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Water supply and Sanitation in Burkina Faso: Current status and research perspective to contribute to the Millennium Development Goal achievement

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D'**I**ngenierie (Engineering) de l'**E**au (Water) et de
l'**E**nvironnement (Environment) : **IIEE=2IE**

By Angelbert BIAOU

Hokkaido University, 2 November 2009



Burkina Faso is located in the sahelian arid region of Africa.

- Area: 274 000 km² (renewable water: 20.7 billion /year)
- Population: 14.5 million inhabitants and a Growth rate: 3%.
- Population under poverty line: 46%
- Urbanisation : < 30%, Rural 70%
- Evaporation is estimated at > 2 m/year
- One rainy season of 3-4 months from June to September
- Mean rainfall: 800 mm



Current status of water in Burkina Faso



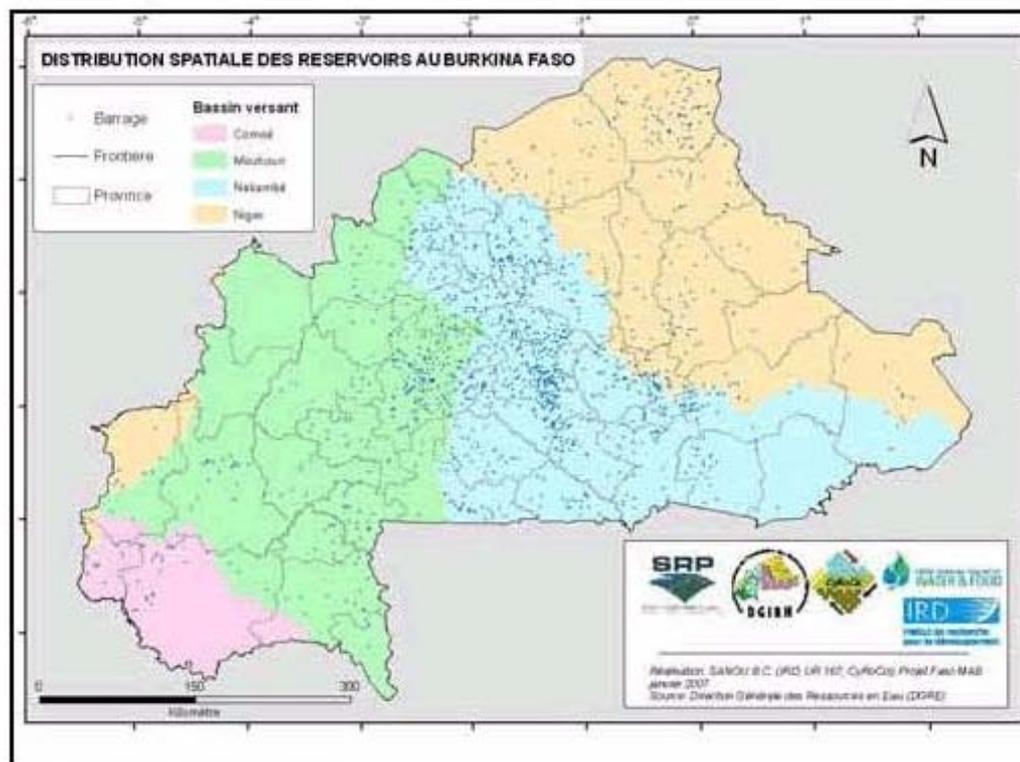
Use of water : Irrigation, Water supply and electric power production (with two dams).

Surface water:

storage capacity:
6 billion m³

-Major dams: 3 + 1
(under-construction)

-Small dams: 2 000
(380 permanent).



Groundwater: more than 30 000 wells and drillings (23 000 in operation)



Constraints of water management in Burkina

The constraints highlighted in the report (Etat des lieux des ressources en eau du Burkina Faso et de leur cadre de gestion, 2001) are as follows:

1. The main problem: the rainfall is at the same time weak and random, marked by the climatic changes. The rainfall regularly dropped, with periods of increased dryness, especially in the Eighties:

- Variability of rainy days with a trend to decrease
- exacerbation of extremes events (droughts and floods).
- precipitations are often unequally distributed, from one year to another and during the same rainy season.

➔ annual intervariability is increasing



Constraints of water management in Burkina

2. The second major problem is the geological nature of the rocks of the country. They are primarily crystalline rocks. It cannot provide significant flows (the average flows is $2 \text{ m}^3 / \text{H}$),
3. Uncertainty of rainfall projection is very large in Sahel region (african monsoon, major source of rainfall in not well known)

According to above referred report, the renewable resources amount to $852 \text{ m}^3 / \text{capita/annum}$, Burkina is below the threshold of shortage caused by water scarcity and population growth.

→ We rely on surface water and groundwater. But since groundwater is bad known (quantity and quality), we rely essentially on surface water

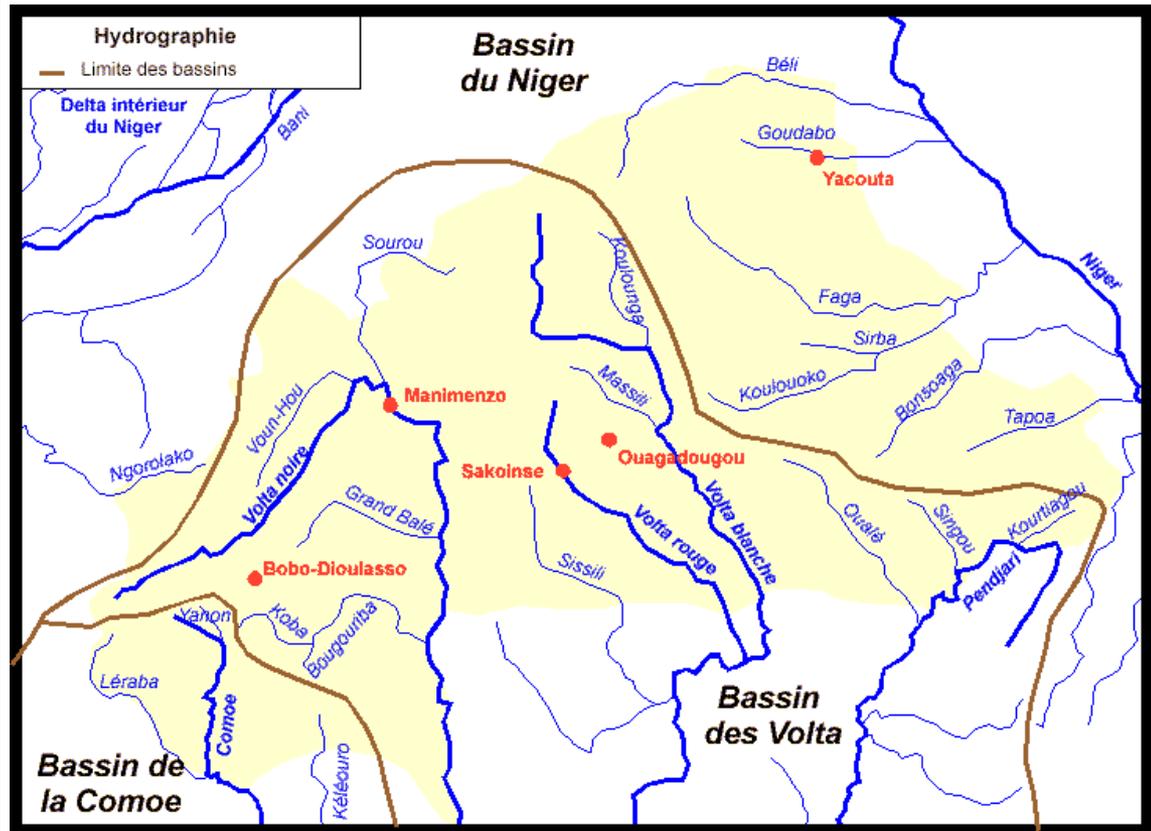


Constraints of water management in Burkina

The hydrographic network is constituted by 3 river basins, draining 8 billion m³ of water per year :

- Niger
- Volta
- Comoé

➔ Most of Rivers start from Burkina Faso, but all are shared with the neighbors





Anthropic impact

- the pressure on natural resources, mainly groundwater and surface water resources, trees and vegetation: these natural resources are also heavily exposed to anthropogenic pressures (wood cutting for energy needs and construction, extension of farm and housing sizes, overgrazing, etc.) resulting in the loss of arable land, reducing the useful soil reserve and loss of essential nutrients for plant growth,
- the decrease in flows and velocity of runoff in permanent or non-permanent rivers, results in significant reductions of natural wetlands areas and the drastic decline of water availability. These phenomena coupled by the degradation of the water resources' quality, leading to exacerbations and conflicts to access the water resources.



Anthropic impact

-less than 5% of the population has access to potable water supply network and

-only 58% use water from modern water points.

Despite the efforts undertaken by the Government and its partners to improve the coverage rate of drinking water, it remains that the access rate is limited by the distances to cover and especially by the rate of breakdown, which averages 38% of realized structures so far (60% of modern wells, 25% of drill-holes and 34% simplified systems),



Current status of sanitation in Burkina Faso



Sanitation state in Burkina

- Burkina Faso, like most countries in sub-Saharan Africa, is characterized -
- by a low rate of populations' access
 - especially the poorest, adequate sanitation.
 - This situation is most critical in villages and small and medium-sized cities where only less than 1% of populations of these localities have adequate sanitation facilities (improved pit latrines, septic tanks), such as the ones that are considered in the Millennium Development Goals (MDGs),
 - and the vast majority of people directly use nature as a place to defecate.

Consequence: bad hygiene condition so persistence of the diarrheal diseases in Burkina Faso.



Constraints on sanitation in Burkina

High rate of poverty of the populations : 46,4% of the population are below the absolute poverty line and and 73.4% of the poor populations live in rural areas.

Conventional water purification and wastewater treatment plants are expensive for mostly poor municipalities in charge of sanitation of the population in their charge for these services. So they are not equipped with technical services and financial and human resources.

Very little study and experimentation, taking into account the socio-economic, climatic and environment contexts adapted to the sahelian countries are conducted locally, to make available to the municipalities, scientific and technical parameters.



Development of a new strategy

It is therefore more urgent than ever to develop national strategy through education and research, by individual and national initiatives to achieve the specific objectives :

- provide sustainable drinking water supply and sanitation
- protect human from water aggressive action
- improve the public finance by promotion of private public partnership
- prevent conflicts in the international water resources management through IWRM



ZiE contribution to the strategy



ZiE attribution

the contribution of the ZiE is

- to provide training of PhD, master and technician students in water, sanitation and environment domain ;
- to provide Capacity Building in these domains for the public or private professionals ;
- to develop research programs in water supply and sanitation in order to develop new and adapted technology for water purification and wastewater treatment plants.



LEDES Laboratory

“Pollution control and water treatment systems” Laboratory (LEDES) is one of ZiE laboratories, in charge of water supply and sanitation research. It is through this laboratory that ZiE contribute to the achievement of this strategy. The objectives of this laboratory are :

To provide new technological options for

- Water and sanitation
- environment protection

To provide new strategies for Water and sanitation

To provide tools for adaptation to climate variability



LEDES research axes

3 axes of research

Axe 1 : Study of the quality of ecosystems and their impacts on health in Center and West Africa

- Factors and scenario of modification and deterioration of the quality due to anthropic actions
 - impacts of environmental changes, due to anthropic actions, on the dynamics of the communities and human health,
- Development of predictive models of the ecological processes and their interactions with the ecosystems and health.



LEDES research axes

Axe 2 : Study of dynamics of flows of pollutants in the ecosystems water and ground of Volta basin

- Anthropic pollution such as aromatic hydrocarbons, nitrates and their flow through surface water and Groundwater,
- Development of the models of prediction of the transfer of above studied pollutants



LEDES research axes

Axe 3 : development of the approaches and innovating processes of depollution in tropical climate:

- Fundamental study of the hydrodynamic, physicochemical and bacteriological phenomena in the processes of water treatment and solid waste and liquids,
- Optimization of the approaches and innovating technologies for valorization of solid waste and liquids (water reuse), in tropical context



LEDES Equipement



Measures of grounds: pH,
Temperature, Conductivity, Turbidity,
Oxygen.



LEDES Equipement



SAA 200

Dosage of heavy metals by atomic absorption flame

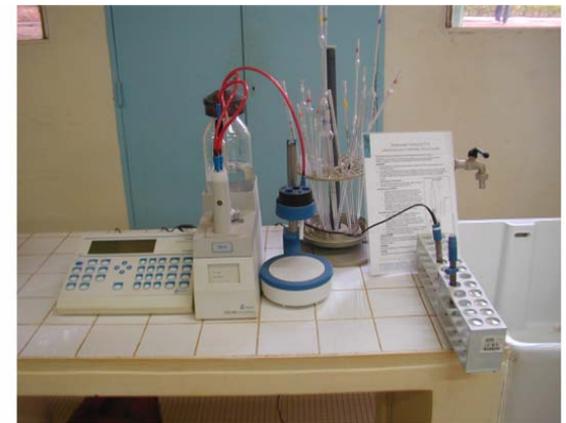


Spectrophotometry of molecular absorption with direct reading DR put into series 2010 (dosage alternative of ions).



Ionic chromatography. Dosage of the major and minor ions.

Automatic programmable Titration volumetric Dosage





LEDES Equipement



Titration volumetric by electronic oilcan.



Dosage of the total nitrogen after distillation by method Kjeldahl



Control of the carbon pollution. Measure of DBO5 by "oxytop" and direct reading



Accessories SAA 200 Turret for automatic selection of the lamps-configuration automatic of the optical parameters



LEDES Equipement



Tries(essays) of water treatment of surface: test Jar (determination of the rate of treatment of coagulant)



Volatile and fixed determination of residues in oven (550°C).



Quality control ISO-certified Standard



Internal and External Controls of the analytical parameters



Waste Water treatment Plant (ZiE Campus)





Institut International d'Ingénierie de l'Eau et de l'Environnement
International Institute for Water and Environmental Engineering



Partnership 2iE - Hokkaido University



ZiE partnership

ZiE also contribute to this strategy by developing partnership with other university or scientific institution

It is in this way that we are developing a research partnership with Hokkaido University trough the project “**Improving Sustainable Water and Sanitation systems in Sahel Region in Africa: Case of Burkina Faso** “. Hokkaido University and ZiE are agree to call the project AMELI-EAUR.



AMELI-EAUR Objectives

The three fundamental objectives are as follows:

- 1- to develop the sustainable water and sanitation system that are adapted to the socio-economic, urban and environmental contexts of villages and small and medium cities in Burkina Faso, a country located in sub-Saharan Africa in the Sahelian climate zone,
- 2- to contribute to making available for professionals and local or central policy makers, technical solutions for drinking water and wastewater treatment technologies,
- 3- to make a road map to implement the newly developed system.



Expected Results

- Safe water supply and onsite different wastewater treatment and resource recovery systems are designed and tested in the socio-economic, urban, technical and environmental contexts (villages, small, medium sized cities),
- Solutions including technical and social proposals are proposed to actors in charge of water and environment resources management in order to reduce climate change impacts,
- Safe water supply and wastewater management system, at low cost to facilitate access to poor populations, are validated and implemented in Burkina Faso climate context,
- Populations access rates, in particular the poorest in rural areas, small and medium sized cities in Burkina Faso, are increased by the implementation and vulgarization of newly developed sustainable water and sanitation system at low cost,
- Top level professionals for international organization and academic society, professionals and technical persons for local government, water and sanitation enterprises, and community leaders competences are increased



Project Activities

Activities for Research for rural and peri-urban water and sanitation model; and Activities for Research for urban water and sanitation model

- Key technology elements
- Pilot plant study
- Development of Social system for supporting and implementing the water and sanitation system for rural and peri-urban area
- Identifying key factors for design of the financial and institutional system;
- Identifying key factors for design of the maintenance and operation organization
- Designing the Collection /transport and utilization of final products from the system.
- Capacity building



Burkina Faso is a very poor country.

Unfortunately hard conditions, for this poor country, such as very hard geology, extreme variability of climate as well as climate change and so on, don't help this country to perform his irrigation (food) system, water supply (drink) .

Another consequence of this poverty is that the sanitation system is poor too in this country so we assist to diarrheal diseases.

In addition to those natural effects, we don't have to forget the role of the human in degradation of his resources

That's why a new strategy has to be built, through ZiE for example and through partnership with other universities and scientific institutions, such as the one in construction with Hokkaido University



Thank you for your attention

Merci Beaucoup

2iE - Hokkaido University