



IMPETUS Benin

People and Water – Anthropological and Medical Research Highlights

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Alarming facts ...

• The access to clean drinking water ensures the reduction of illnesses as well as economic growth (UNDP, 2006). Yet, to this day, there are local and regional specific, partly massive difficulties of access to clean drinking water: only 63% of the total and 55% of the rural population have access to improved water supply and basic sanitation in Benin (Global water supply and sanitation 2000 assessment report, WHO).

Some striking consequences are ...

- Water-related diseases and costs for medical care, loss of working potential, long distances and an overall disadvantage for women due to their responsibility to catch water. Moreover, they are often responsible to pay for their sick children's medication – especially in polygamous households.
- Instead of going to school, girls spend much of their time ensuring their families' water supply (especially in the dry season).
- Global warming and the resulting variability of precipitation constitutes an unprecedented challenge to water management as well as water-associated diseases such as malaria. The projected warmer climate and changed precipitation regime will mostly affect the risk for malaria epidemics in the Sahel and the East African highlands.



Fetching water: a time-consuming female domain

... ask for a better understanding

• Interdisciplinary investigations over 8 years provide important insights to the use of water resources, water access, water use, water quality, therapeutic pathways, the impact of climate change on malaria risk and the brought field of social and economic action.

Some results for the Upper Ouémé Basin

- Approximately 40% of the population depends on the additional purchase of water, thereof 17% all year round (n = 839). In rural areas these additional expenditures frequently result in intra-family conflicts due to unresolved responsibilities.
- ¼ of the population depends on water use for personal business (e.g. horticulture). 25% utilize unclean waterholes as sources, thereof 17% all year round (n = 839, 2004). The poorest access situation is in the north-west. Here, 58% run water-dependent activities (vulnerability indicator).
- 70% of drinking water supplies are contaminated with bacteria of faecal flora as *E. coli* and coliform bacteria.
- More than 10% of all investigated pumps exhibit nitrate concentrations that exceed the limit of 50 mg/L according to WHO-drinking water guidelines (n=150, 2007).
- Because of an irresponsible management of water infrastructures, 31% of wells and pumps are broken down.
- New models of water management could guarantee the sustainability of water infrastructures but are likely to introduce an exorbitant price of water.
- In West Africa malaria transmission generally decreases due to a dryer rainy season, but the epidemic risk increases in more densely populated areas.

People & Water access

- Both personal well-being and economic activities of people crucially depend on the access to safe drinking water. The consumption of contaminated water seriously threatens the health status of the population resulting in lower productivity through sick leave and higher expenses for medical treatment and decreasing available income.
- The information system SIQeau- and the LISUOC/DGEau-databases of drinking water supplies have been combined to create a detailed database with information of about 3800 rural water sources in the Upper Ouémé basin (see P18).
- The SIQeau dataset of drinking water supply reveals that 90% of all water sources used by the inhabitants are traditional and modern wells.
- Asking the concerned people reveals an interesting specification of this result: a quarter of the population is forced to consume water of waterholes (marigots), therefore 63% all year round. See further information: Atlas 2008, Hadjer 2006



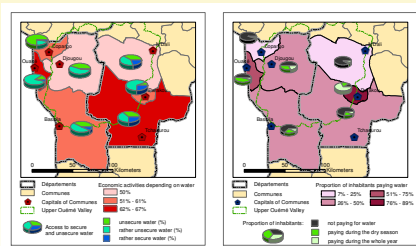
Types of Water source and bacterial contamination (Water analysis since 2001)

Type of water source	Percentage distribution	Bacterial contamination
Open Wells	90 %	70% contaminated with <i>E. coli</i>
Ponds ("Mangot")	4,7 %	8% contaminated with enteric <i>Salmonellae</i>
Rivers	0,3 %	No bacterial contamination
Pumps	5 %	No bacterial contamination

People, Water quality and Water hygiene

- Surface water extracted from open wells is used as drinking water by most inhabitants.
 - Pumps and AEV (Adduction Eau Villageoise) provide safe drinking water according to the definition of the Guidelines for Drinking Water Quality (WHO). In the Upper Ouémé basin, they only constitute 5% of all water supplies.
 - Besides *E. coli* (70% of water supplies are contaminated with this faecal indicator), a great variety of different enteric *Salmonella* serotypes could be isolated from 8% of samples taken from open wells.
 - More than 10% of all investigated pumps exhibit nitrate concentrations that exceed the limit of 50 mg/L, which can be a human health threat especially for very young children, old and undernourished people.
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- Salmonellae on selective nutrient agar plate, blood agar and biotyping of bacteria
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- Presence of animals around wells
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- Defective wells and well shafts, stagnant water and sewage can enter wells; missing latrines
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- Inappropriate handling of "pulsettes"
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- Transport and storage of drinking water

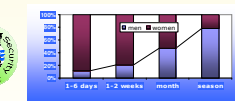
People, Water use and Money



income: 1.300 CFA; amount of purchase: approx. 1.000 FCFA / month / ps.). But all in all income structures are exposed to high fluctuations. Only 1/5 of respondents had earned money on the previous day. Women earned 13%, men 87% of the total revenues on average, but it is the women who are mainly responsible for ensuring water supply and purchases to the family.

Apart domestic needs, a third of the population requires water for productive activities. All in all, 57% of all acquired productive activities depend on water. On the assumption that the average per-capita consumption

amounts to 18.7 litres (Hadjer et al. 2005), the maximal costs for water from pumps will sum up to approximately 1.000 CFA per month/adult. Thus, earning structures allow the additional purchase a water (mean value of a regular daily

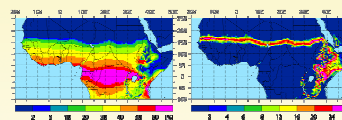


The correlation of sex and (regular) income is highly significant (r=0,14, p=000): "Women = smaller amounts, short time intervals, smaller profit peaks. Men = larger amounts, longer time intervals, higher profit peaks."

See further information: Atlas (2008), Hadjer (2006)

Malaria, Climate change and Water

Present-day malaria (1960-2000)

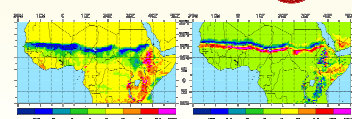


Liverpool Malaria Model (LMM) simulations of the average annual mean malaria prevalence (left) and the standard deviation with regard to the annual maximum prevalence (right) for 1960 to 2000. Note, the malaria prevalence is the proportion of the population that is carrier of the malaria parasite.

- The rainy season provides breeding sites for mosquitoes. Temperatures above ~16°C enable the transmission of the vector-borne malaria disease. Sufficient rainfall and high temperatures therefore lead to a spread of the malaria parasite *Plasmodium falciparum* in the human and mosquito population. Resulting in:
- decrease in malaria transmission level from the equatorial tropics towards the Sahel
- variable malaria transmission in the northern Sahelian zone and in the East African Highlands => epidemic-prone areas

Malaria projection (2001-2050)

- West Africa: decreased malaria transmission due to the decline in the annual rainfall
- Northern Sahel: interannual variability of malaria decreases => fewer epidemics or malaria retreat
- Southern Sahel: interannual variability increases in more densely populated areas => more frequent epidemics, e.g. Niger
- Sudanian/Guinean zone: stable malaria levels but shorter seasons due to a dryer rainy season
- East Africa: formerly unsuitable (epidemic) areas => more (less) frequent epidemics



Same as above, but here for the difference between 2041-2050 and 1960-2000 regarding the ATB climate projection.

Further information on resulting information systems: See P19