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Potentials and projections of freshwater resources in Sub-Saharan Africa; focus on Nigeria

Temitayo A. Ewemoje

Department of Agricultural and Environmental Engineering, Faculty of Technology,
University of Ibadan, Ibadan, Nigeria.
(E-mails: ta.ewemoje@mail.ui.edu.ng ; tayo_ewemoje@yahoo.co.uk)

Abstract

This paper discusses the abundance of freshwater availability in Nigeria which is approximately 0.51% of world freshwater resources. It further highlights the projected freshwater crises in Nigeria and Africa as a whole. Based on analyzed country data retrieved from International Organizations, Nigeria and in fact many developing countries in Sub Saharan Africa is presently termed water secure based on total Actual Renewable Water Resources, but projections into the nearest future (2025) classify Nigeria as water stress/scarce due to lack of economic, financial and skilled human resources to tap water for basic human needs, food production and maintenance of freshwater ecosystem. Causes of this projected impending danger were attributed to increase in freshwater quantity supply made available through unsustainable water resources development and inappropriate water management programmes.

Keywords

Freshwater, Resources, Sustainable development, Developing Countries.

INTRODUCTION

One question most projections of world resources leave open is the degree to which the level of population is resource-determined. The most basic of all resources, although often taken for granted is water. Unlike carbon reduction, there is no global water alternative to neither promote nor negotiate. Turning off your tap in Europe will not mitigate the drought in Africa. Water is local, but water issues are of importance in the world's major water basins. The poorest of the world continents in terms of annual freshwater renewal is Africa (Falkenmark, 1990).

Globally this environmental resource - water, suffer from irreversible degradation leading to scarcity due to the fact that only 0.3% of the 1.385 billion m³ of water on the earth are available for human activities (Water Department, 2006). Water, the "blood of the biosphere" according to IWMI (2008) is grabbing the world's attention these days. Against a backdrop of growing water scarcity, it is no wonder that the profile of global water development is rapidly rising. Water scarcity is both a national and a regional problem for many Sub Saharan countries; water resources are generally recognized as unevenly distributed. Until now, most activities have been geared towards storing water at the local level, for instance, for irrigation, urban supplies, and hydro power, with no consideration for neighbouring countries. As Samson and Charrier (1997) noted, the chance of finding new water sources is small in most regions of the world. Hence without new supplies, there should be increase in the efficiency of urban water use and improvement in the conservation of available water resources.

As the global population grows and the economies of countries expand, the world is going to get hungrier and thirstier. Agriculture uses up to 70% of the world's freshwater and to make basic

things for development takes volumes of water (IWMI, 2008). Africa has the highest rate of population growth in the world, and is also one of the regions that are most vulnerable to climate change. Problems with freshwater availability in Africa are further complicated by highly variable levels of rainfall. As a result, large numbers of people are dependent on groundwater as their primary source of freshwater (UNEP, 2008). Surface and groundwater supplies have been exploited, and some countries have turned to alternative sources of water such as desalinization of sea water and recycling of wastewater, in order to attempt to meet this increasing demand. Approximately 38 per cent of the population of West Africa lives in urban areas. Thirty years ago, only one Western African city (Lagos) had a population of more than a million. By 2000, cities with populations exceeding one million included Ouagadougou (Burkina Faso), Abidjan (Côte d'Ivoire), Accra (Ghana), Conakry (Guinea), Bamako (Mali), Ibadan (Nigeria), Lagos (Nigeria), and Dakar (Senegal). Lagos, the largest city in Africa and the 6th largest in the world, has an estimated current population of 13.4 million people and this is expected to grow to over 23 million by 2015 (UNEP, 2008).

MATERIAL & METHODS

The conceptual framework of the analysis of potentials and projections of freshwater resources in Sub Saharan Africa (SSA) is based on the International Water Management Institute (IWMI) methodology of assessing the performance of water resources systems. This methodology is reported in various previous studies of IWMI research reports and working papers; notable of mentioning is the works of Seckler et al (1998) and Sakthivadivel et al (2001).

The first part of this paper focuses on the potentials of freshwater resources in Africa and narrowing it down to a focus on Nigeria; viz a viz the freshwater availability and withdrawals. The latter part highlights the projections of this availability and withdrawals in the next few years. The data used in this work are data obtained primarily from four different sources which are the Food and Agriculture Organization of the United Nations (FAO), Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, and IWMI.

The choice of these organizations stems from the fact that data on water quality at a global level are scarce; there are few sustained programs to monitor water quality worldwide. Information is usually limited to industrial countries or small, localized areas. For regions such as Europe, where some monitoring is taking place, differences in measures and approaches make the data hard to compare (World Resources, 2000). Similarly in Africa, water quantity statistics are poor on water use, water availability, and irrigated area on a global scale. Estimates are frequently based on a combination of modeled and observed data.

RESULTS AND DISCUSSION

The Potentials

Freshwater availability which is also referred to as Internal Renewable Water Resources (IRWS) is $214 \times 10^9 \text{m}^3$ per year while total IRWS is $221 \times 10^9 \text{m}^3$ per year for Nigeria. The IRWS is an indication to the fact that there is an appreciable average annual flow in the rivers within the country and also recharge of groundwater from precipitation within Nigeria's borders is quite enormous. As a rough global indicator of water sufficiency if the annual amount of water available per capita is less than $1000 \text{m}^3/\text{capita}/\text{yr}$, water scarcity occurs (United Nations Economic Commission for Africa (UNECA), 2001). The total Actual Renewable Water

Resources (ARWS) is $286.2 \times 10^9 \text{m}^3$ per year while total ARWS per inhabitant in the country is 2251m^3 per year according to FAO (2006). IRWS for Nigeria is approximately 5.61% and 0.51% of the SSA and world freshwater resources respectively. Total ARWS in Nigeria is approximately 5.23% of SSA while total ARWS per capita cubic meters per person in Nigeria is approximately 35.62%. This water abundance in some selected countries is depicted in Table 1. In Nigeria, a value of $1982 \text{m}^3/\text{capita}/\text{year}$ was reached according to African Water Development Report (AWDR, 2003), while FAO (2005) value was $2252 \text{m}^3/\text{capita}/\text{year}$, depicting a water sufficient nation.

Table 1: Water Resources Potentials of Selected Countries

Countries	Area, 10^3 Km^2	Water Resources, Km^3/year					Annual Runoff Layer, mm
		Local			Imported	Total	
		Max	Min	Average			
Gabon	268	272	133	205	15.6	221	765
Gambia	11	5.69	1.24	3.97	6.7	10.7	361
Niger	1267	5.4	0.28	2.33	32.1	34.4	18
Nigeria	924	437	148	275	43.7	319	293
Senegal	196	31.1	6.31	21.4	14.9	36.3	109
Sudan	2505	65.3	9.74	34.6	132	167	53
Congo Dem. Rep	2345	1328	786	989	313	1300	133

Source: Shiklomanov (2002)

Freshwater Crisis and Projections

While Africa uses only about 4 per cent of its renewable freshwater resources (WRI, 2005), water is becoming one of the most critical natural resource issues. The continent is one of the two regions in the world facing serious water shortages (Johns Hopkins 1998). Although it has abundant freshwater resources, there are great disparities in water availability and use within and between African countries because the water resources are so unevenly distributed. Only three Sub-Saharan countries, Guinea, Democratic Republic of Congo and Angola, have untapped water resources. In all other countries, water scarcity is inevitable within the first quarter of the 21st century (Kakonge, 2002). Other contributing factors are the inadequate assessment and underdevelopment of water resources, the lack of technical and institutional infrastructure as well as the lack of investment in water resource development. While the Sahelian countries have limited supplies of freshwater, most countries in the humid tropical zone have abundant water. The availability of water varies considerably, even within countries, and the situation is further complicated by frequent droughts as well as inappropriate water management programme. The demand for water is increasing rapidly in most countries due to population growth and economic development. Projected freshwater resources are shown in figure 1.

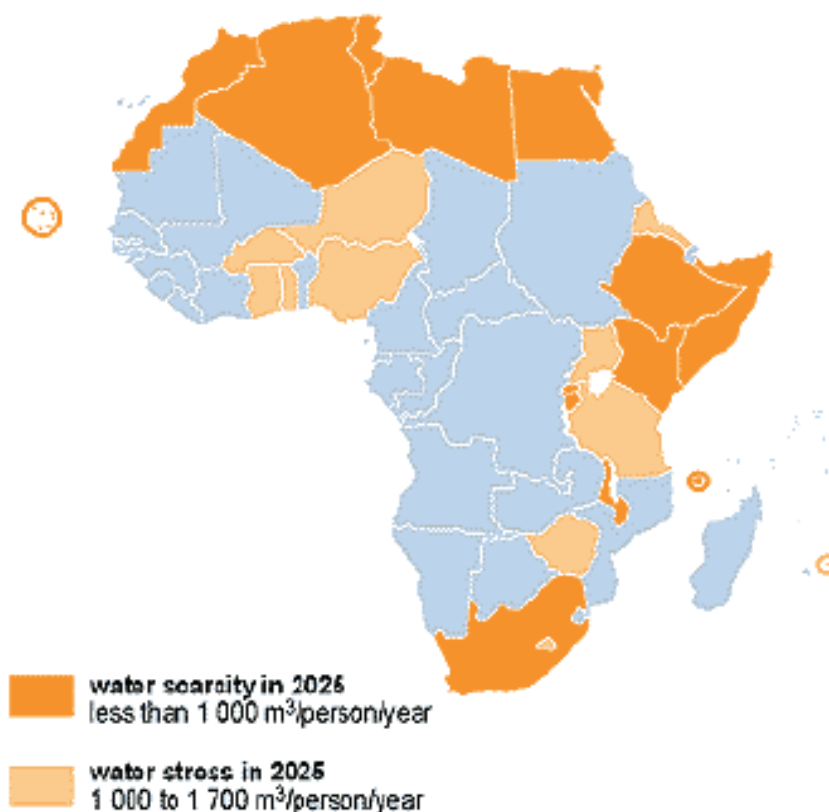


Figure 1: Freshwater Resources in Africa.

Source: AWDR (2006).

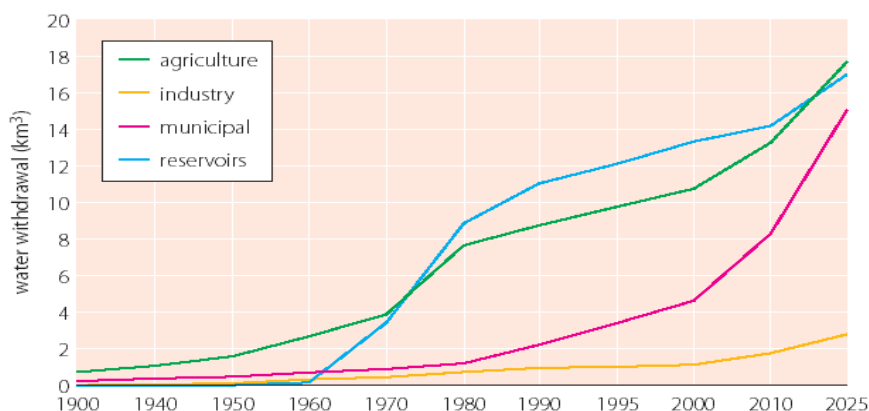


Figure 2: Water Use by Sector in West Africa

Source: UNEP, 2008.

In view of the increasing demand for water, Molden et. al. (2001) projected that municipal (urban) sector withdrawals will be greater than those for domestic sector in most developing countries, and this municipal withdrawals are projected to double over the next 30 years. Increases in demand for freshwater are anticipated in all African countries, in all sectors (domestic, agricultural and municipal), over the next 10 years. In West Africa countries, demand is projected to double within the next 30 years (Figure 2). This projected double in withdrawals and demand arises not just from an increase in the number of people requiring water, but also from increasing consumption patterns such as the growth of water hyacinth which is adversely affecting many water bodies in Nigeria. This weed affects fishing, disrupts water-borne

international trade and the movement of people, and blocked water intakes thus endangering hydroelectric installations (figure 3). The infestation of this water weed (hyacinth) has necessitated the call on neighbouring West African countries which share surface water resources to jointly tackle the eradication of this water weed which is already affecting socio-economic activities of these neighbouring countries. Likewise, industries rarely pay the true price of water and are, therefore, not encouraged to recycle or to reduce their consumption.



Figure 3: Water Hyacinth Infested Reservoir in Ibadan, Nigeria

The lack of improved sanitation is the most important feature of slums in the African urban context. About 57 per cent of urban Africans do not have access to improved forms of sanitation. The lack of improved water supply appears to be the second most important determining factor, affecting about one fifth of urban Africa. Lack of sufficient living space or overcrowding is the third most important factor, widely varying from one country to another (UN-HABITAT, 2004).

Pollution of these waters is a cause of many public health problems. Polluted urban surface water often leads to water-borne diseases, such as cholera, typhoid and schistosomiasis as a result of human activities in dirty water (Figure 4). A case of the urban Ogunpa river channelization project in Ibadan Nigeria shows one of the many inappropriate urban water management practices in Nigeria as a result of refuse dumping and other forms of pollution thereby degrading the ecosystem (Figure 5). Up till now, no measures have been put in place to curb this pollution menace in this locality.



Figure 4: Human Activities on Polluted Urban Water



Figure 5: Refuse Dumping and other Pollution Sources in Urban Water Channels

By 2010, SSA will have at least 33 cities of more than 1 million inhabitants, with two cities exceeding 5 million and the city of Lagos, Nigeria having more than 13 million inhabitants. In 1995, Lagos became the world's 29th largest urban agglomeration, with 6.5 million inhabitants. In 2000, it was the 23rd largest, with 8.8 million people. Lagos became one of SSA's first mega-urban regions when its metropolitan population reached 10 million inhabitants around 2002. Lagos continues to grow and by 2015 it is envisaged to become the world's 11th largest urban system, with 16 million inhabitants (UN-HABITAT, 2004). With a population of about 130 million and a cultivable/habitable area of 330,000Km² which is about 35.7% of the total area of Nigeria, this increased population pressure puts a heavy strain on the available water resources of the country. Nigeria is termed one of the most densely populated countries in Africa (figure 6). Only three sub-Saharan countries, Guinea, Democratic Republic of Congo and Angola, have untapped water resources. In all other countries, water scarcity is inevitable within the first quarter of the 21st century. According to Kakonge (2002), the populations of Kenya, Burundi, Rwanda and Malawi are expected to double by 2025 and by then per capita water availability will have fallen below the accepted standard (see Figures 6 and 7). South Africa will have a projected population of 68 million in 2025 and a projected per capita water availability of 725m³.

For its water resources, most freshwater in Nigeria comes from abundant seasonal rainfalls and relatively low levels of withdrawals of water for its three major uses, namely, agriculture, community water supply and industry. Demand for water in West Africa has been steadily increasing as a result of population growth, commercial agricultural expansion, and industrial development. Current total withdrawal of water for domestic, industrial and agricultural consumption is 11Km³/yr, and demand for water from all sectors is expected to increase to some 36Km³/yr by 2025 (Figure 8). This figure indicated an increase in projected water withdrawal and consumption all over Africa; however this increase did not match the percentage of water withdrawal and consumption in relation to renewable water resources. Hence, this necessitates the putting in place in Nigeria appropriate water management programme through sustainable development of this vital resource.

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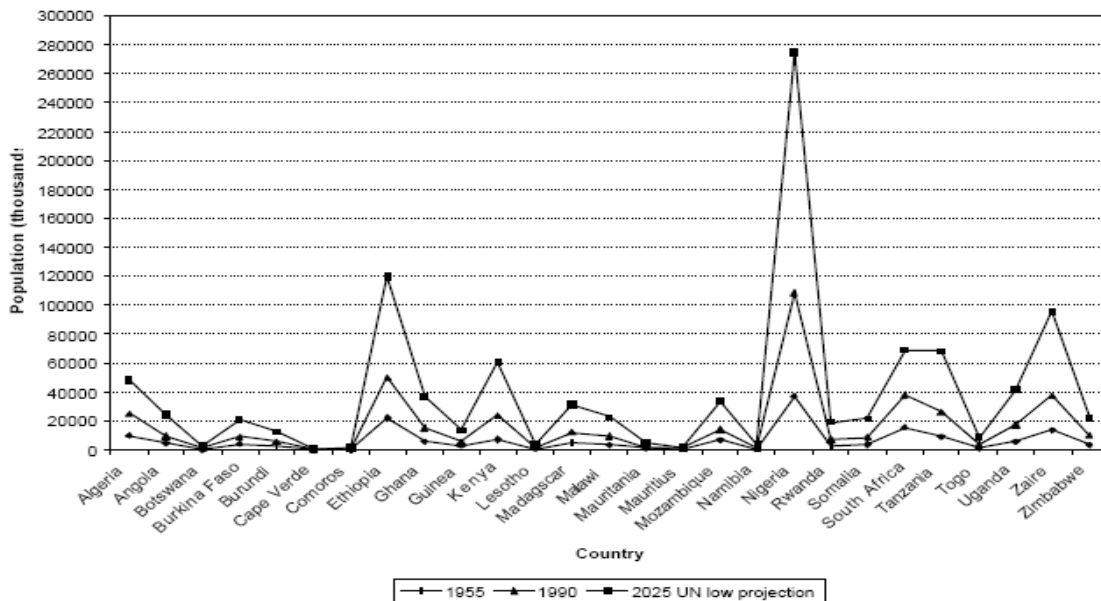


Figure 6: Estimated Population 1955, 1990, and 2025

Source: Kakonge, 2002.

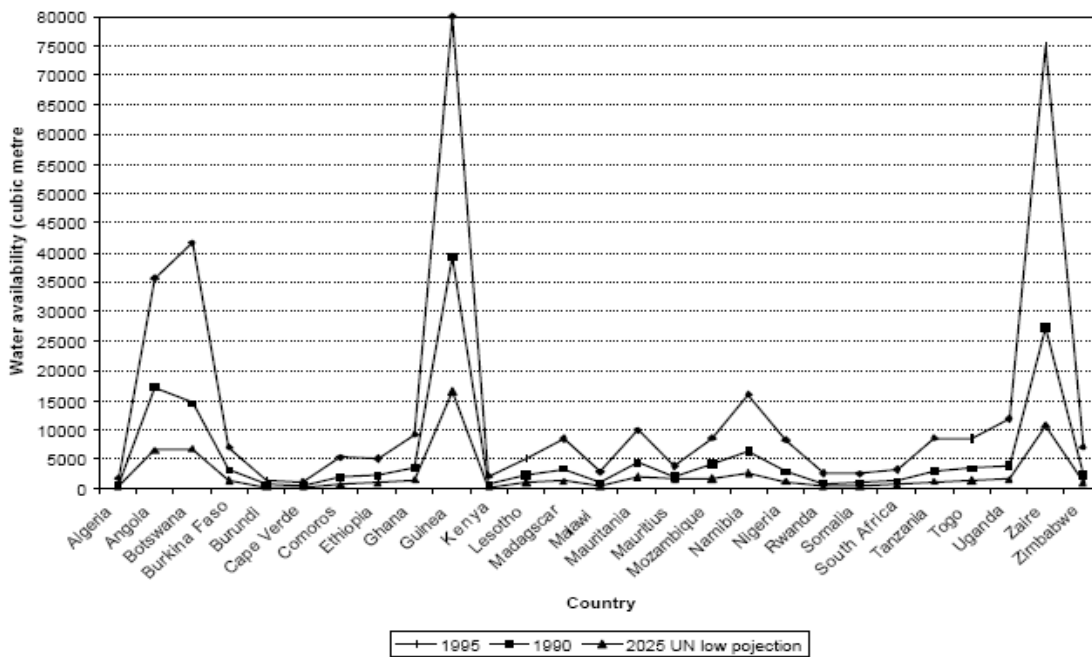
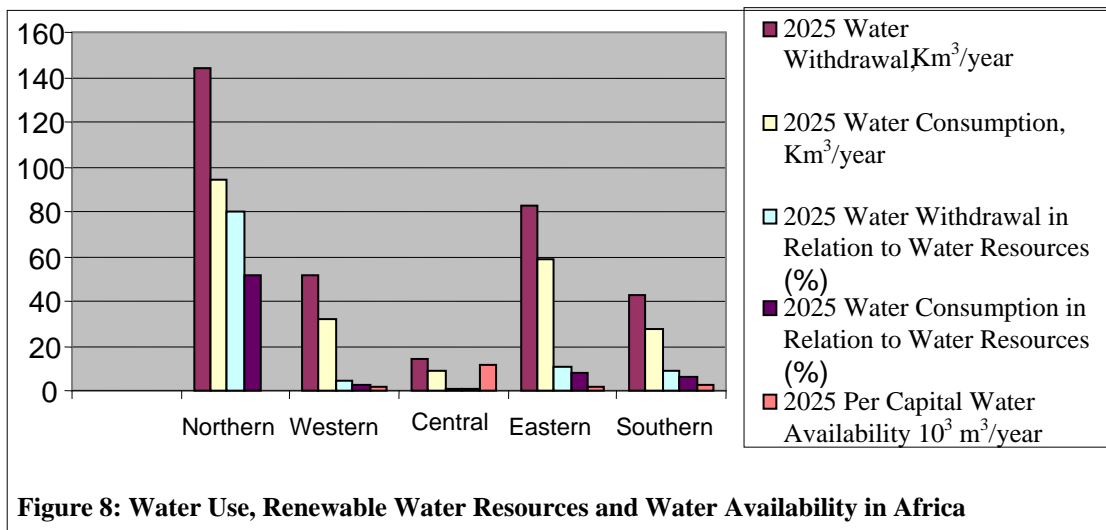


Figure 7: Annual renewable freshwater available per capita

Source: Kakonge, 2002.



CONCLUSIONS AND RECOMMENDATIONS

Availability of freshwater in Sub Saharan African and in Nigeria is currently a resource, however projections into the nearest future of this vital natural resources indicated a risk of water stress for many countries in Africa and for Nigeria in particular, water scarcity has been projected to be a reality if adequate measures are not taken into consideration in sustainable development of freshwater resources through deliberate attempt to reduce the pollution of urban water supply from human and anthropogenic sources in urban cities in Nigeria as domestic and municipal freshwater demand is expected to double by the year 2025.

Low values of internal renewable resources in 2025 also shows that there is room for improvement in conservation of rainwater which has been attributed to the abundance of freshwater resources in Nigeria, the lack of these conservation measures accounts in part, for endemic drought in many parts of Nigeria.

Hence, efforts should be geared in Nigeria towards meeting basic human and ecosystem needs through proper government policies that will guarantee access to water. Water should be recognized as an economic good, which was one of the cornerstones of the Dublin and Rio statements (Lundqvist and Gleick, 2000). Planners and users should recognise the true value of water in all its competing uses and functions. Water users must assume a larger responsibility in recovering the full cost of providing water-related services, including development, provision, maintenance and treatment costs. This will help reduce the ever increasing freshwater quantity demand and hence limit the withdrawal of unsustainable water resources in Nigeria.

The government in Nigeria should foster the principle that water planning and decision-making should involve affected parties and interests in a democratic manner thereby ensuring participatory approach which means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users.

REFERENCES

- AWDR (2003). National Reports (Congo Rep., Nigeria, Cameroon, Benin, Burundi, Niger, D.R. Congo, Gabon). African Water Development Report.
- AWDR (2006). Freshwater Resources in Africa. African Water Development Report.

- Falkenmark, M. (1990). Rapid Population Growth and Water Scarcity: The Predicament of Tomorrow's Africa. *Population and Development Review*, Vol. 16, Supplement: Resources, Environment, and Population: Present Knowledge, Future Options, Pp. 81-94. Retrieved on 27/09/2008 from <http://www.jstor.org/stable/2808065>
- FAO (2005). Earth Trends Data Tables: Freshwater Resources 2005. http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/water_res/index.htm
- Hopkins, J. (1998). Solutions for a Water-Short World. *Population Report*, Vol. XXVI, No. 1, September 1998. Johns Hopkins Population Information Program, Baltimore, Maryland, United States <http://www.jhucpp.org/popreport/m14sum.stm>
- IWMI (2008). Water Figures; Turning Research into Development. Quarterly newsletter of the International Water Management Institute. Issue 1.
- Kakonge, J. O. (2002). Water Scarcity and related Environmental Problems in Parts of Sub-Environmental health References. *Impact Assessment and Project Appraisal*, volume 20, number 1, March 2002, pages 49–59, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, UK
- Lundqvist, J. and Gleick, P. (2000). Comprehensive Assessment of the Freshwater Resources of the World; Sustaining our Waters into the 21st Century. Stockholm Environment Institute, Stockholm, Sweden. Retrieved 18th January 2009 from www.earthscience.org/r1/luj01/luj01
- Molden, D., Amarasinghe, U. and Hussain, I. (2001) “Water for Rural Development: Background Paper on Water for Rural Development Prepared for the World Bank”. Working Paper 32. International Water Management Institute, Colombo, Sri Lanka.
- Samson, P and B Charrier (1997), “International freshwater conflict: issues and prevention strategies”, The Green Cross Project, Geneva, Switzerland.
- Shiklomanov I.A.: Regional Distribution of Rivers and Streams in Africa. UNESCO Encyclopaedia on Life Support Systems – EOLSS <http://greenplanet.eolss.net/EolssLogn/Login-Form.aspx>, UNESCO, 2002.
- UNECA (2001). Safeguarding Life and Development in Africa – A vision for Water Resources Management in the 21st Century. United Nations Economic Commission for Africa. The Hague, The Netherlands, March 2000, First Edition.
- UNEP (2008). AFRICA ENVIRONMENT OUTLOOK; Past, present and future perspectives. United Nations Environment Programme. Retrieved on 27/09/2008 from <http://www.unep.org/dewa/Africa/publications/>
- UN-HABITAT (2004). State of the World's Cities: Trends in Sub-Saharan Africa Urbanization and Metropolitanization. United Nations Human Settlements Program (UN-HABITAT). Retrieved on 27/09/2008 from www.unhabitat.org
- Water Department (2006). The French Water Policy. Ministry of Ecology and Sustainable Development.
- World Resources (2000). Freshwater Systems. Chapter 2: Taking Stock of Ecosystems. Retrieved from http://pdf.wri.org/wr2000_freshwater_wholesection.pdf
- WRI (2005). Water Resources and Freshwater Ecosystems - Nigeria. Earth Trends Country Profile. Retrieved from http://earthtrends.wri.org/pdf_library/Country_profiles/wat_cou_566.pdf