of the study, water consumption emerges as a variable dimension. Fig. 2 illustrates a continual reduction in rural and urban households' consumption of water in the transition from the rainy season to the dry season.

In January the consumption in rural households increases slightly, which can be explained by the increased presence of the inhabitants, who are engaged in very little work in the fields during this month. In the town there is hardly any effect in January. The marked reduction in urban water consumption in December is related on the one hand to the beginning of the Moslem month of *ramadhan* (Arabic: fasting) in 2001[4], which is observed very differently in the various villages. Religious families only eat and drink before sunrise or after sunset, thus water consumption is reduced. On the other hand, *ramadhan* happened to be 2001 in December—the time when many private wells start to dry out. Overall, consumption falls from an average of 22.6 l (in August) to 15.8 l (in December).

Seasonal variations are smallest in Dendougou, which also exhibit a very low mean consumption per capita with 16.6 l, and is thus under the minimum value all year around. Here the monthly averages vary by about 3 l.

No direct link was identified between the existence of private water connections (piped water) in urban households and increasing water consumption. De facto, the connections in one household are not used at all, and in another they are only used in two months out of six. Well water is preferred, which the household informants explained as resulting from excessive costs for piped water and its poor taste. These explanations of the lack of acceptance of public supply are widespread in Djougou. Piped water tastes of chemicals and the connections are often 'tapped'; in some cases corruption within the local administration leads to exorbitant bills; and not least, the water comes from a dammed lake, half of which, 'people say,' contains numerous dead bodies and spirits, and is therefore regarded by many inhabitants as unsuitable for consumption. In spite of this, connections which have been installed are kept on. Water taps frequently become prestige objects or represent an opportunity to earn money by selling water to neighbours. Financial transactions of this type also take place

[4] Ramadan is the ninth month of the Muslim calendar. Lasting for the entire month, Muslims fast during the daylight hours. Islam uses a lunar calendar—that is, each month begins with the sighting of the new moon. Because the lunar calendar is about 11 days shorter than the solar calendar used elsewhere, Islamic holidays "move" each year.

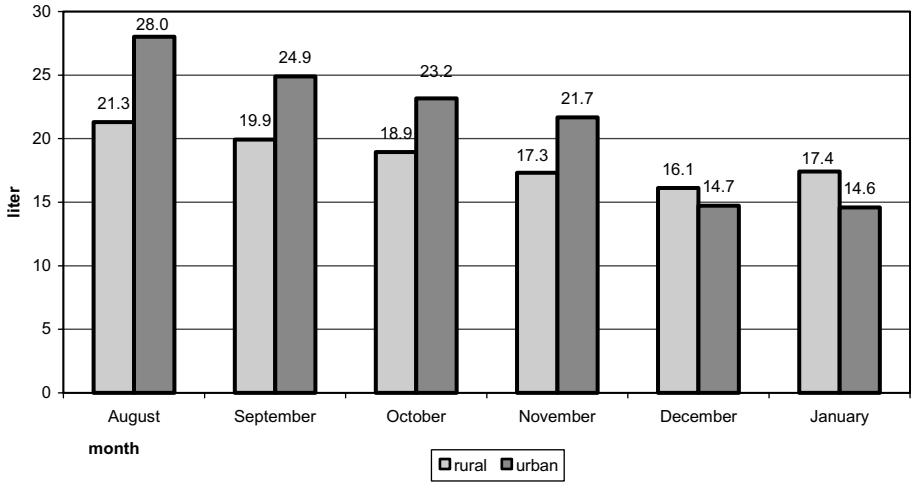

Fig. 2. Per capita water consumption in rural and urban areas.

at private wells in the dry season, and especially at the pumps which are operated collectively.

In the case of the indicator 'prosperity,' a significant difference can be identified when comparing urban and rural areas. While, on average, in the town rich households use twice as much water as poor households (21.9 l vs. 11.2 l), the mean values for poor and rich households in the villages are very close (16.8 l vs. 15.6 l). Here, poor and rich families have the same, limited access, so that prosperity does not emerge as a significant factor influencing water consumption. In the town, on the other hand, rich households have multiple accesses to the most varied sources of water. In addition, water consumption increases due to ownership of more possessions and associated activities such as 'car washing'.

Accordingly water consumption appears to rise with proximity to water sources and the associated improvements in access, as in the case of Dendougou: the mean per capita consumption in the four households with access to the nearby village well comes to 18.6 l. Households using only distant *marigots* consume an average of only 14.6 l.

Comparing different types of water access (rural: *marigots* and village wells; urban: range of sources) in dependence to water consumption, the following causal picture emerges:

Intermediate access, range of sources	>21.2 l
Basic access, village wells	>18.6 l
No access/basic access, *marigots*	>14.6 l

Another major factor of influence is the size of the household. The larger the number of household members, the less water consumed per head – as Iskandarani also found for water consumption in rural Jordan and Amman: "A correlation analysis showed that there is a strong, statistically significant, negative correlation between number of household members and household water consumption per capita" (Iskandarani, 2002).

The mean size of the households in the conducted study was 13.05 people (maximum value 42, minimum value 3). The mean total consumption in the four largest households at any of the sites came to 14.9 l, while the four smallest households consumed 17.4 l. In addition, water consumption within the household by visitors and neighbours was at a constant level in all households, totalling 5% as an overall average. On the subject of the purposes for which water is used, it can be commented in general that "while the amount of water required to maintain survival depends on surrounding environmental conditions and personal physiological characteristics, the overall variability of needs is quite small" (Gleick, 1996). A total of 256 different uses for water were listed, which can be grouped into 12 clusters.

Fig. 3 below compares the mean total consumption in the villages with consumption patterns in the town. It is clear that the two situations demonstrate some similar consumption patterns, calculating purposes as percentages. The largest items of water use were personal hygiene (43% in the villages vs. 34% in the town) and kitchen activities (20% vs. 22%). The virtually identical amounts used for washing dishes (12.5% vs. 12.1%) are striking. In the villages, more water is used for producing drinks (10% vs. 7%), which is explained among other things by the limited access to commercial drinks, especially as compared to the town.

Water consumption in the category 'washing laundry' is higher in the town (8% vs. 14%), as is the quantity used for cleaning objects such as cars, bicycles or motorcycles (1% vs. 6%). Both of these categories are dependent on ownership of material goods, which possibly reaches a higher level in urban areas than in rural areas. Both in the villages and in the town, only very little

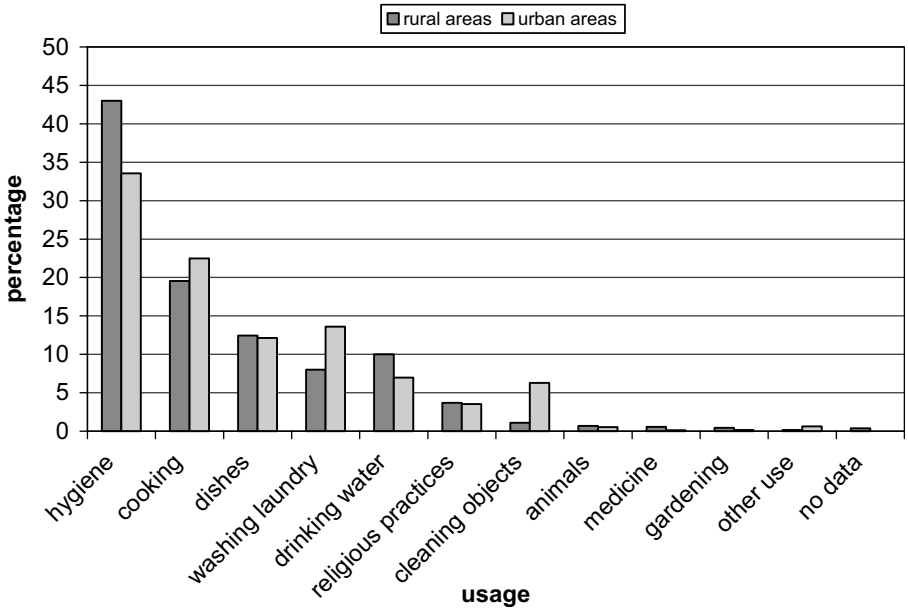

Fig. 3. Water usage in rural and urban areas.

household water goes on cleaning and feeding animals (0.7% vs. 0.5%), since this is frequently undertaken directly at the watering places. The slightly higher quantity consumed for producing medicines in the villages (0.6% vs. 0.1%), including the preparation of herbal extracts and teas in particular, could also be connected, like the production of drinks, with the limited access to commercial goods at village level and/or limited access to herbal remedies at rural level.

5. Conclusion

The water access situation in the region investigated is very heterogeneous. Villages with many wells (e.g. Bougou) lie in close proximity to villages in which all the inhabitants have to share a minimum of public sources (e.g. Pélébina). This heterogeneity is due to very different ground qualities in the diverse villages. In Pélébina wells collapse easily, if not constructed at high technical and financial expenditure.

If one looks at the mean per capita consumption in all settings, the influence of seasonality on consumption becomes clear. Overall, a continuous decline of consumption occurs during the transition from the rainy season to the dry season (see Fig. 2). The overall mean water consumption per capita amounts to 18.7 l, with urban households that have access to multiple sources using considerably more water than, for example, village households drawing their water from *marigots*. The further water sources were removed from the home, the less consumption took place. At household level, no significant dependencies were revealed in the patterns of consumption relating to family status (monogamy vs. polygamy). By contrast, there was a direct correlation between size of the household and the quantity of water consumed: the larger the household, the lower the consumption per capita.

As for the indicator 'prosperity,' it becomes obvious that there are clear differences in the water consumption of poor and rich households, especially in town. Here rich households consume up to 50% more water. At the village level prosperity is not a significant factor influencing water consumption. Amongst the 256 different identified utilisations for water, it became obvious that personal hygiene, kitchen activities, washing dishes and doing laundry are the most important uses both in the town and in the villages.

6. Outlook

According to the Swedish hydrologist Falkenmark, Benin does not yet rank as a country affected by water stress or water scarcity regarding its water resources (Falkenmark and Widstrand, 1992), even if water stress is forecast for the year 2025 (UNEP, 2003).

If one examines water consumption at a local level, however, it is certainly the case that even today, seasonal situations already create water stress. The average water consumption at the sites investigated is 18.7 l, which is already below the "Per Capita Water Supply Standard" of 20 l (l/p/d) put forward by the World Water Council for villages (WWC, 2003).

In the dry season the mean per capita consumption shrinks even further, to 15.8 l, with an absolute

minimum of only 5.2 l. These figures represent quantity only. Quality—safe drinking water – is even rarer.[5]

Participatory observations confirm that in Pélébina and Dendougou some public wells were already exhausted in the morning at the core of the dry season, and more water could only be made accessible if they were deepened. This means that in Benin, at a local level, situations ranging from explicit water stress to water scarcity certainly occur, which again emphasises the importance of micro-studies for assessing the water situation in various countries.

These situations are precarious, and have direct consequences which include waiting for long periods at water sources, having a detrimental effect on women's time management in the dry season. This results in a lesser amount of remaining time for other actions such as gainful commercial activity. Overall, decreased access to freshwater results in a reduction in the amount of water used for hygiene and a reduction in the quality of drinking water, which then favours the spread of associated diseases. The declining water quality is a point which has been highly emphasised by the village population in conversations and surveys (HADJER, KLEIN 2001).

In the future more interdisciplinary approaches will be necessary in the scientific investigation of water management and the search for solutions, which should combine hydrological, climatological, economic and anthropological findings.

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World Water Council, 2003. Available from: <http://www.worldwatercouncil.org/Vision/Documents/WestAfrica2.PDF> (accessed 23.08.04).

[5] Salmonella were found in the mayor village well and 3 *marigots* of Dendougou. A similar situation presents itself in the other villages.