UNIVERSITY OF CAPE COAST

THE SOCIO-ECONOMIC IMPLICATIONS OF FRESHWATER SCARCITY IN THE BUILSA DISTRICT

COMFORT AFELIK

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Name: Comfort Afelik

Signature:……..…… Date:……..……..……

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Name: Professor Stephen B. Kendie

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ABSTRACT

The research is a descriptive study that examined freshwater scarcity in the Builsa District and its socio-economic implications. The main objective of the study was to examine the phenomenon of freshwater scarcity in the Bulisa District and how it impacted socially and economically on the people. The specific objectives include, identifying the factors that were responsible for the scarcity of freshwater, the effects of freshwater on the socio-economic lives of the people and to ascertain how the existing water bodies in the district were being managed to ensure their continued existence for socio-economic development. The methods used in collecting the data were interviews.

The study shows that the scarcity of freshwater in the Builsa District emanates from factors that were interconnected. They were both natural and manmade which include poor rainfall, poor agricultural methods, bush burning and deforestation which exposed the area to periodic drought. Though the main economic activity of the people in the district was farming, the study revealed that there were not enough water conservation systems in the district for the people to be engaged all year round and especially in the dry season. It was also revealed that organisations such as District Water and Sanitation Team (DWST) and Water and Sanitation committees (WATSAN) were not functional and this compounded the problem.

Recommendations offered in the study were that community members should see water as a valuable asset and stay away from all practices that threaten the existence of water bodies.

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To my family, I say God bless you for the understanding and love you showed to me during this period.

DEDICATION

To my dearest husband, Joseph Asitik and lovely children, Awentiirim, Awenlie and Alimsewen.

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LIST OF ABBREVIATIONS

CWIQ	Core Welfare Indicator Questionnaire
DEFRA	Department for Environment, Food and Rural Affairs
DWST	District Water and Sanitation Team
FAO	Food and Agriculture Organisation
GEO	Global Environmental Outlook
GLSS	Ghana Living Standards Survey
GSS	Ghana Statistical Service
GWA	Gender and Water Alliance
GWP	Global Water Partnership
ICOUR	Irrigation Company of Upper Region
ICWE	International Conference on Water and Environment
ISSER	Institute of Statistical, Social and Economic Research
ITFC	Integrated Tamale Fruit Company
IWRM	Integrated Water Resource Management
NHIS	National Health Insurance Scheme
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Programme
VIP	Ventilated Improved Pit
WATSAN	Water and Sanitation Committees
WMO	World Meteorological Organisation

WRI	Water Resources Institute

CHAPTER ONE

INTRODUCTION

Background to the study

The inadequate supply of water at a minimally satisfactory level, will affect the progress of humankind. In fact, availability of water dictates the pattern of human settlement such that lack of water generally inhibits large concentrations of human populations (Nsiah-Gyabaah, 2001). Therefore, policies aimed to promote development that fail to address water supply or incorporate strategies to protect and conserve water resources would fail.

It is estimated that about 75% of the earth's surface is covered by water in the form of oceans, rivers, lakes, streams, ground water and in the air we breathe (Nsiah-Gyabaah, 2001). Hence water is everywhere and shared by all humanity as a basic need that is essential for survival.

Water is a major resource in the developmental process of all economies as it is needed in all the sectors of a country’s economy. In industry, water is mostly needed in production processes, for example in cleaning fruits and vegetables before canning and freezing; as a raw material in soft drinks and many other products. Water is also used to generate electric power to light homes and to run factories. In addition, fresh water bodies such as rivers and lakes aid in transportation, especially the transporting of bulky products such as machinery

and farm products from one place to another to promote industrial and commercial growth with the objective of promoting development in general.

In our domestic lives, we require water for cleaning, cooking, bathing, and carrying away waste products, in order to stay alive. In the agricultural sector, water plays a significant role. It is estimated that 70% of world-wide water use is for irrigation, which is necessary to grow all kinds of crops (Liswaniso, 2007) and animal rearing. Many religions also consider particular sources or bodies of water to be sacred or at least auspicious; examples include Lourdes in Roman Catholicism and the Zamzam Well in Islam among many others (Wikipedia, 2007). Water also has economic value for fishing while others provide means of recreation like swimming.

Regarding the immense role water plays in the developmental process of a nation, there is a growing concern on the quality and quantity of water available to individuals as these have a direct bearing on the livelihood and survival of the people. Interestingly, Chiras (2001) found out that global freshwater supply is the same in quantity as it was when civilization began because water is a renewable resource. However, many areas in the world have water shortage relative to their needs, and this problem may increase unless changes are made in the pattern of water supply and consumption.

According to the World Commission on Water, (cited in Prasana, undated), more than half of the world's major rivers are either heavily polluted and/or are drying up because of over-use, while of the world's 500 major rivers, 250 are seriously polluted and depleted from overuse. Concerning water quality,

global statistics show that, about 3.4 million people, mostly children die annually from water-related diseases made up of cholera, malaria and diarrhea (WHO, 2000).

The issue of water availability in the African context differs widely from what is around the world; this is because Africa uses only about 4 per cent of its renewable freshwater resources. However, it is estimated that already, 14 countries in Africa are facing water stress and by 2025, another 11 countries can be expected to face the same condition. This might be as a result of water not equally distributed over the continent (UNEP, 2001). The prospects are particularly bad in northern Africa. The demand for water is expected to grow by at least 3 per cent annually until 2020 as populations increase and economies develop. In Africa, surface water contamination is a growing problem with serious implications for public health (UNEP, 2001). This therefore calls on stakeholders in water resource management to come out with strategies to avert the situation to save the continent from an eminent water crisis.

According to Ghana's Water Research Institute, (cited in IRIN, 2006), at least seven of Ghana's 16 major river systems are classified as "poor quality" as a result of pollution. There has also been widespread deforestation on the banks of rivers and lakes. This vegetation forms a protective shield around natural water bodies, without which water evaporates much more quickly. The lack of vegetation also leaves water bodies more susceptible to silting materials and pollutants, which then promote the growth of aquatic weeds and reduce the amount of water held in the system.

In the savanna areas of Ghana, of which the Builsa district forms part, unsustainable agricultural practices, bushfires, uncontrolled deforestation and weak institutional mechanisms are some of the factors responsible for water supply problems (Nsiah-Gyabaah, 2001). All these affect the vegetative cover that also have negative impact on water bodies. Water- ways have been encroached upon due to intense farming activities and bushfires set in immediately the rains are over and by the end of January the vegetative cover is burnt off, leaving the bare land at the mercy of the hamattan winds and subsequently the scorching heat of the sun. One other factor that can have an effect on water bodies in the Builsa District is rainfall. Its pattern and quantities are very essential for the sustenance of water bodies in the area.

The annual rainfall in the Builsa district, in terms of its quantity and pattern has not changed significantly for the past 27 years as shown in Appendix 1. The rainfall pattern shows that the rainy season starts in April, reaching its peak in August, with minimal rainfall in October, thereafter the area experiences dry weather conditions from November to February. However annual rainfall totals rarely exceed 1200mm (Ghana Meteorological Service-Navrongo, 2007).

A look at Appendix 1 indicates that annual rainfall over the past 27 years is not poor. The issue of water scarcity in the district could be as a result of poor or lack of management practices, seasonal and annual variation and other factors. In the Northern part of Ghana where long dry seasons and single unreliable rainy seasons prevail, a programme of construction of boreholes, hand-dug wells, dugouts and small reservoirs (dams) has been implemented over the past years to

provide reliable water supplies to the communities and these have become vital infrastructure of the local communities. The high constructional costs of surface water collection systems for domestic purposes can only be economically justified if multiple use of the water is ensured, including dry-season gardening, improved livestock management, agro-forestry, fish production and even, indirectly, aforestation of catchment areas (MacPherson, 1990).

The Irrigation Company for the Upper Regions (ICOUR) was established by the Government of Ghana to promote the production of food crops by small-scale farmers within organised and managed irrigation schemes, with the objectives of improving food security and increasing incomes (ICOUR, 1995). On the other hand, the operations of ICOUR do not extend into the Builsa District apart from some communities in the Chuchuliga area that migrate to the Tono dam area to undertake dry season farming. In general terms, the Builsa District does not derive direct benefits from the activities of ICOUR. Within the Builsa District only few dams contain water all year round. These dams are managed by the Ministry of Agriculture and only one of them is used for vegetables production in the dry season. The rest are for animal pasturing only because they may dry up if they are also used for vegetables farming in the dry season.

Problem statement

Annual rainfall in the district rarely exceed 1200mm, this has socio-economic implications for the people as the main occupation in the district is in

agriculture and its related work (www.ghanadistrict.com). The major activities are in the areas of crop and animal farming and poultry.

Though, the district has the potential for commercial agriculture it is faced with water scarcity especially in the dry season when natural sources of water dry up (Kendie, 2002). The implications are that during the long period of dryness characterised by water scarcity, the people idle or are under-employed, leading to low economic output with the result being the entrenching of poverty and this contributes significantly to the migration of the economically active youth to the southern parts of the country (Dickson & Benneh, 1988).

It is in the light of these that the study is focusing on freshwater scarcity in the area as a way of finding solutions to the problem.

Objectives of the study

The general objective of the study was to examine the phenomenon of freshwater scarcity in the Builsa district and its socio-economic implications. The specific objectives of the study were to:

- identify the factors that were responsible for the scarcity of freshwater in the district.
- examine the effects of scarcity of freshwater on the socio-economic lives of the people in the district.
- ascertain how the existing water bodies in the district were being managed to ensure their availability for socio-economic development.

- make recommendations to the District Assembly and other environmental organisations to work towards sustaining freshwater for socio-economic development.

Research questions

- What factors are responsible for the increasing scarcity of freshwater in the district?
- How has the scarcity of freshwater affected economic activities and social life of the people in the district?
- How are existing freshwater bodies in the district managed to ensure their availability for socio-economic development.

Significance of the study

The successful completion of the study would help identify the factors that contribute to the drying up of existing water bodies in the area especially during the dry season. This knowledge would help the district to manage its water bodies effectively and efficiently so as to maintain employment during the dry seasons. This in effect would boost economic activities, reduce poverty and curb the movement of the youth to the southern part of the country to seek employment opportunities.

Again the study is useful in providing information for policy makers, development practitioners, researchers, Non Governmental Organisation and

other Agencies in their efforts to find solutions to the yearly problem of water scarcity in the dry season.

Scope of the study

The study examined the issue of freshwater scarcity within the boundaries of the Builsa District identifying the factors that were responsible for the scarcity of freshwater, and the effect of this on the people within the district and their economic activities.

Organisation of the thesis

The dissertation is organised into five main chapters. The first is the introduction, which focuses on the background to the study, problem statement, objectives of the study, research questions and significance of the study and the organisation of the thesis. The second chapter presents relevant literature on the concepts and theories on the subject matter of the study and concluded with a conceptual framework. The third chapter presents the methodology of the study. It involves the study area, study design, sources of data, target population, sample size, sampling procedure and instrumentation. The chapter also discusses data collection, data processing and analysis. The fourth chapter deals with analyses of the results and discussions of findings of the study, while the final chapter which is chapter five contains the summary, conclusions and recommendation of the study as well as areas for further research.

CHAPTER TWO

REVIEW OF LITERATURE

Introduction

Human beings drink water and use it in washing and cooking. It is also used for recreational purposes, irrigation of crops and for industrial activities. Water is therefore a vital resource to human beings and to all other species. It is a primary need and constitutes a basic condition of existence, which is a universal common good for humanity. Its benefits are meant for all and not only for those who live in countries where water is abundant, well managed and well distributed. As a natural resource, water must be at the disposal of the entire human family (Pontifical Council for Justice and Peace, 2006). Water is much more than just a basic human need. It is an essential, irreplaceable element to ensure the continuance of life. It is intrinsically linked to fundamental human rights such as the right to life, to food and to health. In a Message to the Bishops of Brazil in 2004, Pope John Paul II wrote, "as a gift from God, water is a vital element essential to survival, thus everyone has a right to it" (Pontifical Council for Justice and Peace, 2006 p3)

Despite its importance to human beings and other organisms, water is squandered and polluted by industry, agriculture, and many other systems. Aquatic ecosystems such as wetlands are drained to make room for houses,

factories, airports, and farms. Rivers are dammed and their water diverted to cities. To live sustainably on the Earth, we must do a much better job of protecting and managing water resources (Chiras, 2001).

Freshwater crisis

Although the earth is endowed with a generous supply of freshwater, water shortages are becoming more and more common. Virtually every nation in the world experiences water shortages either all year round or part of the year. The consequences can be devastating. This problem of water scarcity and water deprivation is experienced mostly by people living in poverty and often in the poorest countries. However, the concept of "family of nations" recalls that responsibility for the destiny of the less favored countries rests also with those more richly blessed. The challenge faced today in the water sector is both a social as well as an economic issue. In this regard, developing countries require the necessary know-how and technology along with developmental assistance of a scale sufficient to address major projects needed to guarantee access to water especially, safe water for present and future generations (Pope Benedict XVI,. cited in Pontifical Council for Justice and Peace, 2006).

In many less developed countries, women spend a large part of their working hours fetching water, often walking 15 to 25 kilometers a day and frequently drawing it from polluted streams and rivers. According to the World Health Organisation, three out of every five people in less developed nations do not have access to clean, disease-free water (Chiras, 2001).

In the developed world, a child consumes 30 to 50 times as much water as one in the developing world. Africa has a surface area of more than 21 million sq. km. of water and land resources, which are critical for the continent's economic and social development (World Bank, 1989). The crucial role of water in meeting Africa's socio-economic development goals is widely recognised, as the continent faces endemic poverty and pervasive underdevelopment performing worst in terms of poverty reduction in the world (Ravallion & Chen, 2000 cited in UNECA, 2006).

Though Africa uses only about 4 per cent of its renewable freshwater resources (WRI, UNEP, UNDP & WB, 1998), water is becoming one of the most critical natural resources as the continent is one of the two regions in the world facing serious water shortages (Hopkins, 1998). Although it has abundant freshwater resources, there are great disparities in water availability owing to uneven distribution. According to Sharma et al. (1996) cited in United Nations Economic Commission for Africa [UNECA] (2006), eight countries were suffering from water stress or scarcity in 1990 but the situation is getting worse and the number of countries experiencing water stress will rise to 18, affecting a population of 600 million people on the continent by 2025. Many countries will shift from water surplus to water scarcity as a result of population changes alone and the declining precipitation in that region will compound the problem (GEO, 2000, 1999).

The losses of water may occur, in part, through evaporation from surface waters or from plants and other means. For example, the average level of

unaccounted-for water is about 50 per cent in urban water supplies and as much as 70 per cent of the water used for irrigation is lost and not used by plants. The low values of the internal renewable resources also show that there is room for improvement in conservation of rainwater, the lack of which accounts, in part, for the endemic drought in parts of the continent (UNECA, 2001; UNECA, 2006). Owing to the highly variable levels of rainfall in Africa, large numbers of people are dependent on groundwater as their primary source of freshwater (UNEP, 2002).

Though water is intimately linked with African cultures, religions and societies, modern African societies lack the adaptive capacities to provide the basic water needs for households and other vital services. These needs include sufficient water to maintain a basic standard of personal and domestic hygiene and health which does not depend on having access to water in adequate quantities but its quality to maintain good health. The inadequacy of improved domestic water supply leads to diseases such as waterborne diseases from drinking contaminated water and water-washed diseases which occur when there is insufficient water for washing and personal hygiene. Yet treating degraded water entails high cost and the insufficiency of water prevents people from keeping their hands, bodies and domestic environments clean and hygienic which results in skin and eye infections (Yamamura, Magara and Saito, 2002; UNECA, 2006).

In most African rural communities, providing daily water needs is a burden on households with no direct water supply. Apart from the direct health

threats arising from water shortage and possible contamination, water has to be carried from long distances, which takes time and effort, a burden borne mainly by women and children. This trade off other productive activities, as research has indicated that access to direct water supply systems provides the opportunity to spend more time in economic and educational activities (Yamamura et al, 2002; United Nations Economic Commission for Africa, 2006).

To many it may seem the world is running out of water but this might not be the case. This is because precipitation is not evenly distributed across the face of the Earth. Tropical rain forests are drenched with rain, receiving 250 centimeters or more a year. However desert areas receive less than 25 centimeters of rain a year. People living in areas that receive small amounts of precipitation, such as the desert, often suffer severe water shortages (Chiras, 2001).

The fact also is that as population increases, water shortages will become more prevalent. Demand for agriculture, industry and personal use will rise significantly, causing even greater shortages than now exists. According to Brown (1991), between 1950 and 2050, the amount of water available per person will fall by 74%. It is also believed that water scarcity may be the most underrated resource in the world today.

Water shortages result from lack of rain and are therefore most common in dry, arid climates, semiarid regions, and uncommon in rainy areas. But rainfall patterns are just part of the question. Demand also plays a big role and anytime demand exceeds supply water shortage occurs. A stream and groundwater may be sufficient for a small town, but when that town burgeons and becomes a city,

water shortages may arise. Water shortages even occur in areas with seemingly abundant supply when demand exceeds supply. Canada for example has 9% of the worlds freshwater and ranks third in the world's nation's freshwater resources. Yet water shortages are common in many parts of Canada, especially the Southern part of the Prairie Provinces. Part of the reason for this is that Canada's indoor water use is second highest in the world, about 88 gallons per person per day. The other reason is that 90% of Canada's population is concentrated in the lower portion of this vast country and much of the nation's water resources are located in the North (Chiras, 2001).

Montgomery (1992) says, though it is easier to use surface water rather than groundwater for water supplies, the reason for using groundwater is that in many dry areas, there is little or no surface water available, while there may be a substantial supply of water deep underground which may sustain life and farming activities in otherwise uninhabitable areas. Also stream flow varies seasonally and during the dry season water supply may be inadequate. Dams and reservoirs accumulate water only in the wet seasons for use in dry times. However, dams may represent a considerable water loss and aggravate the water supply problem. Precipitation varies widely geographically, as does population density. In many areas, the concentration of people far exceeds what can be supported by available local surface waters, even during the wettest season.

The vital importance of water to humanity means also that it is a strategic factor for the establishment and maintenance of peace in the world. Water is a dimension of what is referred to as resource security. Conflicts have already

occurred for control over water resources and others may come into center stage the more water scarcity manifests its consequences on the lives of human beings and their communities (The Pontifical Academy of Sciences, 2004).

Drought which also contributes greatly to freshwater crisis exists when rainfall is 70% below average for a period of 21 days or longer (Chiras, 2001). A severe drought results in a decrease in stream flow, sometimes a complete cessation of flow, and a drop in the level of lakes, streams, and reservoirs. This, in turn reduces water available for irrigation, domestic use, and industrial production. Drought also results in a drop in the water table, the upper level of groundwater. Drought causes devastating losses to agricultural crops. It may affect wildlife negatively; reduce aquatic organisms and range of production while increasing stress on livestock. Drought years are also characterised by an increasing number of forest fires (Chiras, 2001). For example, the extreme drought in the Horn of Africa is intensifying ethnic tensions and conflicts for the control over the few, still available, water resources. This drought is threatening the food security of already poor populations and has led to a food emergency situation. Water scarcity can present a clear danger to the internal stability of countries. The lasting foundations of water-related solidarity are economic, environmental and strategic factors but also require a strong ethical basis. Sharing water and sharing the benefits which water brings, in a mutually agreed, equitable and sustainable way is the key to preventing conflicts over this precarious resource whether at the local or international level, whether regarding major

hydropower projects or neighbourhood projects in local villages (The Pontifical Academy of Sciences, 2004).

Most people think of drought as a natural event. Though this is true, drought can also be caused by human activities. Overgrazing and deforestation, for instance decreases rainfall in downwind areas.

Socio-economic importance of water

One of the most important uses of water by man is in the area of food manufacture/processing which encompasses a wide range of activities, including meat and fish processing, dairy, canned food and beverages – both alcoholic and non-alcoholic. In these processes, water is mainly used for "in-process" purposes and the usage varies significantly with the type of product (DEFRA, 2004).

The world's population withdraws enormous quantities of freshwater from lakes, streams, and rivers each year. According to Brown (1991), approximately 70% of this water is used for crop and livestock production. Also industrial use accounts for about 20% while domestic use make up the remaining 10%. These averages vary from country to country. In the United States, for example, 33% of the water is withdrawn for agriculture and 54% is for industry and eleven percent is withdrawn for residential use. In Asia, 85% is used for irrigation. Where does this water come from? In fact, about 34% of the United States' daily water supply comes from lakes, rivers and streams and the remainder is groundwater.

In this regard, Pontifical Council for Justice and Peace (2006) as stated in the Holy See (2003), stated that water plays a central and critical role in all

aspects of life. The Council analysed water as a social good and at the same time an economic good as well as an environmental good. Highlights from the document indicate the central role of the human being in caring for the environment and its constitutive elements of which water bodies are part. It further affirmed that common agreement exists that the survival of humanity and all species on earth depends to a great degree on the fate of water.

The multiple use concept of water

People use water for a wide range of activities, which can earn them much-needed incomes. Single-use approaches to water development and management do not reflect the realities of poor people's water use which include the use of domestic water supplies for activities such as irrigating backyard gardens, keeping livestock, fish farming, processing crops and running small-scale enterprises. When provisions for these multiple uses of water are made during the designing of water-supply system, it could greatly reduce poverty, increase gender equity, and improve health (IWRM, 2006).

A multiple use approach involves three main activities, thus assessing the range of water needs in collaboration with end users, examining the water sources available and matching water supplies to needs based on the quantity, quality and reliability required for various purposes. However, three crucial aspects of a multiple-use approach are neglected in traditional approaches to water supply. These are participation of local communities, identification of all water needs, and consideration of the different water sources available (IWRM, 2006).

There are three ways of accommodating multiple uses of water. These are through irrigation systems, domestic systems and the use of other water sources. Irrigation systems can be adapted by releasing water for household uses and bathing, building community domestic-supply reservoirs, adding pipes, canals and taps to bring water into villages/houses, promoting low-cost, point-of-use treatment for drinking water, sinking shallow wells to tap cleaner 'seepage' water and adding access and crossing points to canals for cattle. The domestic system can be adapted by adding cattle troughs to supply points, adding micro-irrigation systems, using different water sources depending on quality needs and promoting reuse of household "grey" (waste) water. Also the use of other water sources can be maximised by working with the private sector to promote the use of affordable pumps and drip irrigation kits, promoting community/rooftop rainwater harvesting, enlarging wells, promoting credit and access to other inputs to enable people to make use of productive water supplies (IWRM, 2006).

The multiple use approach benefits include poverty reduction and improvement in livelihoods. Evidence has shown that people are adding value by using water in ways which weren't originally planned for. For example, a study in South Africa found that the productive use of domestic water accounts for 17% of the average household income in villages with very limited domestic water provision, but 31% in villages with adequate domestic water supplies (Pérez de Mendiguren Castresana, 2004). In some semi-arid areas, a reliable water supply that fulfills domestic needs and the needs of livestock and backyard gardens has

been found to be making positive contribution to poverty alleviation (Moriarty, Butterwort & Batchelor, 2004).

The multiple-use approach is also a means of fighting hunger and surviving drought. It provides water to support economic activities such as backyard-gardening, fishing and livestock-keeping which are not normally considered in initial domestic or irrigation water supply schemes. It increases individual incomes, reduces vulnerability and ensures food security as Zimbabwe's small productive water points proved to be crucial, allowing small-scale food production when the major crops failed during the drought period of the season (Robinson, Mathew & Proudfoot, 2004). Similarly IWRM (2006) noted that multiple-use approaches have the added value of also providing water for more food and more income, which improves nutrition and allows people to take extra preventive health measures and pay for health services thus improving health status.

The multiple-use concept also leads to improving gender equity and possibly empower women. The availability of water promotes gender equity, as poor women and children are primarily responsible for fetching water as women in Africa are noted to spend around 40 billion productive hours per year on drawing water. Also a study in Gujarat (India) revealed that rural women put the time saved by improved water supply into other productive activities (James, 2004). The multiple-use concept of water supply is deliberately gender-sensitive, taking into account women's water needs for cooking, food processing, cleaning, and other domestic tasks which are often otherwise considered secondary to the

need for drinking water (IWRM, 2006). The question arising is whether women are given the opportunity to fully participate in water decision making.

Conservation of freshwater

Elsdon (1973) explains that humans have mastered their environment to the point of upsetting ecological balances and exhaustion of some vital physical resources which have made it necessary to change to the attitude of conserving the conservable natural resource.

Poor water management is a major contributing factor to most of the water problems evidenced today. Governance is therefore perhaps the most important requirement for solving problems of access to water. The problems and challenges must be looked at by all national governments, international agencies, the private sector and local communities. More attention must be given to coordination and cooperation between these actors at all levels. It must be noted that at present there is no single global organisation mandated to coordinate and deal with water and its related issues among the community of nations.

An essential component of good management is community participation and ownership. Traditional knowledge can be vital in planning water resources management. Contrary to community participation management concept, more highly technological solutions often ignore local knowledge regarding terrain and climate and more importantly the human component (Pontifical Council for Justice & Peace, 2006).

As part of community participation in water conservation in the Yatenga region of Burkina Faso, a heavily populated area adopted a simple technology for determining the slope of the land and therefore the location of contour lines for the construction of the rock bunds which were the essential means through which water was to be 'harvested'. The use of rock bunds to collect runoff during the rains, rather than earth bunds which had previously been suggested was in response to the priorities identified by the farmers themselves (Elliott, 1994). In order to solve the problem of water shortages, attention was much focused on expanding supply: damming rivers and streams and pumping water out of natural lakes. As the cost of these options rose and concern over the environment increased, more and more attention has been focused on ways to use water more efficiently. As a result, water conservation methods that involve measures that can be brought on- line fairly quickly and at costs well below those incurred by building new dams and reservoirs as well as conservation measures that offer numerous environmental benefits became the better option (Chiras, 2001). In their effort to reduce cost of water conservation, The Integrated Tamale Fruit Company (ITFC) in Tamale has constructed weirs (These are valleys blocked using walls and stock pile of stones to retain water) on water ways at Gushie, Naboku, Bagurugu and Yapalsi that collect rain water in the rainy season and used in the dry season to water the company's mango plantation and the communities also benefit as these weirs serve as source of water for animals and some domestic purpose such as washing of clothing. The cost of constructing a weir is lower than the cost involved in constructing dams.

According to Dickson and Benneh (1988) streams or minor rivers in northern Ghana are all tributaries of the Volta and are not permanent. They do not contain enough water for use in the dry season, but they become so full of water in the rainy season that they flood and cause damage over extensive areas as a result the flow has been regulated to conserve water in the artificial Volta Lake which has formed behind the dam at Akosombo.

Disaster risk assessment is an integral component of the development plans and poverty eradication programmes and ways need to be found to break the vicious circle of poverty, environmental degradation and lack of preparation that turns natural hazards into disasters that destroy development gains. In this respect, poor countries especially, should be encouraged with the help of the richer ones, to invest in mitigation measures to reduce the consequences of floods and droughts. For example, water reserves to face periods of drought should be created (Pontifical Council for Justice and Peace, 2006).

The water issue is truly a right to life issue. It is the poor who are deprived of the right to water, to health and to food. The human family must be served and the primary objective of all efforts must be the well-being of those people - men, women, children, families, communities - who live in the poorest parts of the world and suffer most from any scarcity or misuse of water resources (Pope John Paul II, 2002).

Urban development policies are increasingly focusing on better ways to incorporate sustainable development as part of the development process and in doing so contribute towards better water use and waste management. Urban land

use changes can impact on water use in a variety of ways and therefore affect demand, waste, diffuse pollution and flooding. At a water body level the pattern of changes in land use will drive pressures and therefore an understanding of local and regional planning objectives and policies is a key input into the overall development planning process (DEFRA, 2004). In the light of this, water conservation today makes great sense. It has been stated that recycling of water and scheduling water application according to crop and soil needs cost about $10 per acre. Switching for instance from irrigated crops, such as cotton, to dry land crops costs farmers about $40 per acre in lost crop yield. Water conservation by using more efficient sprinkler systems costs about $ 175 per acre. However, water for new dams, costs up to $500 per acre. This has made many sustainable farming practices reduce the demand for water by increasing the organic content of the soil to reduce water requirement in the soil because organic matter retains soil water (Chiras, 2001).

Water is central to life and the action of wasting water is morally unsustainable. It is lost or wasted due to an infrastructure that is old, badly or improperly constructed or inadequately maintained. There is an urgent need to regain a "culture of water", to educate society to develop a new attitude towards water. In the face of waste, water cannot be treated as a mere product of consumption among others since it has an inestimable and irreplaceable value. It is cultural traditions and societal values that determine how people perceive and manage water (Pope John Paul II, 2005). In this regard, Montgomery (1992) observed that the basic approach to improving the supply of water is through

conservation. He stated that water drawn from water bodies, using different methods for domestic use are wasted everyday through the use of long showers, inefficient plumbing works, insistence on lush green lawns even in the heat of summer, and many other ways.

Impact of human on freshwater resources

In addition to overuse, pollution of available water resources also endanger freshwater. Human impacts on freshwater resources in Africa are mainly as a result of population growth which is incompatible with economic growth, fast growing urban cities and urban waste refuse disposal. Others are human and animal faecal disposal into the environment, waste water and storm water run-off disposal and fertiliser use in agriculture (Meissner, 2002).

In times past the obvious ways to dispose of industrial waste was into rivers, which transport the material into the seemingly infinite volume of the seas and ocean. This practice is now leading to severe danger because of the huge amount of waste involved and the extent of the pollution problem is now quite staggering. Rivers with little or no life in them are too common and also some waters are dangerous for bathing (Elsdon, 1973).

Also, according to Montgomery (1992), streams and large lakes have historically been used as disposal sites for untreated wastewater and sewage, which makes the surface waters decidedly less appealing as drinking waters. A lake, in particular, may remain polluted for decades after the input of pollutants

has stopped and there is no place for already deposited pollutants to go or if there is a limited input of fresh water to flush them out.

In another development, Kumar De and Kumar De (2005) stated that our usable water is getting polluted by man-made activities and unfit for use sooner than expected. Water crises are more serious than food or population crises, since food production or population issues are irrelevant without water supply. The use of polluted water affects 25,000 people all over the world every day (Kumar De & Kumar De, 2005). In India out of 6l villages, one third or about 2l villages are without access to water. They added that the US Food and Agricultural Department estimated that if the present day practices of wasting and polluting water are not stopped then within less than a century the world's biosphere including man will disappear. Therefore, proper and efficient ways of managing water resources globally is necessary.

Integrated Water Resource Management – IWRM

IWRM is about integrated and 'joined-up' management. It is about promoting integration across activities and time based upon an agreed set of values (Moriarty et al, 2004). It is a global movement driven by a perception of global water crisis in the present and the future. However the heart of the water crisis is poor management but with careful management and wise selection of priorities, even the driest parts of the world would have sufficient water all year round.

IWRM has been defined differently: it expresses the idea that water resources should be managed in a holistic way, coordinating and integrating all aspects and functions of water extraction, water control and water-related service delivery so as to bring sustainable and equitable benefit to all those who are dependent on the resource (EC, 1998). It is also seen as a process of assigning functions to water systems, setting of norms, enforcement and management of water resources (van Hofwegen & Jaspers, 1999). In the view of Calder (1999), IWRM involves the coordinated planning and management of land, water and other environmental resources for their equitable, efficient and sustainable use. In a similar vein GWP (2000) explained that IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, so as to maximise both economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. There are three key concepts which are present in all definitions of IWRM. These are equity, efficiency and sustainability. The aims of IWRM are to promote more equitable access to water resources and the benefits that are derived from water in order to tackle poverty. It is also to ensure that scarce water is used efficiently and for the greatest benefit of the greater number of people, and to achieve more sustainable utilisation of water, including a better environment (Moriarty et al, 2004).

IWRM is guided by four main principles derived from the 1992 Dublin conference on environment and development, the first of which states that fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. As a life and livelihoods sustenance commodity, its effective

management demands a holistic approach, linking social and economic development while protecting the natural ecosystems. The second principle explains that water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. This approach will create the needed awareness about the importance of water among policy-makers and the general public. This means that all stakeholders are involved in the planning and implementation of water projects. The third principle acknowledges the central role women play in the provision, management and safeguarding of water. Women as providers and users of water and guardians of the living environment have seldom been reflected in institutional arrangements for the development and management of water resources. This principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them. The last principle explains that water has an economic value in all its competing uses and should be recognised as an economic good. It is vital to recognise that it is a basic right that all human beings should have access to clean water and sanitation at an affordable price. The past failure to recognise the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources (WMO, 1992).

Stakeholders in IWRM

Water resources management involves various stakeholders with multiple objectives. In this regard stakeholders may include all individuals, groups or organisations that have some interest in the use or management of water resources. They include water users such as households, farmers and industries and government agencies on different administrative levels that have an interest based on their official mandates. Potentially, everyone is a stakeholder in water resources management. Public health concerns may be the main driver for water quality improvements, environmental grounds may trigger investments in wastewater treatment, and agriculture interests may drive the development of water control infrastructure. While not everyone may be able to participate in decision-making on water resources management, ongoing trends towards democratisation, privatisation and globalisation are leading to the expansion of the network of stakeholders to include a multitude of other stakeholders (Hermans & Renault, 2006).

The involvement of the concerned stakeholders in the management and planning of water resources is universally recognised as a key element in obtaining a balanced and sustainable utilisation of water. But in many cases stakeholders represent conflicting interests and their objectives concerning water resources management may substantially differ. To deal with such situations, the IWRM should develop operational tools for conflict management and resolution as well as for the evaluation of trade-offs between different objectives, plans and actions. An important issue here is the need to identify and designate water

resources management functions according to their lowest appropriate level of implementation so that at each implementation level the relevant stakeholders need to be identified and mobilised (GWP, 2000).

Before 1998 in Zimbabwe, stakeholder participation in water management was limited to those with water rights, mainly white commercial farming, urban, mining and industrial sectors, thus communal and resettlement farmers were not involved in water management because they did not possess water rights (Mtisi & Nicol, 2003). With the reforms, stakeholders from different water user groups are represented on the sub-catchment council. However, the criterion for election or selection of stakeholders to sub-catchments was viewed as 'unclear and lacking wide consultations with new stakeholders'. It was common among new stakeholders that they did not know how their representatives were selected or elected onto sub-catchment councils, and in some cases, not knowing if at all they had a 'representative'. The problems of stakeholder representation are compounded by the lack of adequate resources to conduct wide spread information and awareness programmes (Mtisi & Nicol, 2003).

Participation in IWRM

Participation in IWRM is the process of involving those who are affected by and have an interest in water resources, and hence in the formulation of water management strategies. It is a two-way communication process that seeks to identify and to clarify interest at stake, with the ultimate aim of developing a well-informed water management strategy that has a good chance of being supported

and implemented (FAO, 1995). On the other hand, Grigg (1996) states that water is a subject in which everyone is a stakeholder, hence real participation only takes place when stakeholders are part of the decision-making process. This can occur directly when local communities come together to make decisions related to water supply, management and choice of usage. Participation also occurs if democratically elected or otherwise accountable agencies or spokespersons can represent stakeholder groups effectively. Additionally, there are circumstances in which participation in decision-making can take place through market processes, and that is when appropriate pricing systems are in place. The type of participation in issues related to water will depend upon the spatial scale relevant to particular water management and investment decisions and upon the nature of the political economy within which such decisions are made.

A participatory approach is the only means for achieving long-lasting consensus and common agreement. However, for this to occur, stakeholders and officials from water management agencies have to recognise that the sustainability of the resource is a common problem and that all parties are going to sacrifice some desires for their common good. It is about taking responsibility, recognising the effect of sectoral actions on other water users and aquatic ecosystems and accepting the need for change to improve the efficiency of water use and allow the sustainable development of the resource. Participation will not always achieve consensus, however arbitration processes or conflict resolution mechanisms will lead to agreement (Grigg, 1996).

One of the responses to the global policy thrust of integrated water management has been the establishment of catchment-based management of water resources. This approach to water management seeks to promote the coordinated development and management of water with the view of maximising the resultant economic and social benefits in an equitable manner without compromising the sustainability of vital ecosystems (GWP, 2000). IWRM seeks to accelerate the devolution of responsibilities to water users and build transparent and accountable mechanisms for resource allocation. In this regard, institutional reforms are much needed to foster stakeholder participation and representation in water management. However, emerging evidence indicates that high transactional cost limit participation most often to stakeholders who can afford to pay the cost of traveling to attend meetings, as well as those who can communicate and articulate effectively. Consequently, the concerns and consensus that emerge from catchment and sub-catchment councils is that of few stakeholders (Mtisi & Nicol, 2003).

Gender dimension of IWRM

For effective participation of women at all levels of decision-making, regarding water, there is the need to ensure that the water sector as a whole is made gender friendly. The process should begin by the implementation of training programmes for water professionals and community or grass root mobilisers with women being in the centre. This is because they play a key role in the collection and safeguarding of water for domestic and agricultural use and men should not

be allowed to play any domineering role in management, problem analysis and in the decision-making process related to water resources. The fact that social and cultural circumstances vary between societies suggests that there is the need to explore different mechanisms to increase women's access to decision-making and widening the spectrum of activities through which women can participate in IWRM (GWP, 2000).

Moser (1989), identifies participation in community management work as part of women reproductive and productive roles, and notes that this has formed the basis for many women welfare approaches such as mothers' clubs, provision of relief, or community services like, domestic water supply, health care, etc which are seen as an extension of their domestic roles. According to Meinzen-Dick and Zwarteveen (1997), the major types of women's organisations for production have been cooperatives and micro credit programmes. However, women's participation in organisations that gives them the power to have control over natural resources is more challenging, because it deals with property rights over existing resources, especially natural resources.

In dealing with the usage and the management of water and water systems, women and men assume distinct responsibilities. Most societies allow women and girls in the collection of every litre of water for cooking, bathing, cleaning, maintaining health and hygiene, raising small livestock and growing food. Rural men need water for irrigation and larger livestock, but women often care for the milk cattle, young animals and also oversee family health due to differences in gender roles, they have different stakes in water use (CESCR, 2002). Though

there is a tendency to overemphasize women's reproductive roles in relation to water resource management, women have pressing needs too for water to engage in economic production, including agriculture and micro enterprise. However gender disparities ensure that these needs frequently go unmet, with discrepancies in land tenure, access to water, and control of other related commercial linkages (GWA, 2003 cited in CESCR, 2002).

Acceptance and implementation of management and safeguarding of water resources requires positive policies that address women's specific needs, to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them (ICWE, 1992). Though, projects and programmes which involve the organisation of community based groups do guarantee some degree of participation of women, the level of participation is not the same as their male counterparts. Contrary to these policy statements, there exists very little evidence of explicit attempts at increasing or improving the involvement of women in this regard. Most of the 'mainstream' literature on natural resource management does not mention gender differences or differentiate between male and female users. The 'gender and environment' and 'ecofeminist' literature do make frequent mention of women as resource managers, but it seems to be mainly based on the recognition of women as important users of natural resources. If management implies some kind of control over decision making and planning, it is less likely that women are still as frequently to be considered 'managers' (Jackson, 1993).

All over the world, what can be a time-consuming and dangerous duty is supplying the water needs of households and that is what women and girls have assumed. Many walk long distances to fetch water, spending four or five hours per day, burdened under heavy containers and suffering acute physical problems, especially in drought-prone areas spending up to 27 per cent of their caloric intake in collecting water (CESCR, 2002). Consequently, many have no time to pursue education, income generation or cultural and political activities especially in urban areas. Also since they are in regular contact with poor-quality water, they face a higher exposure to water-borne diseases. Seventy per cent of the world's blind are women who have been infected, directly or through their children, with trachoma, due to limited access to water (GWA, 2003).

The gender dimension of water resource means that women and men experience changes in water availability, services or water policies differently. Thus an initiative should be studied for its differential impact on women and men to ensure that all implications are clearly understood and there are no unintended negative repercussions.

Theories

From an illustration of the common pool resource theory, it reveals a situation where multiple individuals, acting independently and rationally focusing on their own self interest, will ultimately deplete a shared limited resource. This scenario was described using cattle and a herder, where the herder put a cow he acquires onto a common piece of land without considering the quality of the land

even if it meant damaging it for all as a result of overgrazing. The herder receives all of the benefits from an additional cow, while the damage to land, water source and all aspects of the environment is shared by the entire group. What is advocated here is resource management solutions to population and resource problems because the impact of human population growth is a concern, with the earth's resources being a general common (Hardin, 1968). Neo-Malthusians observed that land degradation is associated with rising population growth, which can come through a variety of processes such as deforestation, desertification through poor agricultural techniques, amongst others. In their view, the increasing number of people will increase land degradation, because more people consume more trees (deforestation) and more food (agriculture) and they emphasized that one of the ways that humanity is 'biting the hand that feeds it' is through air and water pollution (Wolfgram, 2005).

Aristotle (384 B.C.-322 B.C.) similarly argued against common goods that all persons call the same thing mine, and in the sense in which each does so may be a fine thing, but it is impracticable; or if the words are taken in the other sense, such a unity in no way conduces to harmony. For what is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest; and only when he is himself concerned as an individual. Besides other considerations, everybody is more inclined to neglect the duty which he expects another to fulfill; as in families many attendants are often less useful than a few.

In a reverse way, the tragedy of the commons reappears in problems of pollution. Here instead of taking something out of the commons, it is about putting something in -- sewage, or chemical, radioactive, and heat wastes into water, and noxious and dangerous fumes into the air. The rational individual finds that his/her share of the cost of the wastes she/he discharges into the commons is less than the cost of purifying such wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest," so long as we behave only as independent, rational, free enterprisers (Hardin, 1968).

The tragedy of the commons as a food basket is averted by private property but the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented using other means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated.

The pollution problem is a consequence of population. "Flowing water purifies itself every ten miles". This thought and myth could be true in early years when there were not too many people but as population became denser, the natural chemical and biological recycling processes became overloaded, calling for a redefinition of property rights (Hardin, 1968). The sensational topic in the population-resources argument is whether or not there is a finite character to water. The neo-Malthusian argues that there is finite availability in water supply. Contrarily, the protagonists of the human/technological advancement argued that water is not limited in the sense that there is not enough to support human life. Scientific experts observed that, whatever benchmark is taken, the precise amount

of water has no absolute significance because scarcity is a relative concept and can occur at any level of supply, depending on demand and other circumstances. There are always options available to societies that are confronted with water scarcity and that water scarcity is not necessarily inevitable or immutable (Wolfgram, 2005).

The issue of sustainability arises from the discussions of tragedy of the commons theory which present some actions that seem to have negative effects on the environment – the host of humanity. Though humanity has to exploit the environment to improve living conditions, this must be done sustainably.

This is the focus of the theory of sustainability, which serves as a working tool that foster a well-functioning position between individuals, society, the economy and the regenerative capacity of the planet's life-supporting ecosystems. This alignment represents a particular type of dynamic, balanced interaction between a population and the carrying capacity of its environment. It is based on this specific balance that sustainability has been defined, stressing on population developing to express its full potential without adversely and irreversibly affecting the carrying capacity of the environment upon which it depends. This definition of sustainability highlighted cross generational equity, which is an important concept but then poses difficulties because it is not always easy to determine future generations' needs as two positions are held regarding sustainability. The first position accepts that non-ecospheric natural capital (minerals) can be depleted but the ecosphere must be protected absolutely – 'there is no substitute to the planet' thus a planet over people approach (strong

sustainability); and the second position that propounds that human made capital (e.g. technology) will substitute for natural capital so this can be run down, providing a critical minimum level is maintained thus essentially a willingness to pay approach (weak sustainability). Sustainable development as a concept has largely evolved from the latter position (Ben-Eli, 2006).

Analytical framework

The analytical framework (Figure 1) is the concept problem tree analysis and focuses on the factors (causes) that are responsible for freshwater scarcity and the accompanying problems (effects) that emanate from the freshwater scarcity. The root cause of freshwater scarcity as presented in Figure 1 is rapid population growth which puts pressure on land and forest resulting in deforestation, bushfires, poor farming practices and pollution.

Poor farming practice and pollution may lead to siltation of water bodies while deforestation and bushfires deplete the vegetative cover that give rise to high temperatures coming from the direct sun rays and also creating less wind breaks causing rapid evaporation of water and also affect the rainfall pattern negatively. The end result of these actions is the scarcity of water especially freshwater. In addition, rapid population growth comes with sanitation problems, waste is disposed indiscriminately and sometimes into water courses which affect the quality of freshwater and contribute to siltation. All these will increase poverty levels and one of the effects is that it will result in people migrating to the southern part of the country in search of jobs.

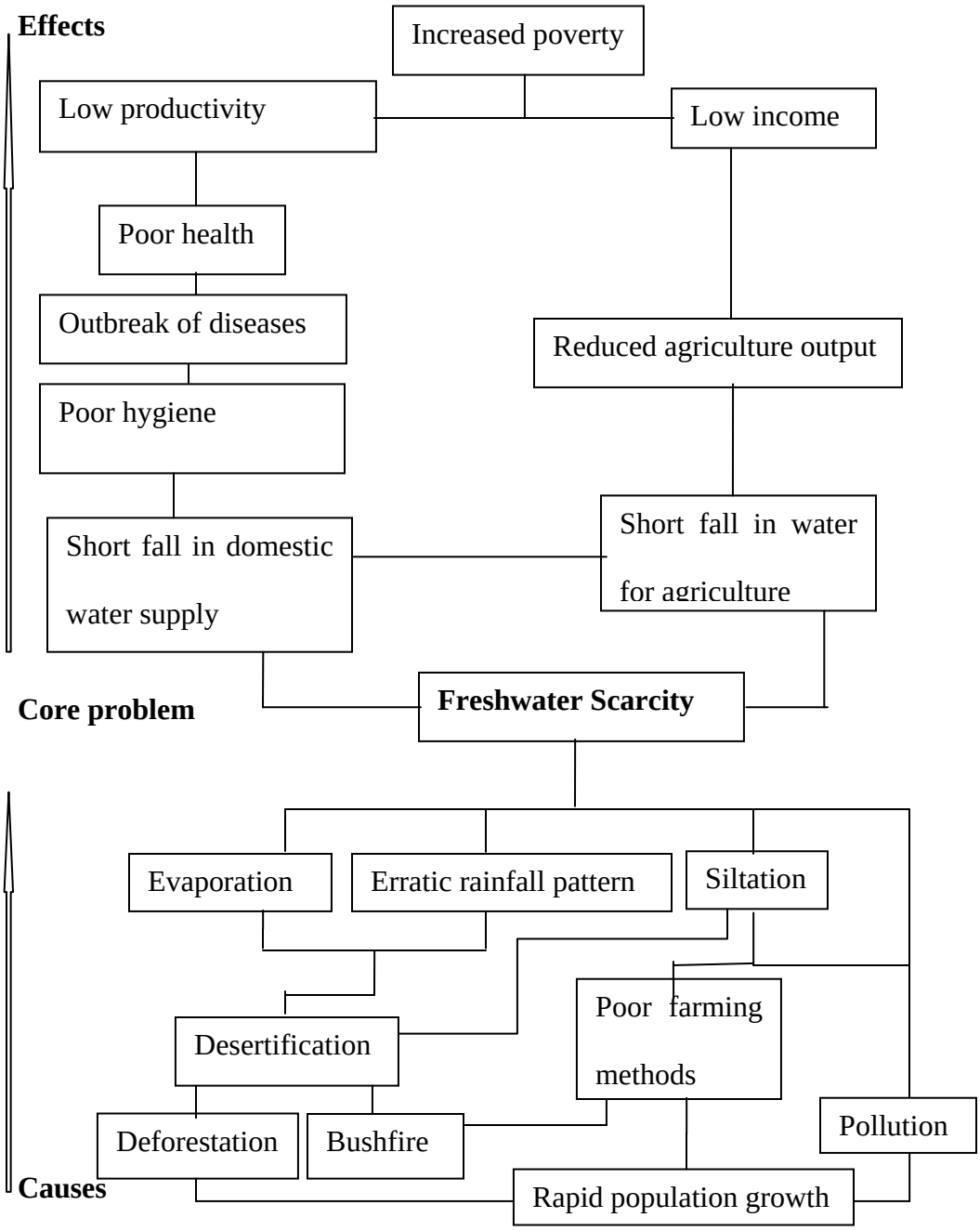


Figure 1: Analytical framework on the causes and effects of freshwater scarcity

Source: Author's construct, 2008

The scarcity of freshwater implies that there will be short fall in domestic water supply and since the quality of water is affected and poses poor hygienic conditions, there is the possibility of outbreak of diseases which in the long run affect health statuses reducing productivity levels. Also the scarcity of freshwater in the long run causes a short fall in water supplied for agricultural activities. This will reduce output from the agricultural sector, leading to low income levels of the people since their main economic activities are in agriculture.

Conceptual framework

Water is a shared resource needed by individuals or group of people to be able to carry on basic activities of life. Limited as water is, especially in the savanna areas of Ghana, it is prudent to always find suitable means to manage the water sources available in order to ensure its sustainability.

The conceptual framework (Figure 3) illustrates the relationships amongst the effective management of water by various stakeholders, the sustainability of water bodies and both economic and social benefit derived from it. Water as a resource from the various sources (rivers, ponds, streams, spring and dugout) accessed by water users for their social or economic benefits (GWP, 2000) with little attention given to the management and maintenance of these sources. This situation reflects the theory of the tragedy of the commons which reveals itself in a situation where multiple individuals, acting independently and rationally focusing on their own self-interest, will ultimately deplete a shared limited resource (Hardin, 1968).

To ensure that the problem of water scarcity is reduced, if not totally overcome, it might be necessary to involve the private sector (privatisation) in the management of water and its sources. This would ensure that some economic value is placed on water, which would lead to achieving efficiency and equitable use, and encourage conservation and protection of water bodies. Though fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment as indicated under the first principle of IMRW (WMO, 1992), allowing the privatization of water by placing economic value on it, with the aim of making profit may affect the 'commons' as the question of ability to pay, which is currently the debate going on in the country (Ghana), would arise.

One way of resolving the challenges regarding the management of freshwater as a scarce basic necessity of life and to achieve long-lasting consensus and common agreement among all, is to recognise that the sustainability of water resource is a common problem and all parties must be identified and ensuring that they are involved in the process of effective and efficient utilisation of water and it sustainability. This requires adopting the participatory approach involving users, planners and policy-makers at all levels (WMO, 1992), which is a central theme of the second principle of IWRM. Hence the participatory approach would involve management structures put in place like prohibiting bush burning, planting of trees to provide vegetative cover, improving farming methods, de-silting water bodies and providing appropriate laws and regulations to ensure water sustainability and compliance.

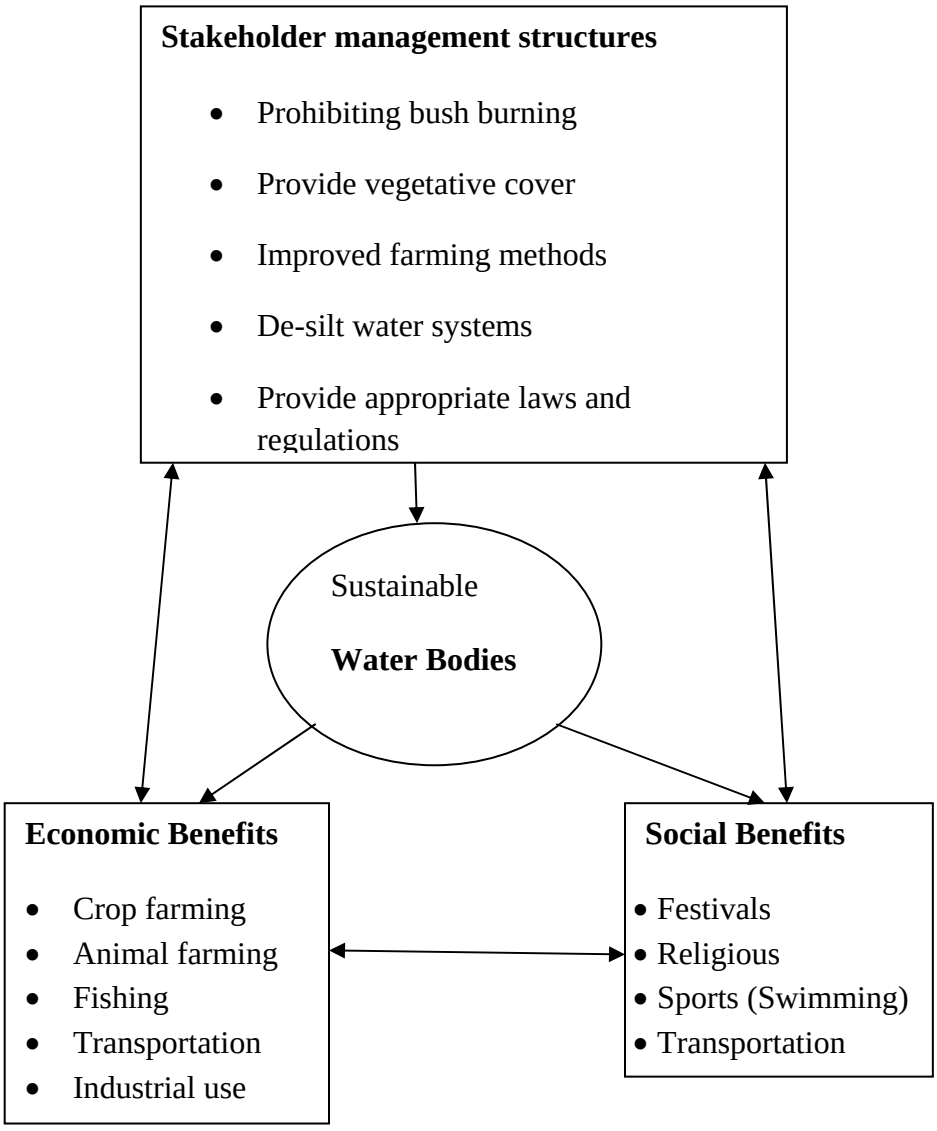


Figure 3: Conceptual framework on management of water bodies and its socio-economic benefits

Source: Author's construct, 2008

However looking at the study area water resources, most of which are in the form of surface water or freshwater bodies, the conceptual framework suggested an IWRM stakeholder participation which would be appropriate to manage the freshwater source identified in the area. This would bring all those

involved in water related activities together, to identify practices and actions in the study area that would result in managing water sources properly to preserve and conserve water for both social and economic uses (GWP, 2000).

CHAPTER THREE

METHODOLOGY

Introduction

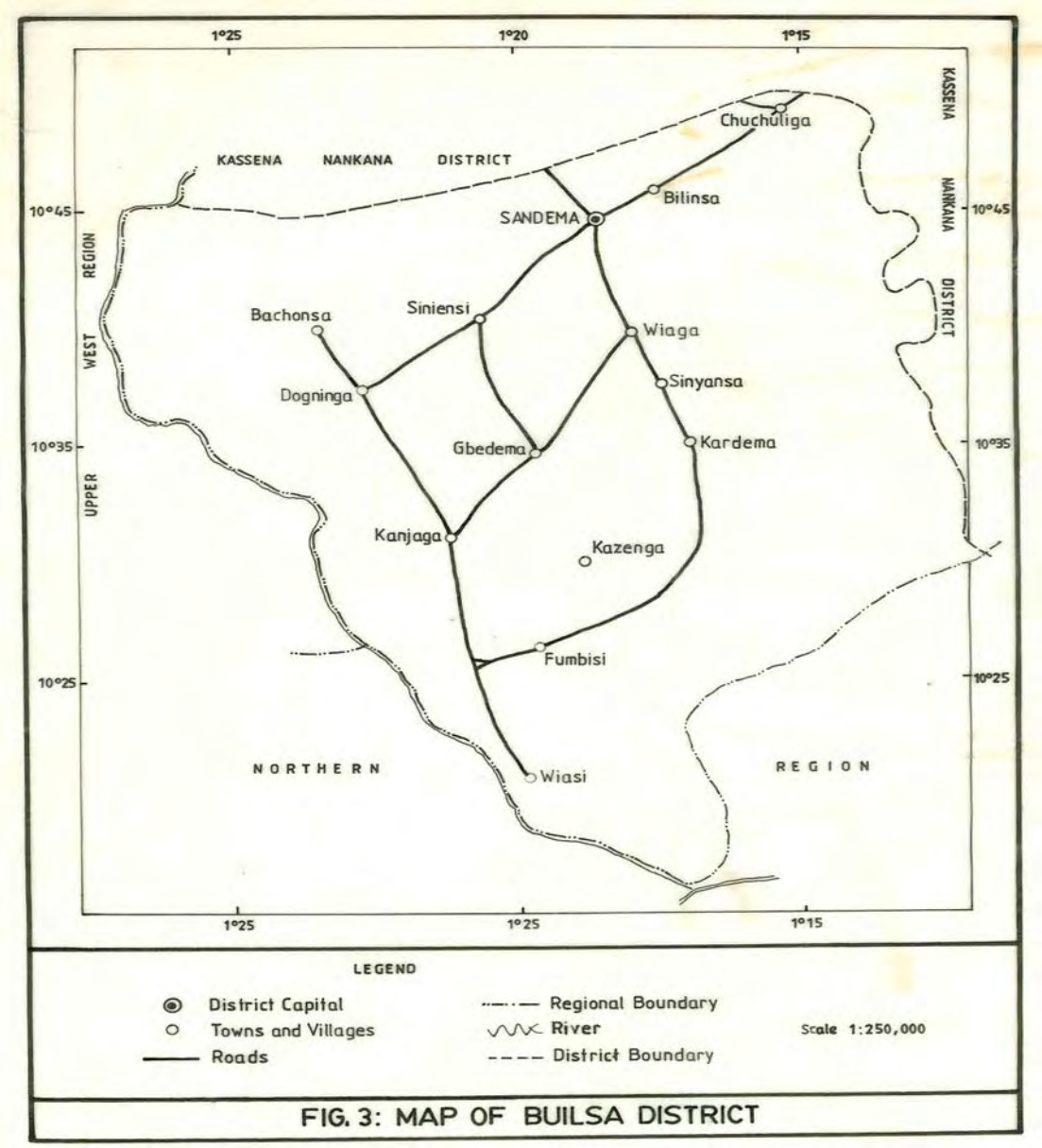
This section discusses the study area and present methodological issues, which include the research design, target population, sample and sampling methods used to select the study unit. The section also covers issues related to data such as data sources, method of data collection, processing and analysis.

Study area

The Builsa District as shown in Figure 3 lies to the South-Western end of the Upper East Region and has a land area of 2,220 square kilometers. The district shares boundaries to the north with Kasena-Nankana district, West Mamprusi district to the south and Sissala East district to the west. It is made up of 13 scattered villages, with Sandema as the administrative capital. The 2000 population census enumerated the population of the district to be 75,375 made up of 38,379 females and 36,996 males (GSS, 2000).

The average household size of the district was 5.15 persons and this compares favourably with the national figure of 5.1 persons for rural savanna areas. The household sizes in the relatively larger communities were smaller e.g. Sandema 4.3, Fumbisi 4.4 and Wiaga 4.1 persons per household (GSS, 2000).

Apart from Sandema town, almost the whole of the district's population live in rural settlements where houses were built largely from mud with thatch or mud roofs, occasionally with corrugated iron sheets (Kendie, 2002). Sanitation is a major problem in the district since majority of the communities had no household toilets or even a public toilet for use.



Source: Department of Geography and Regional Planning, 2011

Defecation took place anywhere they found conducive for instance, adults defecated in the bushes behind their homes and children defecated sometimes in the compound or just by the outside walls of the building (Kendie, 2002). Statistically, it has been found that only 4.0% of the people in the district practiced safe sanitation, 96% of the people did not have toilet facilities and hence defecated in the bush, also 3.5% used ventilated improved pits (VIP), and the remaining 0.5% used covered pit latrines (GSS, 2005).

The occupation of the people in the district is categorised into five main kinds that include agriculture and related work (67.4%), production, processing and transport equipment work (13.5%), sales work (8.6%), services (4.5%) and Professional and technical work (3.8%) (www.ghanadistrict.com). Agriculture is the dominant occupation of the people in the Builsa district with the main farming type being subsistence farming which fetches them inadequate income. Most women are found in the production and processing of items like smocks, baskets and pottery making especially in the dry season. Brewing of pito (a local beer) is also found common business to women of the Builsa district. Others are engaged in petty trading, carpentry, teaching etc. The common crops grown in the district are millet of different varieties, groundnuts, beans, rice, okro among others. Fowls and guinea fowls rearing are also a major part of the people's economic activities.

Ghana Statistical Service (2000), reported that there is preponderance of Builsa migrants into the Ashanti Region (15,394) and Greater Accra Region (13,385). The other regions with high concentration of Builsa's are Northern Region (8,905), Eastern Region (5,072), Brong-Ahafo Region (4,426) and Western

Region (4,131). It is important to note that most of these Builsa migrants fall within the economically active age group of 15 years – 64 years and they migrate outside their home district to look for employment in various economic activities ranging from farming, administrative/professional work, clerical jobs, artisan, to trading, including hawking.

Climatic conditions are not favourable for farming activities as there is only one rainy season in the district, which builds up gradually from little rains in April to a maximum in August/September and then, declines sharply in mid-October when the dry season sets in (www.ghanadistrict.com). Annual rainfall rarely exceeds 1200mm, and irrigation for agriculture activities are limited in the district so most farming activities take place in the wet season (Kendie, 2002).

Temperatures in the district are high and the dry season is characterised by dry harmattan winds and wide diurnal temperature ranges (www.ghanadistrict.com).The dry north-easterly winds from the Sahara desert dry up the vegetation during this season. Bush fires subsequently destroy the vegetation, leaving a parched and empty terrain. The prolonged cultivation, bush fires and the torrential rains have caused considerable soil erosion and degradation of the vegetation which now consists mainly of short grasses and isolated trees (Kendie, 2002). Relative humidity is high during the rainy season (70 to 90%). On the other hand, relative humidity in the dry season (November- April) can be as low as 20% and the mean monthly temperature varies sometimes as high as 40 degrees Celsius in March to about 26 degrees Celsius in August (Benneh & Dickson, 1988).

The topography is undulating with slopes ranging from 200m to 300m found in the northern part of the district. In the southern valleys however, the slopes are gentler and range from 150m to 200m. The vegetation is characterised by Savannah woodland and consists of deciduous, fire and drought resistant trees of varying sizes and density with a cover of perennial grasses. Overtime, the woodland savannah has been reduced to open park land with trees of economic value like baobab, acacia, sheanut and dawadawa (www.ghanadistrict.com).

The Builsa district has a significant portion of it falling within the Volta Basin and is heavily dissected by the White Volta and its tributaries, namely Sissili, Kulpawn, Belipieni, Bukpegi and Asebelika. Most of these streams however, are seasonal and dry up during the extended dry season (www.ghanadistrict.com).

The geology of the area is such that a greater part of the soil falls within several associations most of which are ground water laterites developed over granitic formations. Soil textures vary within the district but coarse textured soils predominate with various amounts of loosely packed stones and concretions. The alluvial soils of the south are very suitable for rice production due to the seasonal flooding in the areas. In general a large percentage of the soils are poorly drained and intense erosion overtime has contributed to serious reduction in soil depth and thereby to loss of arable land surface.

The effects of large scale uncontrolled deforestation is wide-ranging and complex. Among the most serious environmental consequences are the damage resulting from increased erosion, disturbance to water regimes and in the extreme,

desertification-all of which have serious negative effects on food productive capacity and food security. At the micro level, the environmental benefits of trees and forests in reducing wind erosion and stabilizing soils against water erosion and conversely, the negative impacts of large-scale deforestation on erosion are readily demonstrable.

In the Builsa District in particular, these negative impacts may be seen for example in the silting up of dugouts, drying of boreholes due to lowered water tables, the exposure of the underlying parent rock as in the Chuchuliga Hills, silting of the Red and White Volta river valleys and their tributaries and increasing floods in their basins.

Veihe (2002) stated that in the Builsa- Navrongo- Bawku area almost one meter of soil have been removed in the moderately eroded areas. This affects crop production and coupled with the general harsh environmental conditions and the lack of significant employment opportunities outside subsistence agriculture, produce a stream of migration to the southern regions particularly in the long dry season where natural sources of water dry up, forcing women to walk long distances in search of water (Kendie, 2002).

Socio-politically, the district has only one paramount chief. Both the seat of Central government and the paramount chief are located in the district capital – Sandema. There are twelve divisional chiefs who are responsible for the day to day administration of the twelve towns and villages excluding Sandema. The district has two constituencies namely; Builsa South and Builsa North.

Research design

The study was a non interventional type and it used a descriptive design, to show how vivid the phenomena were, and made critical analyses of the situation. This design was chosen because the researcher wished to give a detailed picture of the issue being studied and focused on questions related to who, whom and how among others.

Target population

The study population was made up of those aged 25 years and above who had stayed in the district for at least 10 years. This was because the younger population might not have a fair knowledge of the issues the researcher was investigating. Also, some institutions and organisations such as the District Assembly, Forestry Department, District Agricultural Office, were part of the study.

Sample and sampling procedure

The sampling process involved multi-stage sampling employing both probability and non-probability sampling methods. The sampling method used under the probability sampling technique was simple random sampling while the techniques employed under the non-probability sampling technique, were purposive and accidental methods.

A multi- stage sampling process was involved in deriving the study units. The first stage involved simple random sampling technique, which was used to

select the seven towns and villages from the sample frame of thirteen (13) towns and villages in the district. Among the seven sampled, three were urban in nature, thus Sandema, Fumbisi and Chuchuliga. Each of these sampled towns and villages were made up of a number of smaller communities and put together they present a larger population that could not easily be considered as a sample to deal with due to resource constrains. As a result, two communities from each sampled town or village was selected using simple random sampling and the total number of communities sampled were fourteen (14) but none of these sampled communities were urban in nature (Table 1). The only urban respondents were four from institutions and organisations.

The total population of the sampled communities was 11, 527 but the study was dealing with the segment of the population that was 25 years and above and this section of the population was derived from the Population Census of 2000 data, which was arrived to be 5,303 (Table 1).

The study sample size was 356 using Kirk's (1995) table of sample sizes of given population sizes. It states that a study population of 5,000, requires a sample size of 357 and when the population is 6,000, the sample size required is 361 a difference of four units. Since the final study population was less than 6,000 and just a little above 5,000, the sample size of 357 was chosen and based on this the sample of each community was mathematically worked out (thus community population divided by total population of communities multiplied by Kirk sample size which is the 357). This generated a sample size of 356 but the actual sample size arrived at was 330.

Table 1: Sample

Sampled Towns and villages, population and sampling method		Sampled communities, populations and sample size and sampling method				Sample obtained from the field
Town/Village (Simple random sampling)	Population	Community (Simple random sampling)	Population	population aged 25 and above	Proposed Sample size (Simple random and purposive	Actual sampled size
Sandema	18794	Nyaasa	800	368	25	24
		Balansa	1591	732	49	47
Fumbisi	7910	Buterisa	556	256	17	17
		Baasa	1131	520	35	24
Chuchuliga	11707	Azug-yeri	793	365	25	24
		Namonsa	683	314	21	21
Kanjarga	5494	Musidem	429	197	13	13
		Gininngsa	1110	511	34	25
Gbedema	4709	Jagsa	1921	884	60	54

Table 1 continued

		Kunkwak	778	358	24	24
Dogninga	2057	Wupiensa	427	196	13	13
		Doringsa	393	181	12	12
Wiesa	1693	Guta	515	237	16	16
		Yipala	400	184	12	12
Subtotal	*52364*		*11527*	*5303*	*356*	*326*
Environmental committee of the District Assembly					2	2
District Forestry Officer					1	1
District Agriculture Officer					1	1
Grand Total					360	330

Source: Ghana Statistical Service, 2000

To sample respondents from the communities, first a sample frame was established which contained all the houses in the community and the names of the houses written on papers and put together. Then the lottery method was used to draw the required sample. The respondents were sampled by convenience as the sampled houses were visited and when an adult within the study age range was found, the person was interviewed but in situations where potential respondents were more than one the oldest was interviewed. Also to ensure a good representation of the sexes, during the interviewing, once a particular sex was interviewed, the next was the opposite and where this did not follow, the researcher along the interviewing process ensured that the sex that had a lower number was always the first option when the researcher got to a sampled house. This sampling process was repeated in each of the fourteen communities. Though simple random sampling was used to reach majority of the respondents in the communities through their houses, others such as traditional leaders and opinion leaders in the communities were purposively sampled, likewise the institutional respondents.

The proposed sample could not be attained due to the difficulty of getting respondents to interview because the time the data was collected coincided with the beginning of the farming season and people were busy on their farms and were not available to respond to the instrument. This actually prolonged the period of data collection.

Data sources

Data was collected from both primary and secondary sources. The primary data was gathered from respondent, while the secondary data was obtained from documents which contained environmental issues that dealt with freshwater bodies at the District Assembly, the District Agricultural office and the Office of the Environmental Protection Agency in the district. Any other relevant documents such as journals, magazines, edited books that contained relevant information were gathered for analysis. Also the internet was one of the main sources of secondary data.

Data collection methods

The main instrument for the collection of data included the use of questionnaires, interviews and observation. Questionnaires were used to gather data from the District Assembly Environmental Committee, the District Forestry Officer and the District Agricultural Officer. This option was considered because these respondents were literate. Interview schedules were designed to gather information from farmers, pito brewers, opinion leaders and traditional authorities. These interview schedules were administered by research assistants who helped by interviewing the respondents and writing down their opinions accordingly, because most of them could not read nor write and issues that needed further explanation were possible with the use of this instrument. Periodic visits were also made to observe the surface water in the district especially during the wet and dry seasons.

Field work

The researcher supervised the work of the research assistants by monitoring and evaluating each day's work to ensure that data was collected from the correct source. The research assistants worked for twelve days. The initial estimation of five days was not possible because the data collection coincided with the seasonal rainfall so it was very difficult getting the respondents to respond to the questions. Also locating the sample categories in the communities was a difficult task and it took the research team almost a month to gather data from the few officials who responded to questions. These problems prolonged the collection of the data. The fieldwork commenced on the 24th July and by the 5th August, 2008 the bulk of the data had been collected except those of the institutions.

Data processing and analysis

The data collected from the field was processed i.e. edited and then entered into the computer for analysis. The data analysis used included descriptive statistics, for example, frequencies and percentages which were transformed into tables for easy understanding. Cross-tabulation was also adopted to determine some relationships. The computer software used in the data analyses was the Statistical Product and Service Solutions (SPSS) software, versions 16 and 20.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The chapter presents data on background information of the respondents in the district, water bodies available in the district, factors responsible for freshwater scarcity, effects of scarcity of freshwater on the socioeconomic lives of the people in the district and the management systems available in the district.

Background information of respondents in the Builsa District

The sampled respondents were aged between 25 and 60 years, with the mean age found to be 44.7, giving the impression that the selected units would have adequate information of what changes had taken place over the years on their water bodies.

Majority (65.1%) of the sample population were traditional believers by religion. This implies that if the traditional norms and beliefs of the people in the district especially those that had links with protecting the environment were adhered to, it would help protect the water bodies and other environmental resources for the general good of the Builsa community. Moslems on the other hand were the minority in the study area as only six percent were sampled. However the rest were Christians. Family size ranged from 1 to above 9. Most

family sizes were between 5 and 8 which are almost the same as the regional average (6 to 8) and more than the national average of 4.5 persons for rural savanna (GSS, 2000). It is assumed that the larger the family sizes the more the usage of water.

Sex, educational attainment and occupation of respondents

Table 2 presents the background information (sex, educational attainment and occupation) of the respondents. From a sample of 330 respondents, 55 percent were males. Also 80 percent had no formal education, indicating that the area had a high illiteracy rate. This is a reflection of the general situation of educational attainment in the region as the 2000 Population and Housing Census results showed that the overall levels of educational attainment were much lower in the Upper East region, compared with the national average. Regarding the low level of educational attainment in the Upper East region, the 2000 Population and Housing Census revealed that the proportion in the region which had never attended school was 71.8 percent (GSS, 2000).

Among the sexes, there were more males (42%) who had no formal education compared to the females (37%). Again, the number of females who had attained basic education were more than the males but the trend changed as the males dominated at the higher level. This might be attributed to the gender roles that places heavy burden on the female as they grow. These included walking long distances to draw water for domestic chores, which affected their performance leading to them dropping out of school at an early stage in school

life. This is supported by the GWA (2003) that women spent long hours in looking for water and this consequently affects their quality time to pursue education as well as engage in income generation activities.

Table 2: Background characteristics of respondents

Sex	Education Level	Occupation			Total
		Primary	Secondary	Tertiary	
Male	No formal education	137	1	2	140
	Basic	15	1	0	16
	Secondary	11	1	1	13
	Tertiary	8	2	1	11
Total		171	5	4	180
Female	No formal education	111	12	0	123
	Basic	12	3	3	18
	Secondary	3	2	1	6
	Tertiary	1	1	1	3
Total		127	18	5	150
Total	No formal education	248	13	2	263
	Basic	27	4	3	34
	Secondary	14	3	2	19
	Tertiary	9	3	2	14
Total		291	23	9	330

Source: Field survey, 2008

Regarding the occupational activities of the people in the area, majority 90.3 percent were engaged in the primary sector of the local economy, that is in the areas of crop and animal farming and poultry, all at a subsistence level. The heavy engagement in the primary sector was as a result of the low level of educational attainment of the people as indicated in Table 2 which is a reflection of Ghana being an agrarian country, with the sector contributing as much as 34.5 percent to GDP (ISSER, 2009). The people lacked the knowledge and skills to engage heavily in the secondary and tertiary sectors.

The few respondents in the secondary sector were dominated by females who were mainly engaged in agro-processing, producing shea butter, dawadawa and pito brewing, activities that involved the use of substantial amounts of water. The very few in the tertiary sector were either engaged in retail services or were public sector employees.

Water sources in the district

Water sources found in the Builsa District were dams, wells, dugouts, boreholes, rivers, streams, and pipes. However, the sources relevant to this study were the dugouts, rivers, streams and dams for irrigation. From secondary data obtained from the Technical office of the Builsa District Assembly, there were 311 boreholes and 286 hand-dug wells in the district. It must be noted that the data from the District Assembly on the number of boreholes and hand-dug wells were for those constructed by the government and non-governmental organisations and did not include private systems.

Uses of water

According to the respondents, the major sources of water in the district for both domestic and commercial usage were wells, boreholes, dugouts and dams. Other sources included springs, streams, and rivers. Among the various sources of water in the Builsa District, the survey results revealed that not all were frequently used for drinking and domestic purposes by the people. Wells (40.3%) were the most frequently used water source in the district. The reason for this high rate was that, it was a source that the people had the skills and knowledge to construct on their own. Though others used water from sources like dams, dugouts, streams, and rivers for drinking and domestic activities, about 59 percent of the respondents claimed they used water from these sources for animal watering, building of houses, shea butter processing, pito brewing, fibre preparation and gardening. These activities were mainly done during the dry season.

Most of the dams in the district were constructed purposefully for irrigation purposes. Unfortunately a number of them either dried up easily or the construction projects had been abandoned. The Yisobsa dam at Wiaga was one of the irrigation dams with adequate water all year round and was used for dry season vegetable cropping (Plate 1). This is a major dam in the district that water is drawn from for dry season farming. Plate 2 shows the cropping field of the Yisobsa dam which was mainly used in the dry season for vegetable farming. The dam is also a water source for animals and building of houses. It holds water all year round and it is an economic asset of the district.

Plate 1: Wiaga irrigation dam

Source: Field survey, 2008

Plate 2: Wiaga crop field

Source: Field survey, 2008

State of freshwater sources in the Builsa District

Freshwater supply in the district is only abundant during the rainy season but becomes scarce in the dry season. Though this situation is obvious

everywhere, what was worrying in the case of the Builsa District was the way the water sources in the area dried up shortly after the rainy season, which seems to be contrary to Montagomery (1992)'s statement that though stream flow varies seasonally and during the dry season water supply may be inadequate, dams and reservoirs accumulate water only in the wet season for usage in the dry season. From the survey results, 29 percent of the respondents said their dams, dugouts and rivers could store water all year round, while 71 percent of respondents indicated that, their water sources in their community did not store water all year round. Plate 3 shows the Abelekpien River near Sandema. The river was a source of economic activities such as fishing and animal watering. However, in recent times, the river does not contain water all year round. The river receives water from the Bagre dam in Burkina Faso between August and September and sometimes overflows its banks causing flooding in the area.

Plate 3: Abelekpien River in Sandema

Source: Field survey, 2008

Plate 4 shows the Basiik River located in Dogning. The economic value of the river in the dry season was virtually reduced to the supply of sand for constructional works because water in the river dries up by the end of February. The river could conserve water all year round and so fishing in the river was a major economic activity for the community and other communities in the dry season. The river was also the major source of water for animals in the dry season for the five communities in its catchment area. However with sustained human activities (farming, bush fires for hunting) the story is different now as siltation has become common.

Plate 4: Basiik River at Dogning

Source: Field survey, 2008

The study also examined some of the water sources in the communities and their capacity to harvest and retain water throughout the year. In this regard, 80 percent of the respondents indicated that, there were water sources that had the

capacity to harvest rain water but 20 percent responded that such water sources were non-existant in their communities. However, as to whether the existing water sources were capable of holding water all year round, there was almost a split view among the respondents who attested that there were water sources in their communities capable of harvesting rain water. In the opinion of 51 percent of them, the water sources could retain water throughout the year, but 49 percent disagreed, stating that the water sources dried up in the dry season due to pressure on their usage. Also, most of the water bodies were filled with silt and there were no management systems in place to maintain these water sources. Communities with all year round water bodies were Weisi, Wiaga, and Sandema (Table 3).

Table 3: State of freshwater sources

Name/Type	Location	Situation in the dry season
Yisobsa Dam	Wiaga	Water all year round
Singysa Dam	Wiaga	Water all year round
Chiok Dam	Wiaga	Water level decreases in March
Bilinsa Dugout	Sandema	It is chocked with silt
Balansa Dam	Sandema	Water all year round
Kori Dugout	Sandema	Dries up between March and April
Kunkwak	Gbedema	Water all year round
Dabomsa	Gbedema	Water level decreases, needs desilting
Balerinsa Dugout	Gbedema	Dries up in march

Table 3 continued

Luisa Dam	Kanjarga	Water all year round
Sinsangsa Dugout	Fumbisi	Dries up in April
Chansa Dam	Kadema	Dries up in March
Azug-yeri Dam	Chuchulga	Water all year round, needs desilting
Chongdem Dugout	Chuchulga	Dries up in March
AbelikpeinRiver	Sandema	Dries up in March
SissiliRiver	Wiase	Water all year round
AsibalikRiver	Kadema	Reduces in the dry season
BasiikRiver	Dobning	Dries up between February and March

Source: District Assembly, 2009

The respondents were interviewed on their observations of the performance of water bodies for the past 20 years. The same was done to ascertain their views on the vegetative cover since it has effects on water sources. The state of freshwater in the Builsa district showed continuous deterioration as most of the water sources were silted and dried up immediately the rainy season was over. In line with this, 62.1 percent of the respondents stated that water bodies in their localities dried-up during the dry season while 20.9 percent emphasized that most of the water sources in their communities were almost silted up and took in less water even in the rainy season. However, 14.2 percent of the respondents claimed that water bodies in their communities were still in good condition and conserved adequate water throughout the year. Nearly 48 percent of the respondents indicated that five years ago, water sources within the period of

five years back were almost chocked with silt just like in recent times and 22.4 percent of the respondents explained that the water bodies quickly dried up when the rains stopped. However, 24.2 percent claimed the sources were still good and conserved water but about six percent of the respondents did not recognised any difference between the current situation and five years ago (Table 3).

According to the responses obtained regarding water sources ten years ago, 60.6 percent of them indicated that their water bodies were in good state and harvested enough water during the rainy season. Furthermore, 22.1 percent of the respondents indicated that the few water sources that dried up in the dry season did so when the wet season was about starting and that prevented long periods of water crisis in the area. It was also stated by 17.3 percent of the respondents that the problem of siltation at the time was minimal. In further assessment of the situation of water sources in the study area twenty years ago, 90 percent of the respondents explained that twenty years ago water bodies were deep, harvested enough water and held water all year round while five percent of the respondents explained that only a few water bodies reduced in volume before the commencement of the rainy season. Again, about five percent of the respondents indicated that they were young at the time and could not make a fair assessment of the situation of the vegetation of the area at the time (Table 4).

Table 4: Opinions on the state of water sources over a period of twenty years

State of water	Observations	Frequency	Percentage
Present	Dry up immediately rains stop	208	63.0
	Almost silted up	72	21.8
	Holds adequate water	50	15.2
Total		330	100.0
Five years ago	Almost chocked with silt	157	47.6
	Still good (retains water)	80	24.2
	Dries up when rains stop	74	22.4
	Seen no difference	19	5.8
Total		330	100.0
Ten years ago	Good state, harvest enough water	200	60.6
	Dries up when rainy is about starting	73	22.1
	Silting was minimal	57	17.3
Total		330	100.0
Twenty years ago	Holds water all year round	297	90.0
	Few dry up before the rains set in	17	5.2
	Cannot assess (younger at the time)	16	4.8
Total		330	100.0

Source: Field survey, 2008

Vegetative cover

Trees are important to human life as the saying goes ‘when the last tree dies, the last man dies’. Trees also provide protective cover to water bodies and as such help sustain the life span of these water bodies. In assessing the state of freshwater sources, it is relevant to link it to the vegetative cover. Evaluating the use of firewood, 97.8 percent of the respondents derived their firewood directly from the forest and two percent bought firewood for their domestic use, which also came from the forest. The over dependence on fuel wood from the wild would surely affect the state of the vegetation in the area in the long run. It is against this background that assessment of the vegetation cover was deemed important.

The present vegetative cover was described by 64.8 percent of the respondents as depleted leaving dispersed cover, which results in dry conditions especially in the dry season (Table 5). Also 31.3 percent of the respondents stated that the area was becoming a desert as it was characterised by open spaces and few big trees due to the cutting down of trees for firewood and constructional activities. If the situation is not checked, it would create unpleasant environmental conditions in the very near future that could affect human life. However, about four percent of respondents observed that the vegetation was good and had thick cover in their communities.

In explaining the situation of the vegetative cover over the last five years, 29 percent of the respondents observed that the depletion of vegetation was gradual but 60.3 percent of the respondents had different observation indicating

that the depletion of the vegetative cover over the last five years was rather rapid. About 11 percent of them claimed they had not observed any significant change in the vegetation for the past five years.

Table 5: Opinions on the state of vegetative cover over a period of twenty years

Period	Observation	Frequency	Percentage
Present	Characterised with dispersed trees	214	64.9
	Signs of desertification, few big trees	103	31.2
	Vegetation is thick	13	3.9
Total		330	100.0
Five years ago	Depleting fast	199	60.3
	Depleting was minimal	96	29.1
	No change	35	10.6
Total		330	100.0
Ten years a go	Good and thick	187	56.7
	Gradual depletion	110	33.3
	No change	33	10.0
Total		330	100.0
Twenty years a go	Thick, tall trees and different species	316	95.8
	Houses different kinds of bush animals	11	3.3
	Too young at the time to make assessment	3	0.9
Total		330	100.0

Source: Field survey, 2008

Regarding the state of the vegetation cover ten years ago, 56.7 percent of the respondents described it as good at the time with thick cover. In contrast, 33.3 percent of the respondents observed a gradual depletion of the vegetative cover at the time while 10 percent of the respondents believed there had been no change in vegetative cover for the past ten years. The situation of the vegetative cover twenty years ago was observed by 95.8 percent of the respondents to be good as it was characterised with very thick cover formed by tall trees and different plant species. Another observation made by three percent of the respondents was that due to the thick nature of the vegetative cover, it housed different kinds of animals. However one percent of the respondents did not observe any change in the vegetation (Table 5).

In summary, ten years ago the vegetative cover was good and quite thick. However, respondents observed a gradual depletion till date, resulting in the present degradable state of vegetation in the district. This is unlike twenty years ago when the vegetative cover was very thick, characterised by big and tall trees; wide variety of plant species and housed different kinds of animals. This current state of depletion, according to the respondents had resulted from the indiscriminate felling of threes especially for fuel and to make way for farming activities and settlements. The situation shows a direct linkage to the tragedy of the commons because everyone is after the benefit to be enjoyed and not the harm being done to the environment, the issue of self satisfaction over shadows the common interest in this situation (Aristotle 384 B.C.-322 B.C.). However with the adoption of the conceptual frame work (figure 2) it beholds on all stakeholders

to be part of the participatory approach which is the second principle of IWRM (WMO, 1992), to ensure that management structures are put in place to help sustain the water bodies with the vegetative cover for the benefit of all.

Freshwater scarcity

Having established the state of freshwater in the Builsa District, it was necessary to examine the factors accounting for freshwater scarcity in the District. The respondents categorized according to religious beliefs (Christianity, Islam and Traditional worship) and occupation identified various factors that they believed were responsible for the scarcity of freshwater in the study area (Table 6).

Table 6: Respondent views on factors responsible for freshwater scarcity

Religion	Factors	Occupation			Total
		Primary	Secondary	Tertiary	
Christian	Erratic rainfall	41	8	2	51
	Poor agricultural practices	16	2	0	18
	Rapid population growth	9	5	1	15
	Deforestation	9	0	1	10
	Total	75	15	4	94
Muslim	Erratic rainfall	3	0	3	6
	Poor agricultural practices	12	0	0	12
	Rapid population growth	2	0	0	2
	Deforestation	1	0	0	1
	Total	18	0	3	21

Table 6 continued

		144	5	2	151
Traditionalist	Erratic rainfall				
	Poor agricultural practices	32	1	0	33
	Rapid population growth	10	0	0	10
	Deforestation	19	2	0	21
	Total	205	8	2	215
Total	Erratic rainfall	188	13	7	208
	Poor agricultural practices	60	3	0	63
	Rapid population growth	21	5	1	27
	Deforestation	29	2	1	32
	Total	298	23	9	330

Source: Field survey, 2008

Both Christians (51 out of 94) and Traditionalist (151 out of 215), who were engaged in the primary sector economic activities have identified erratic rainfall as the main factor that accounted for the freshwater scarcity in the Builsa District. However, the minority group (Muslims) of the sample, identified poor agricultural practices as the major factor responsible for the freshwater scarcity in the study area but both Christians and Traditionalist rated poor agricultural practices as the second factor. Other factors such as deforestation and rapid population growth were also identified by all the three groups. All these are human activities except erratic rainfall which is as a result of the negative human activities on the environment. As pointed out by Meissner (2002) that human impacts on freshwater resources in Africa are mainly as a result of population growth which is incompatible with economic growth, as fast growing

communities disposes human waste indiscriminately and the inappropriate use of fertilizer in agriculture.

Though deforestation was not considered a major factor to freshwater scarcity it was identified to be a contributing factor to the erratic rainfall by 28.0 percent of the respondents. They indicated that the problem of deforestation could be traced from bad farming methods that required cutting down trees, clearing of watersheds to make land useful for crop cultivation. This eventually led to desertification as presented in the analytical framework, and subsequently affected the water bodies, because of reduction in cloud formation. The cycle continues in that manner because when rainfall is affected water bodies' cannot get enough water indicated by Chiras (2001) that people living in areas that receive small amounts of precipitation such as deserts, often suffer severe water shortages.

Varied effects emanating from water scarcity were given and according to the respondents, the insufficient water from freshwater sources had always resulted in most of them drying up just after the rainy season. Regarding the contribution of rapid population growth to the problem of freshwater, 25.2 percent of the respondents explained that it brought pressure on existing water resources resulting in freshwater scarcity. This explains the effect in situations where demand outweigh supply as Chiras (2001) pointed out that stream and ground water may be sufficient for a small town, but when that town burgeons and becomes a city, water shortage may arise. Again, respondents indicated that population increases, generated more pressure on agricultural land needed for

farming, which led to farming activities being carried out on water ways and thus increasing siltation of water sources. Since the common property (the environment) is exploited by individuals for their personal interest, the larger society suffers from the consequences of the actions of the few illustrating the tragedy of the commons. Owing to the fact that rapid population growth is the root cause of almost all the factors raised, the analytical framework could also be adopted to illustrate the problem and all it possible linkages (Figure 1).

Other factors identified by the respondents as being responsible for freshwater scarcity but not captured in Table 6 included drought and pollution of water sources. Drought is a prolong period of dryness without rain, it has hit the country several times especially in the 1980's which resulted in water scarcity. However, water agencies and people in affected communities had not adopting anti-drought measures to reduce the impact and forestall future occurrences (Nsiah-Gyabaah, 2001). As to whether the Builsa District is drought prone, 85.8 percent of the respondents responded in the affirmative. This requires the district taking appropriate measures to break the vicious circle of poverty, resulting from environmental degradation, which has the potential of "kick starting" drought. It is for the purpose of averting or minimizing the occurrence of drought that it has been suggested that poor countries should be encouraged with the assistance of rich nations to invest in mitigation measures to reduce the consequences of floods and droughts (Pontifical Council for justice and Peace, 2006).

Figure 4 presents the responses on causes of drought in the district. While 34 percent of the respondents indicated that indiscriminate cutting of trees was the

remote cause of drought in the area, 31 percent attributed the problem to natural causes such as inadequate rainfall and the intense heat. Yet 10 percent ascribed the problem to non-adherence to cultural practices and others saw bush burning and bad farming practices as the contributing factors to the drought problem in the district. From the survey, respondents made it clear that the causes enumerated to be responsible for drought in the area are due to poverty, which is capable of destroying the sustainability of livelihood.

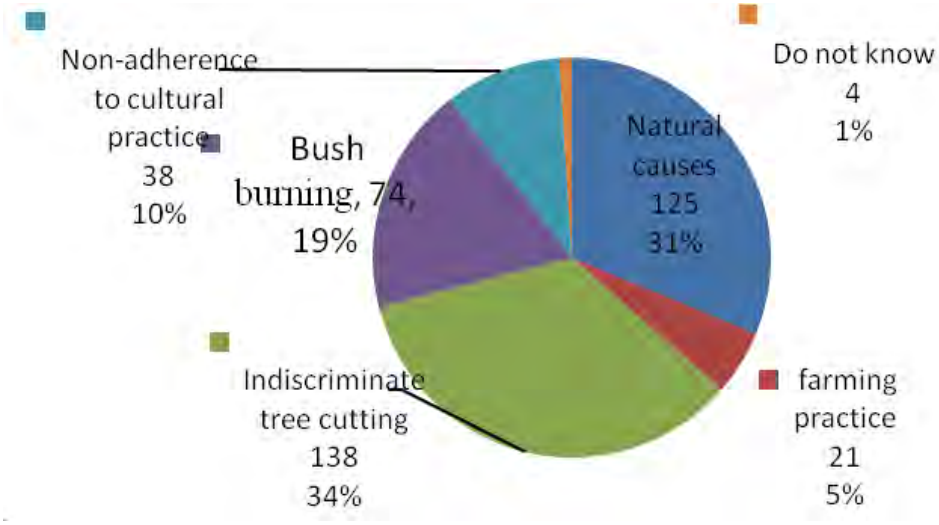


Figure 4: Causes of drought

Source: Field survey, 2008

Drought has some effects on human life either directly or indirectly, as presented in Table 7. Among these, 46.4 percent of the responses indicated that drought led to poverty because it was associated with low agricultural output. Closely related to this, was the view of 19.8 percent of the responses who attributed the effect of drought to a period of inadequacy of water in the area.

Also 16.2 percent of the responses stated that drought brought about sickness which had a direct effect on agricultural output and resulted in poverty. It was also observed that in the event of drought the issue of migration came up and about eight percent respondents claimed that there was emigration of able labour force to other parts of the country, specifically the southern part.

Table 7: Effects of drought

Effect	Frequency	Percent
Poverty due to low agricultural output	223	46.4
Inadequate water	95	19.8
Illness and possible death	78	16.2
Emigration of able labour force	40	8.3
High prices	25	5.1
Increase in crime	20	4.2
Total	481*	100.0

Note: The responses are more than the sample size due to multiple responses

Source: Field survey, 2008

Regarding water pollution in the area which the respondents identified as one of the factors responsible for freshwater scarcity, 39.7 percent (131) of the respondents said there were no polluted water bodies in the area. The 60.3 percent (199) respondents who were of the view that polluted water bodies existed in the area stated some causes of the pollution, which are presented in Table 8. The major causes indicated by 57.3 percent of them were that of human and animal

waste. Bathing in water bodies and the use of chemicals in crop farming and fishing activities were other sources of water pollution in the district noted by 21.1 percent and 16.1 percent responses respectively (Table 8).

Table 8: Source of water pollution

Source	Frequency	Percent
Human and animal waste	115	57.8
Bathing in water bodies	42	21.1
Chemicals used in farming and fishing	32	16.1
Siltation due to farming activities closer to water bodies	10	5.0
Total	199	100.0

Source: Field survey, 2008

Effects of freshwater scarcity on socio-economic activities

As the saying goes, “water is life” and in every human life water plays a vital role as it is the basis of existence. Water has a direct relation with the socio-economic activities in every society. In this regard, it was important to ascertain the effects of freshwater scarcity on the socio-economic activities of the people in the study area, which were mainly crop and animal production which worldwide takes approximately 70 percent of its freshwater (Brown, 1991). Essentially, it was revealed that freshwater scarcity was observed during the dry season. This necessitated an assessment of the usage of freshwater in the dry season to

ascertain the level to which freshwater scarcity affected socio-economic activities. Worrying, though not surprising, majority (78.2%) of the respondents indicated that water for drinking and domestic use was seriously affected in the dry season because water was required daily and frequently. However, it has been analysed and confirmed that the survival of humanity and all species on earth depends to a great degree on the fate of water and as such water issues should be treated with serious attention because water crisis are more serious than food or population crisis, since food production or population issues are irrelevant without water (Pontifical Council for Justice and Peace, 2006 as stated in the Holy See 2003 & Kumar De & Kumar De, 2005).

Regarding the effects of water scarcity on the construction of houses, the study revealed varied views. Among these views were those of 32.1 percent respondents claiming that water scarcity affected construction, especially when such activity was on a larger scale but 20.6 percent respondents had a contrary view. According to them constructional work was not affected while 16.7 percent of the responses showed that constructional work was not affected at all by water scarcity in their communities. These two categories (26.6% and 16.7% respondents) claimed the water sources in their communities held water all year round and therefore served all purposes including the construction of houses (Table 9). They further explained that building of houses was mostly done immediately after the harvesting of crops, to avoid extending into the rainy season, and within this period most water bodies contained enough water.

Table 9: Effects of water scarcity on domestic activities and housing

Activity	Level of effect	Frequency	Percent
Drinking and domestic work	Seriously affected	258	78.2
	Affected	23	7.0
	Moderately affected	10	3.0
	Not affected	25	7.6
	Not affected at all	14	4.2
Total		330	100.0
Construction of housing	Seriously affected	35	10.6
	Affected	106	32.1
	Moderately affected	66	20.0
	Not affected	68	20.6
	Not affected at all	55	16.7
Total		330	100.0

Source: Field survey, 2008

Though 32.7 percent of the respondents said crop farming was affected during the dry season, 26.7 percent of the respondents indicated that crop farming was rather affected moderately because crop farming was done in the rainy season and could only be seriously affected when the dry season set in earlier than expected shortening the rainy season (Table 9).

Regarding the effects on animal rearing as an economic activity in the area, 37 percent of the respondents observed that it was moderately affected since the activity was not undertaken on large scale and as a result they were able to

manage with the few water sources available until the rainy season set in. On the other hand, 28.8 percent of the respondents indicated that animal rearing was affected especially in years that the rainfall was poor and animals died due to water shortages. Contrarily, 24.2 percent of the respondents indicated that in their communities, animal rearing was not affected by water shortage because they had water sources that held water all year round, for their communities and other nearby communities. Examples of these communities are Sandem-Balansa, Wiag-Yesobsa, Gbedem-Kunkwak, Kanjarg-Luisa among others.

Table 10: Effects of water on some livelihood activities

Activity	Level of effect	Frequency	Percentage
	Seriously affected	18	5.5
	Affected	108	32.7
Crop farming	Moderately affected	88	26.7
	Not affected	56	17.0
	Not affected at all	60	18.2
Total		330	100.0
	Seriously affected	19	5.8
	Affected	95	28.8
Animal farming	Moderately affected	122	37.0
	Not affected	80	24.2
	Not affected at all	14	4.2

Table 10 continued

Total		330	100.0
	Seriously affected	4	1.2
	Affected	8	2.4
Poultry rearing	Moderately affected	44	13.3
	Not affected	89	27.0
	Not affected at all	185	56.1
Total		330	100.0

Source: Field survey, 2008

The survey revealed that poultry as a specific animal rearing in the district was not affected at all by water scarcity. This was indicated by 56.1 percent of the respondents with the explanation that, poultry rearing was at a very subsistence level in the area and required very little amount of water such that, water scarcity would not really have any significant effect on it. However, 13.3 percent of the respondents held the view that water scarcity affected poultry activities moderately (Table 10). They explained that as long as there was water scarcity in the community, all living things would be affected but the impact would be different.

Effects of water scarcity on community members

Regarding the effect of water scarcity on community members, 75 percent of the respondents indicated that water scarcity affected the happiness and comfort of community members. They gave varied explanations as presented in

Table 11 but 25 percent of them did not assign reasons or explanations on how water scarcity impacted on the general well-being of their community members.

According to 36.7 percent of the respondents, when there was scarcity of water, people were likely to drink dirty or contaminated water, the consequences of which may be difficult to manage. Further observation was made by 27.3 percent of the respondents who had the view that people may become distressed as a result of insufficient usage of water. Also, 17.2 percent of the respondents stated that people may be affected psychologically due to their inability to keep their bodies clean and 18.8 percent indicated that water shortage brought about stress as women and children spent a lot of time and energy looking for water (Table 11).

Table 11: Effect of water scarcity on community members

Effects	Frequency	Percent
Drinking of dirty water	121	36.7
Discomfort due to insufficient intake of water	90	27.3
Psychological sickness due to unclean body	57	17.2
Stress as a result of looking for water	62	18.8
Total	330	100.0

Source: Field survey, 2008

As to whether the effect of water scarcity on community members had anything to do with their economic output, 82.4 percent of the respondents answered in the affirmative while 17.6 percent of them said it did not affect their

economic output. Those who affirmed this gave two reasons. They explained that water scarcity led to low agricultural activities and resulted in low farm output. Also 20.3 percent of the responses further explained that water scarcity puts undue pressure and stress on people and that reduced their productivity level, led to low economic output and affected their standard of living negatively.

In assessing whether the people in the area had encountered any water borne and water related diseases, respondents mentioned some of the diseases found in the area (Figure 5). Based on the responses, cholera seems to be the

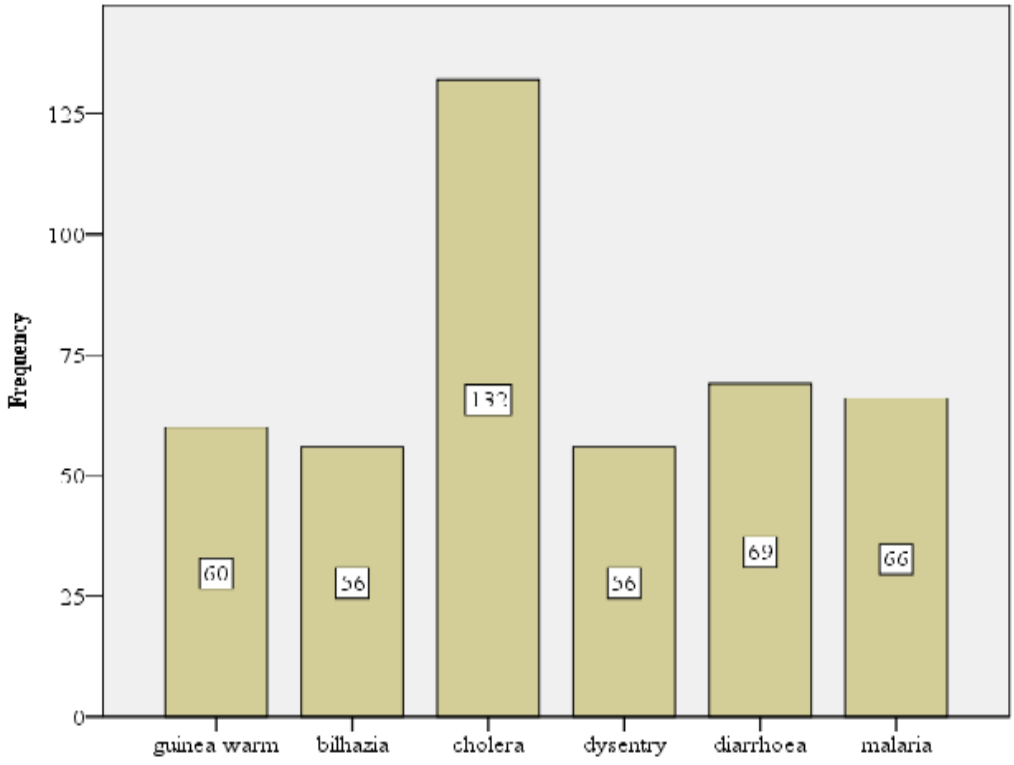


Figure 5: Some water borne or related diseases identified by respondents

Source: Field survey, 2008

the concern of most of the people in the area as it attracted the highest responses of 132. Research has shown that, the inadequacy of improved domestic water supply leads to diseases such as water borne diseases from drinking contaminated water and water washed diseases which occur when there is insufficient water for washing and maintaining personal hygiene (Yamamura et al, 2002; United Nation Economic Commission Africa [UNECA], 2006). Although responses regarding the other diseases were not as high as cholera, they also needed some attention to avoid their spread.

Effects of water scarcity on time

Time is a non-replaceable resource, and must be properly planned and utilised to maximise its value. In relation to the study area where the main economic activity was labour intensive agriculture which required substantial amount of time, 59.3 percent of the respondents mentioned that people in their communities spent more time drawing water as they travelled longer distances to fetch water especially in the dry season to supply household water needs (CESCR, 2002). However, 40.7 percent of the respondents claimed that less time was spent in drawing water in their communities as a result their economic activities were not affected because productive time was not used to draw water.

Effects of water scarcity on the poverty situation in the study area

A survey in 2005/2006 indicated that extreme poverty levels in the Upper East region had increased to 67 percent, being only lower than the Upper West

Region, which stood at 88 percent (Ghana Statistical Service, 2007). The survey sought to find the views of the respondents (Figure 6) on the poverty situation in the area and how it could be linked to water issues. In this regard 46.7 percent (151) of the respondents claimed that the poverty level in the area was very high. Similarly, The Core Welfare Indicators Questionnaire also estimated that 56.3 percent of the people in the Builsa District were poor and 16.2 percent were very poor (Ghana Statistical Service, 2005). Respondents explained that most people in the district were not able to take three meals a day for almost half a year known as 'lean' season. It was also explained that the poverty situation in the area had affected child education because parents were not able to meet the cost of their wards education, especially at the secondary and tertiary levels. They claimed that the factor responsible for the situation was the low yields they got from their farming activities, which they attributed to poor rainfall in recent times. On the contrary, 50 percent (162) of the respondents rather indicated that though poverty in the Builsa District was high, it could not be termed as being very high. Also issues concerning water are a right to life issues, it is the poor who are rather deprived of the right to water, health and food but the primary objective of all efforts must be the well being of the poorest who suffer most from any scarcity or misuse of water resources (Pope John Paul II 2002). Differently, three percent of the respondents indicated that poverty in the area was rather low because food was available and access to healthcare had been made accessible through the national health insurance scheme (NHIS).

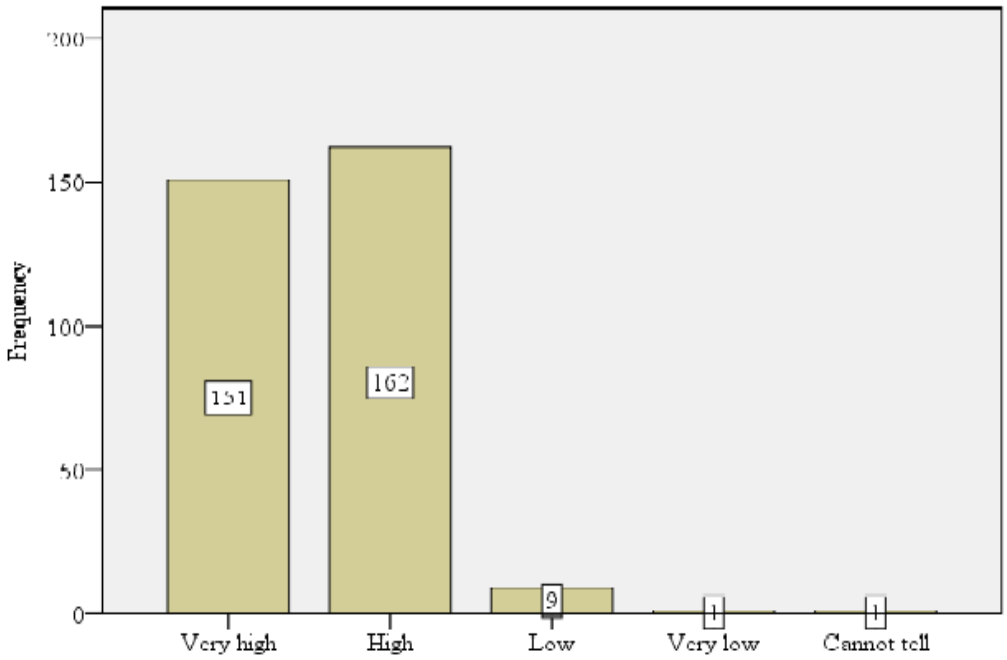


Figure 6: Respondents views on poverty level in the Builsa District

Source: Field survey, 2008

From the study, respondents were interviewed on how availability of freshwater in the area contributed to poverty reduction. The suggestions made by respondents were presented in Table 12. Most (63.8%) of the respondents indicated that, making water available by constructing dams for dry season farming would significantly reduce poverty in the area. Likewise 20.3 percent said the availability of water would encourage the rearing of animals on a large scale, and eventually reduce poverty levels in the district. Also 12.8 percent of the respondents said that the availability of water could aid businesses such as pito brewing, shea butter and dawadawa processing and weaving of baskets. This has been noted by DEFRA (2004) that the most important use of water by man is in the area of food processing which encompasses a wide range of activities,

including meat and fish processing, dairy, canned food and beverages, both alcoholic and non-alcoholic. All these activities require a lot of water except basketry but the actors derive economic benefits from these activities as such water sources must be managed properly as presented in the conceptual framework (Figure 2). The implication is that the absence or shortage of water that arises from poor water management may impede the execution of these activities.

Table 12: Ways of reducing poverty with the availability of water

Use of water to reducing poverty	Frequency	Percent
Dams for dry season farming	229	63.8
Rearing of animals	73	20.3
Business processes	46	12.8
Building of houses	11	3.1
Total	359*	100.0

*The responses are more than the sample size due to multiple responses

Source: Field survey, 2008

Conflict and migration arising from water scarcity

It has also been noted that apart from the disruption of business activities, water scarcity has the potential of generating conflict over the control of water resources (Pontifical Academy of sciences, 2004). Water is seen as a basic need, and its shortage may create conflict, if caution is not taken. In assessing if any

conflict had occurred in any of the communities in the district as a result of water scarcity, 68.6 percent said their communities had not experienced any water related conflict. However, 31.4 percent of the respondents indicated that their communities had conflicts that were related to water shortages. According to 45.5 percent of the respondents from communities that had water shortage related conflicts, the conflict affected relationship of community members while 22.5 percent responses indicated that their communities and other communities had strained relationship as a result of water related conflict, which had affected their long time coexistence. Similarly, 17.6 percent respondents pointed out that farming activities during these conflict periods were affected negatively and likewise trading activities were not spared as was claimed of 14.4 percent of the respondents.

Apart from conflict over the control of water resources, another challenge that arose from water scarcity is migration as 96.5 percent of the total respondents claimed that most people emigrated from the district during the dry season. This is in line with the statement that the cause of migration of people from the northern part of the country to southern Ghana is due to the dryness of the area. The respondents gave varied reasons why the people migrate (Table 13). About 52 percent of the respondents said that most people migrated to other places to seek jobs. Similarly, 22.3 percent of the respondents indicated that during the dry season farming activities were halted and people migrated to other places that they could be economically engaged. Also, 13.6 percent of the responses

attributed the reasons for migration to idleness of people during the dry season, which made them desire to visit relations.

Table 13: Causes of migration out of the Builsa District

Reason	Frequency	Percent
To seek for job	209	51.9
No water for dry season farming	90	22.3
Visit relations and enjoy city life	55	13.6
For higher income	41	10.2
For better schools	8	2.0
Total	403*	100.0

*The responses are more than the sample size due to multiple responses

Source: Field survey, 2008

The majority (87.4%) of the respondents attributed the poverty situation in the area as the remote cause of the youth migrating from the district to the cities. They (58.8%) explained some of the effects of youth migration on their communities (Table 14) to include the deepened level of poverty because it was the economically active segment of the population that migrated to the cities. The effect of this was that it led to low economic output and thereby entrenched poverty in the area. In the view of 24.9 percent of the respondents, farmlands were abandoned when community members migrated and 14.9 percent respondents stated that the problem was compounded because there was no dry season farming opportunities in the district (Table 14). However 12.6 percent of

the respondents said, migration was not responsible for the poverty situation in the area. About 41 percent of the respondents also said they migrated because jobs in the cities were more lucrative. Meanwhile, 31.7 percent claimed the migrants work and send remittances to their relations at home that made up their economic contribution.

Table 14: Consequences of youth migration in the Builsa District

Reason	Frequency	Percent
Economically active youth migrate leaving the aged	170	58.8
Farm lands are abandoned	72	24.9
No dry season farming	43	14.9
Do not know	4	1.4
Total	289	100.0

Source: Field survey, 2008

Conservation and management of freshwater resources in the Builsa District

To overcome the consequences of migration in the Builsa district there is the need to conserve and manage freshwater resources in the district efficiently.

As communities grow in size, the implications are that demand for basic needs should also be on the increase and one of such basic needs is water. In recent times, water is becoming a scarce commodity and requires prudent measures regarding its conservation and management.

Although Ghana should not experience water shortages because the country receives sufficient rainfall of between 1200-1500mm in the forest zone and more than 800mm in the northern zone (Nsiah-Gyabaah, 2001), for decades many communities continue to suffer from water crisis because of the unpreparedness of water agencies and community members to find pragmatic measures such as desisting from farming along water courses, desilting and protecting water sources to deal with the problem.

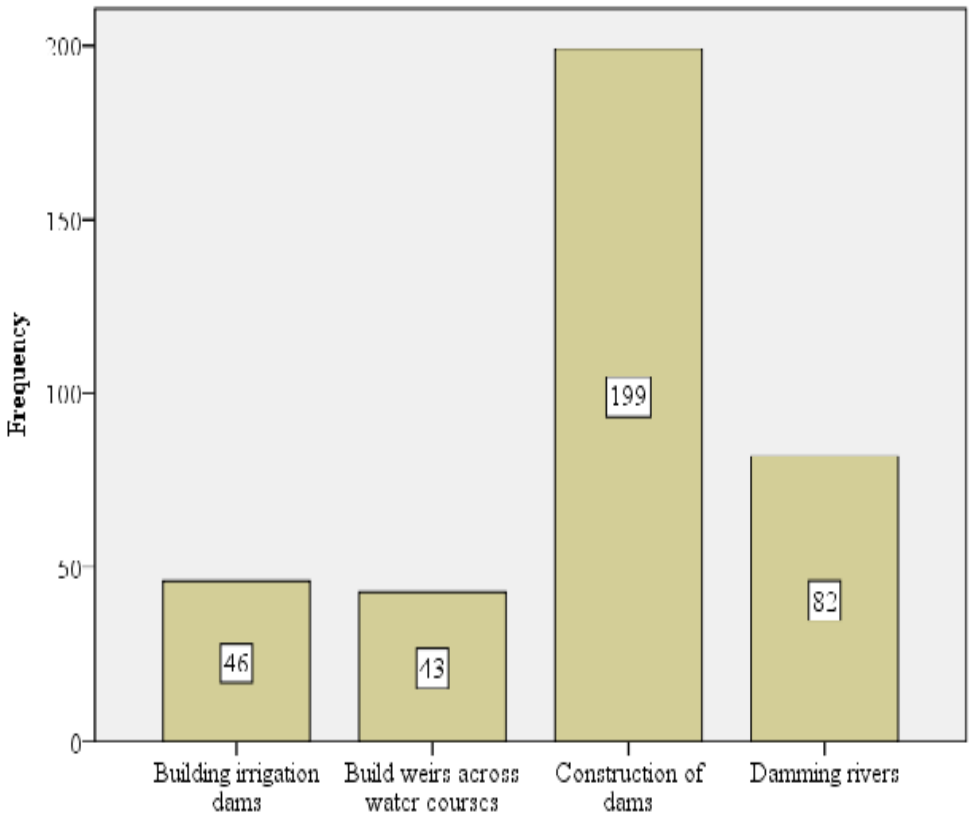


Figure 7: Methods of conserving freshwater in the Builsa District

Source: Field survey, 2008

Putting across suggestions regarding the conservation of water in the Builsa District, 53.8 percent (199) of the respondents suggested the construction of dams while 22.2 percent (82) of them thought, damming of rivers to conserve water (Chiras, 2001) for the people to derive both the economic and social benefits as indicated in the conceptual frame work. This is a viable option because the area receives sufficient rainfall of more than 800mm (Nsiah-Gyabaah, 2001) annually.

Presenting the harvesting of runoff water as a method of conserving water, respondents suggested two methods. From the total sample respondents, 52.1 percent mentioned the construction of earth bunds across the flow of water while 46.7 percent of them opted for the use of rock bunds across the flow of water. These are practices in Yatenga in Burkina Faso (Elliott, 1994), and according to the respondents, when these bunds are well done, runoff water in the rainy season could be collected for socioeconomic activities in the dry season. However, one percent did not foresee any possibility of conserving water in their communities by harvesting runoff water.

Management practices

To conserve water and equitably distribute it, would require some management practices to be in place, hence the research solicited views from respondents concerning the management practices they had in place to ensure sustenance of their water sources. According to 55.6 percent of the respondents, their community members did carry out maintenance on water sources by de-

silting those water sources. Also, 25.6 percent of the respondents indicated that discussions were held in their communities on water regulations to ensure efficient use of the resource. While the rest claimed that planting of trees to protect water sources was adopted in their communities, it was not successful due to low patronage by communities' members.

Accounting for the reasons why water sources should be protected, it was revealed that 36.4 percent of the respondents said it was a necessity in life and 35 percent of them stated that protecting water sources by de-silting them would make water available all year round. Likewise, 28.6 percent of the respondents indicated that, reducing pollutant around the surroundings of water sources would reduce pollution and siltation.

To ascertain whether there were some traditional practices that promoted the conservation and efficient management of water sources, 22.2 percent of the respondents mentioned that the observance of some traditional practices that prohibit the killing of some mammals in water sources like crocodiles and the preservation of some water bodies as deities and taboos were practices that protected water sources. Also keeping clusters of trees around water sources as shrines and sacred places protected such water sources. According to 41.3 percent of the respondents, one traditional practice that could promote the conservation of water was periodic de-silting of water sources, which used to be an annual activity in the communities to protect water sources from erosion in times of floods. Also 36.5 percent of the respondents indicated that to conserve water for future use, some bad practices such as burning of bush, farming on water ways and using

chemicals for fishing must be stopped. Considering the IWRM's participatory approach and the management activities the people are already engaged in, it might be necessary to put stakeholders in organised groups so that they form a strong force to stop some of these bad practices they had identified and to carry on with their periodic de-silting exercise.

Once respondents have identified the management practices in place and why water resources must be protected, it is important to look at all those who are involved in the management of the freshwater resources in the Builsa district.

Level of stakeholder's participation in water management in the Builsa District

To sustain freshwater resource requires a level of management involving all stakeholders with a formal management structure. However, in the Builsa district there was no formal management structure. Traditionally, the authority over the management of freshwater sources in most communities in the district resided in the Chiefs and Elders, Landowners (Teng-nyono) and Sectional chiefs (Kanbongnab) but in recent times Assemblymen were significantly involved. Though women and children were stakeholders, they had very little to contribute to the management of water facilities in their communities because tradition did not recognise women and children as people with authority and hence be allowed to make management decisions. However they were sometimes involved in physical activities such as maintenance and repair.

The research revealed that the WATSAN and DWST activities were not known to many of the communities and where they were functional, their activities were limited to the management of boreholes only.

In order to assess the level of participation in the management of water, respondent were asked to indicate the level of participation of children, women and men. In assessing how each of these were involved in making decision regarding the conservation and management of freshwater resources, 66.4 percent of the respondents indicated that men were deeply involved more than women.

However, the survey revealed that children who were mostly affected in times of water shortages were partially involved in making decisions relating to water issues as was attested to by 55.8 percent of the respondents, contrary to the statement that water is a subject in which everyone is a stakeholder including women and children (FAO, 1995). It is therefore necessary to empower those who are being sidelined especially women when it comes to issues concerning water, though it is more challenging when they are to manage and have control over natural resources (Meinzen-Dick & Zwarteveen, 1997).

Empowering women in water management

Women were majority in terms of population in the study, but were not seriously involved in managing water resource as indicated earlier on, though they were affected mostly when water was scarce. In trying to reverse this phenomenon, 96 percent (317) of the total respondents held the view that women should be empowered to efficiently participate in making water management

decisions. Of the 317 respondents who felt women should be empowered, 66.6 percent of them said women used water most, which was in line with the third principle of IWRM that acknowledged the central role women played in the provision, management and safeguarding of water (WMO, 1992). Hence women should be empowered to be fully involved in the management of water resource. Furthermore, 11.40 percent claimed that women were good decision makers and would transfer these skills into the management of water resources. In addition, six percent had the view that when women were empowered it would lead to proper management of water as a resource since they were the majority. Another six percent of the respondents indicated that women were the focus as far as water was concerned and as such should be empowered to fully participate in the decision making process towards its management. On the other hand, nine percent of the respondents said it was their (women) right to be part of the management process because they were key stakeholders in water issues (Table 15).

Table 15: Views on empowering women to participate in water management

Reasons for yes	Frequency	Percent
Women use water most	211	66.6
They are good in decision making	36	11.4
It is their right	27	8.5
For proper management of water	20	6.3
They are the focus in water issues	20	6.3
They are the majority	3	0.9
Total	317	100.0

Source: Field survey, 2008

However, four percent (13) of the total sample respondents who had the different view why women should not be empowered to participate in water management decision process explained that, women were not effective due to their inability to keep essential information as secrets, which could affect efficient water management processes. Though managing freshwater resource required the involvement of all stakeholders, some perceived that placing value on freshwater would lead to its effective and efficient management.

Perceptions of placing monetary value on freshwater

Pricing water as an economic resource to attain efficiency has been the subject of discussion in recent times (WMO, 1992). In line with this fact, the research obtained views from respondents on how placing value or pricing surface water would bring about efficient management. Also how water pricing would lead to conservation and ensure equitable use of water as well as efficient use of this vital commodity. Among the total sample respondents, 89.1 percent were in favour while 10.9 percent were not in favour of the view that water should be tagged with economic price. Majority (79.6%) of those in favour stated that this would lead to the efficient use of water just as WMO (1992) explains that the failure to recognise the economic value of water in the past has led to wasteful and environmentally damaging uses of the resource. Additionally, 11.9 percent respondents explained that it would encourage the conservation of water because of the payment people would make as they used the commodity (Table 16).

Table 16: Views on pricing water for efficient management

Reasons for yes	Frequency	Percent
For efficient use of water	234	79.6
Encourage water conservation	35	11.9
Undertake regular maintenance	14	4.8
Promote economic activities	6	2.0
For equity in water use	5	1.7
Total	294	100.0

Source: Field survey, 2008

However, 10.9 percent (36) of respondents had reasons why water should not be priced as an economic resource. Among them, 69.3 percent stated that 'water is life' and a basic need and as such people should not be denied having it, in the event that they could not pay an economic price for it. Besides, 13.9 percent of this category of respondents indicated that the poverty level in the district was high and tagging water with an economic price was simply denying majority of the people a life sustaining commodity.

Water pricing for conservation

Earlier on, some respondents associated water conservation with economic pricing of the resource. The respondents gave different reasons why managing water as an economic good would lead to its conservation as 44.2 percent of them indicated that consumers would place value on the commodity and would avoid wastage because of the cost associated with usage. Similarly, 21.5 percent of the

respondents explained that due to the cost implication of the commodity, communities would develop the attitude of conserving water in an attempt to reduce their expenses on the commodity.

Table 17: Reasons for managing and conserving water as an economic good

Reasons	Frequency	Percent
Value it and avoid waste	146	44.2
Adopt good conservation methods	71	21.5
Makes it available	69	20.9
Avoid bad agriculture practices	44	13.4
Total	330	100.0

Source: Field survey, 2008

Likewise, 20.9 percent of the respondents indicated that as people learn to conserve water, it would be available to all. As people tried to make sure that water is available, they would avoid some bad practices such as farming along water courses and using chemicals for fishing, which destroys and contaminate water sources, was the perception of 13.4 percent of the respondents.

Water pricing for equitable use

On the issue of equitable use of water, 61.8 percent of the respondents indicated in Table 18 that if water was given an economic price, people would be more efficient in the management and utilization of water, hence would lead to equity in distribution.

Table 18: Reasons that managing water as an economic good brings equity

Reasons	Frequency	Percent
Good management would lead to equal distribution	204	61.8
Reduce waste for fair dealing	97	29.4
High value for water may aid equal supply	24	7.3
Avoiding conflict over water issues	5	1.5
Total	330	100.0

Source: Field survey, 2008

The perception of 29.4 percent of the respondents was that tagging water with economic price would considerably reduce waste and enhance fairness in the use of water. Also about seven percent of the respondents explained that, managing water as an economic good would bring equity and people would give reverence to the commodity to ensure its safe existence for equal distribution.

Water pricing for efficient use

Mostly, people are efficient in the use of a resource when its usage has a cost implication. In this regard, it is believed that there is a connection between the usage of a commodity and its price, which might lead to efficiency as it may result in the effective use of the commodity. It was on this basis that 60.6 percent of the respondents stated that if water was tagged with an economic price, it would lead to its efficient use as people would reduce wastage. This would provide the foundation for equitable distribution of water as perceived by 18.5

percent of the respondents. This meant people would pay for what they really need. Likewise, 14.8 percent of the respondents also stated that water would be demand driven, leading to its efficient use (Table 19).

Though the people have expressed their perception on cost implication and usage of water, it is necessary to establish the fact again that allowing privatization especially on water bodies as a way of ensuring effective management would affect the 'commons'. What the community should explore is to identify the factors that threaten the existence of water bodies and aim at ensuring sustainable water bodies.

Table 19: Managing water as an economic good to bring about efficiency

Reasons	Frequency	Percent
Reduce wastage	200	60.6
Equitable distribution	61	18.5
Water will be demand driven	49	14.8
Lead to misuse by the rich	14	4.2
Attach high value to water	4	1.3
Proximity can affect usage	2	0.6
Total	330	100.0

Source: Field survey, 2008

From the conceptual frame work (Figure 2), it is observed that all efforts must be directed towards ensuring sustainable water bodies so that the fullest benefit is derived without jeopardising the benefits of the future generation.

Factors threatening water bodies and how to restore them

It is important to have a fair knowledge of the practice that threatens the existence of these freshwater resources in the study area. In this regard, respondents stated that most of the water bodies in their communities were almost dried up and needed to be restored. Regarding activities that threatened the existence of water bodies in the district, 62.1 percent of the respondents mentioned bad agricultural practices. Respondents identified two main practices in the district that represented the bad agricultural practices. These were bush burning and farming along water courses. Similarly, 23 percent of the respondents identified poor rain fall pattern (either low or excess) as a factor that threatened water sources. It was not only low amount of rainfall that was a problem but when it was also in excess. It could cause flooding in the area, destroyed dams and dugouts and fill others with filth, resulting in siltation. In the same vein, 14.9 percent of the respondents attributed the situation of water bodies in their communities to poor water resource management.

Table 20: Factors that threatens the existence of water bodies

Factors	Frequency	Percent
Bad agricultural practice	205	62.1
Poor rainfall pattern	75	23.0
Poor water resource management	49	14.9
Total	330	100.0

Source: Field survey, 2008

According to 77.2 percent of the respondents, the major task involved in restoring these water bodies was to de-silt the filth and mud that had accumulated in them over the years but indicated that some of the water sources required complete reconstruction. Besides, 10.2 percent of the respondents suggested that farming on water courses should be prohibited. Others (11.8%) suggested the provision of protective mechanisms to restore water bodies. These could be done by planting trees, strengthening the banks of water sources with the planting of special grasses as well as carrying out routine maintenance on them.

Bush burning which is a practice in the area is mostly done between the period of November and January each year and respondents assigned some reasons for this practice in the area. Among them were hunting expeditions which respondents indicated was the major cause of bushfires in the district. According to the respondents, hunters burn the bush in search of game or set fire to prepare their game and if such fires were not properly extinguished could always lead to wild fire in the district. Once again the issue of the tragedy of the commons is revealed, with clear indication that the interest of the individual is pursued to the neglect of whatever danger that might have on the environment.

The survey further revealed that, issues of security and safety contributed to bush burning in the district as shown by 27.1 percent of the respondents, with the explanation that bush burning was done to scare away dangerous reptiles and to make people felt safe when walking in the night. It was also explained that accidental bush burning occurred from activities such as charcoal burning, harvesting of honey and cigarette smoking but these were minimal because they

were activities undertaken on a smaller scale in the area. In the same way, bush fires resulting from farming activities seemed to be insignificant since farmlands preparation for cultivation in the district were done at the latter parts of April to the latter part of May when there is nothing to burn.

According to the respondents, bush burning destroyed the vegetation cover, exposed water bodies to the strong sun rays and winds, hence the resultant effect of rapid evaporation of water bodies.

Table 21: Reasons that accounted for bush burning in the communities

Reason	Frequency	Percent
For hunting expeditions	160	41.7
For safety and security	104	27.1
Accidental	57	14.7
For farming purposes	56	14.6
It is a norm in the dry season	6	1.6
Lack of education	1	0.3
Total	384	100.0

Note: The responses are more than the sample size due to multiple responses

Source: Field survey, 2008

To overcome the challenges associated with bush burning and farming along water courses, respondents suggested some measures, which are outlined in Table 22. The consideration of enacting laws and enforcing them to curb the menace of bushfires was the view of 45.5 percent of the respondents.

Furthermore, 41.8 percent of the respondents suggested that people in the area should be educated on the effects as well as the direct and indirect implications of bush burning. Regarding farming along water courses, the suggestions were the same as 55.7 percent advocated for laws and their enforcement, 44.3 percent of them suggested educating people about the consequences of farming along water courses. These suggestions have some relation with a statement by Pope John Paul II (2005), that there is an urgent need to regain a "culture of water", to educate society to develop a new attitude towards water since it has an inestimable and irreplaceable value.

Table 22: Measures to check the practices of bush burning

Measure	Frequency	Percent
Make laws and enforce them	150	45.5
Education on bushfire	138	41.8
Set up bushfire committees	35	10.6
Non response	7	2.1
Total	330	100.0

Source: Field survey, 2008

In an effort to find better ways of managing water resources efficiently, respondents made some recommendations to that effect. It was the view of 40.6 percent of the respondents that some committees should be set up in the communities to monitor and manage water resources using standard rules and regulation and such committees should be empowered legally to punish

recalcitrant community members. Apart from the legal backing to committees, 22.5 percent of the responses suggested that, to efficiently manage water sources well, maintenance in the form of de-silting and possible expansion of water sources should be paramount. However, 23.3 percent of the responses were concerned about farming along water courses and emphasised on educating community members about the negative effects of these activities on water bodies and their implications. These in a way would contribute to better practices that could improve the sustainability of water bodies and their ability to conserve enough water for a longer period. Furthermore, 13.6 percent suggested that planting trees as protective cover to water bodies would go a long way to shelter water resources to conserve more water.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This final chapter presents a summary of the findings of the study. It also presents the conclusions and recommendations. The general objective of the study was to examine the phenomenon of freshwater scarcity in the Builsa district and its socio-economic implications. The design chosen for the study was a non interventional type which used analytical and descriptive study. The main respondents were farmers, pito brewers, traditional authorities, opinion leaders and people from government institutions relevant for the study with a sample size of 330.

Summary

The main findings of the study were as follows:

The major sources of water in the district were wells, boreholes and dams while others minor sources include the springs, streams, rivers, pipes and dugouts. Majority of the people depended on well water for almost everything, because in the dry season most surface water dried up and groundwater became the alternative.

From the respondents, 20 years ago water bodies, could hold water till the next rainy season because silt was not a problem as it is today. Also the vegetation cover 20 years ago was good. It was very thick and characterised by different plant species but the opposite is what can be witnessed currently.

Most of the respondents concluded that both human and natural factors were causing freshwater scarcity, hence erratic rainfall and deforestation were the major factors that contributed to fresh water scarcity than the issues of rapid population growth. Also about 86 percent of the respondents said the area was susceptible to drought because of the indiscriminate cutting of trees, farming along water courses, poor rainfalls coupled with bush burning and strong sunrays. Some of the effects of drought that the respondents rated high included poverty due to low agricultural output, emanating from the emigration of the economically active labour force and inadequate water for economic activities in the community especially during the dry season.

Acute freshwater scarcity occurred in the dry season and this had effect on the quality and quantity of water required for domestic and all other usage. This situation had some socioeconomic implications thus depriving the people of both the economic and social benefits outlined in the conceptual framework (Figure 2). People also travelled long distances to fetch water and this affected productivity and in some cases they resorted to drinking contaminated water due to the scarcity of quality water. This made them sick, resulting in the reduction of agricultural output especially when sickness gets into the rainy season and the end result is increased poverty level as presented in the analytical framework (Figure 1).

There were very few dams in the district that harvested rain water for dry season farming activities and could not engage the people in an all year round faming activities to reduce poverty which was so endemic in the area. This had also resulted in the massive migration of the labour force during the long dry season as claimed by 97 percent of the respondents.

Most of the respondents identified water conservation in the rainy season as a way of reducing the scarcity of water in the area by suggesting the construction of dams, damming of rivers and clearing existing water bodies that were choked with silt as well as discouraging farming along water sources.

The traditional practices that promoted the conservation and efficient management of water sources, which was indicated by some of the respondents were the prohibition of the killing of water mammals like crocodiles in some water bodies and keeping cluster of trees around water sources as shrines.

In making decisions regarding the management and conservation of fresh water resources in the district, men were deeply involved than women. However children were partially involved in some communities. Also WATSAN committees and DWST were not involved in surface water management decision making process. Also, majority of the respondents said women should be empowered for them to participate in making water management decisions because they formed the majority when it came to water users and that they are good managers.

Putting economic value on water was an issue suggested by majority of the respondents. They recognised that it would lead to conservation of freshwater through the efficient and equitable use of the resource.

Two main practices in the area were identified to be impacting negatively on freshwater as a resource and these were bush burning and farming along water courses. For this reason, respondents have the view that to be able to manage the resource efficiently, a committee should be set up to monitor and play a leading role in the management of the resource. The committee should be empowered to punish those who break the rules and regulations, and for the committee work to be effective, community members should be educated on all practices that affected water sources negatively.

Conclusions

These were the conclusions drawn after having come out with the findings of the study. The first specific objective of the study was to identify the factors that were responsible for the scarcity of freshwater in the district. It could therefore be concluded that the factors responsible for freshwater scarcity included erratic rainfall, poor agricultural practices, rapid population growth, deforestation, drought and pollution. Two factors were pointed out as being the major factors responsible for freshwater scarcity and they were erratic rainfall and deforestation. However, if measures were put in place to check human activities that had grate implications for the environment such as deforestation, it would contribute in solving the issue of erratic rainfall as well.

An examination of the effects of scarcity of freshwater on socioeconomic lives of the people in the district was the second specific objective. The conclusion drawn was that the scarcity of water especially in the dry season affected the quality and quantity of water required for domestic work and for all other uses. As the people resorted to drinking water that was contaminated, it resulted in ill health that affected their productivity. Also with insufficient quantity of surface water, especially during a period of no rain, where the people's main economic activity was farming, implied productivity would be low and crop output would also be low. These effects accounted for the poverty that caused people to migrate in their difficult times.

The third specific objective was to ascertain how the existing water bodies in the district were being managed to ensure their availability for socio-economic development. Though there were efforts to manage water resources in the area, they faced difficulties of implementation because others felt that they were not part of the whole process, and in a situation where the involvement of stakeholders were not the same, certainly would lead to decisions that were not generally agreed upon. Managing water resources calls for conservation and maintaining existing ones. This seemed not to be the practice in the district for a long time and so have led to water scarcity in the area. This is evidenced from the fact that there were very few systems that could harvest rain water for dry season use. However, there is the possibility of rectifying the situation as responses indicated that it possible to conserve rain water through damming of rivers,

clearing silt of existing water bodies and discouraging farming along water sources.

Also some traditional practices as observed by the respondents could effectively contribute to proper management of water bodies. There was a perception that when water was tagged with an economic price people would learn to put water into good use thereby economising it for equitable distribution. There was the possibility of conserving water through the construction of systems that would harvest runoff water using earth or rock bunds across the flow of water and also clearing silt in existing water sources periodical.

Basically, there are two major practices that seemed to be affecting water bodies in the district and these were bush burning and farming along water sources. These practices cleared the vegetation and exposed water sources to the direct sunrays that could lead to evaporation, while the farming activities along water courses was the major cause of siltation.

Recommendations

Based on the conclusions arrived above, the following recommendations are targeted at the community members who were predominantly farmers, organised bodies such as WATSANs and DWST and the District Assembly.

The community members

It is recommended that community members:

- adopt good farming practices that are environmentally friendly.

- avoid indiscriminate felling of trees and rather cultivate the habit of tree planting to protect water bodies.
- adopt the means of dealing with current situation of bush burning in the area. Since bush burning could be accidental bush burning could be done at the period that the grass is partially dry so that they will not have a devastating effect. It has been stated that when the grass is burnt this way, it grows out again and animals feed on.
- do their best to avoid drinking water from sources that are unclean during the period of acute water shortage, since this act may result in poor health conditions and affect productivity. Ground water is of good quality for drinking, community members should do all that they can to sink wells and protect them from being contaminated.
- should ensure that all stakeholders (men, women, children) are equally represented and are involved at all stages and participate fully so that decisions arrived at, will be embraced by all.
- cultivate the habit of maintaining the existing water sources by removing silt accumulated in them periodically. This will keep water source ‘alive’ and allow them to hold more water and for a long period.
- use local means of conserving water by using rock bunds across water flow as well as damming their rivers. However, they need to seek for support in the form of technical expertise from the District Assembly or any recognised organisation such as Ministry of food and Agriculture

(MOFA). They (community members) must be ready to make some little financial commitment and to provide extensive labour.

Water and Sanitation Committees and District Water and Sanitation Team

These bodies that are mainly constituted to ensure that water is managed well and free from contamination:

- should ensure that they are involved in taking care and protecting surface water in the Builsa district by guiding communities to come up with workable decisions.
- WATSANs must ensure that community members are well educated on sanitation and the implication of drinking contaminated water.
- DWST should develop community training programmes related to the factors (bad farming practices, bush burning and deforestation) outlined as they indirectly contribute to water scarcity in the district.

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APPENDICES

APPENDIX I

DATA COLLECTION INSTRUMENT

Introduction

This questionnaire is designed to gather information from farmers, women, opinion leaders, traditional authorities, District Assembly environmental committee, District forest officer and District agricultural officer in the Builsa district in the Upper East Region on the research theme "**Freshwater scarcity in the Builsa District: Socioeconomic implication"**.

I am a student of the University of Cape Coast working on my thesis for a Master of Philosophy Degree in Development Studies. This questionnaire is to help me collect data to achieve my academic pursuit. All respondents are assured that their responses are for academic purposes, and that their identity would be protected at all times based on ethical principles of confidential and anonymity. Your cooperation is essential, since the success of the research depends on your truthful and sincere responses.

Consent of Respondent……Date…… Time of Interview……

Instructions:

Please tick in boxes [√] responses that are appropriate, also tick responses for close-ended questions without boxes and provide responses to open-ended questions.

Background information

1. Name of town…….

2. Name of community……...

3. House number [ ]

4. How long have you been living in this community?.....

5. Respondent Sex: Male [ ] Female [ ]

6. Educational Attainment: Basic [ ] Secondary [ ] Tertiary [ ]

7. Respondent Age: 25-30[ ] 31-34[ ] 35-40[ ] 41-44[ ] 45-50[ ] 51-54[ ] 55-60[ ] 60+ [ ]

8. Occupation: Primary [ ] Secondary [ ] others specify……

9. Family size: 1-4 [ ] 5-8 [ ] 9 and above [ ]

10. Religious status: Christian [ ] Moslem [ ] Traditionalist [ ] others specify

11Number of wives: 1[ ] 2 [ ] 3[ ] 4[ ] others specify ……

12. Status in community……..

Section A

A1i.Is water a basic need for human existence? Yes [ ] No [ ]

A1ii.If yes in A13i, why?.....

A1iii.If no in A13i, why?.....

A2. What are the major uses of water in this community/district?

(1) Drinking and domestic work [ ] (2) Industrial work[ ] (3) Pito brewing[ ]

Farming (crops, animals and poultry, fishing) [ ] Others specify. …….

A2i. Do you use domestic waste water for other purposes? Yes [ ] No [ ]

A3. If yes in A11, which of these purposes do you use domestic waste water for? (i) Pasturing animals [ ] (ii) backyard gardening [ ] (iii) building [ ] others specify……..

A4. Is there any economic benefit that can be derived from the use of domestic waste water? Yes [ ] No [ ]

A5. Can the use of waste water from domestic water-supply contribute to poverty reduction? Yes [ ] No [ ]

A6. Explain how the use of domestic waste water can reduce poverty……

A7. Which of the sex will benefit from the multiple use of water (using water for other purposes than what it was original meant for) Male [ ] Female [ ]

A8. Explain how they would benefit in A7……

A9. Do you use a particular source of water for more than one use?

Yes [ ] No [ ]

A10.The particular source use in A9 is

(i) small dam [ ] (ii) river [ ] (iii) stream [ ] (iv) well [ ]

A11 Do the water sources in A10 last the whole year? Yes [ ] No [ ]

A12. Mention the activities that water from the source mentioned in A11 is used for (i)…….(ii)…… (iii)……

Section B: Factors accounting for the scarcity of freshwater

B1. List the sources of water in this community/district……

B2. How are these sources of water?

Today …….

5 years ago ……

10 years ago ……..

20 years ago … …….

B3.where do people get firewood for cooking and for other purposes? .....

B4. How is the vegetation cover?

Today……

5 years ago…….

10 years ago……..

20 years ago……..

B5. If there are increases or decreases in animal production, give reasons for that…….....

B6. How is your farm yield?

Today…….

5years ago……..

10years ago……..

20years ago…….

B7. Give reasons to whether there have been increases or decreases……

B8. How many seasons do you have in a year? ( ) Namely; ……..

B9. How many months in a year do the community/district experience continuous rainfall? …….

B10.How many months in a year does the community/district experience no rainfall? …….....

B11.Are there water sources in the community/district that can harvest rain water? Yes [ ] No [ ]

B12. Are these water sources capable of holding water throughout the dry season to meet the water needs of the community/district? Yes [ ] No [ ]

B13.If No in B12, why? .....

B14. In your opinion which of these are mostly responsible for the scarcity of freshwater in the community/district? Erratic rainfall [ ] Poor agricultural practices [ ] Rapid Population growth [ ] Deforestation [ ] others specify ……

B15. How does the issue mentioned in B14 is responsible for the scarcity of freshwater?

1. Inadequate rainfall

2. Poor agricultural practices

3. Rapid population growth

4. Deforestation

5. Others ……

B16. Does the area experience drought? Yes [ ] No [ ]

B17. If yes in B16, what is/are responsible for the drought? .....

B18.What is/are the economic effects of drought in the area?(i)……

(ii)…… (iii)…… (iv)……

B19. What are some of the human activities that are responsible for the scarcity of freshwater resources? Crop farming [ ] Overgrazing (animals rearing) [ ] Deforestation [ ] others specify. ……

B20.Are there any polluted water body (ies) in the community/district? Yes [ ] No [ ]

B21.If yes in B20, what is/are responsible for the pollution?.....

Section C: Effect of scarcity of freshwater on socioeconomic activities in the Builsa District

C1. Which season does this community/district face serious scarcity of water?

Wet season [ ] Dry season [ ]

C2.What activity is /are affected most due to the scarcity of water in the season mention in C1. (i) Drinking and domestic use [ ] (ii) Crop farming [ ] (iii) Animal farming [ ] (iv) Poultry [ ] (v) Construction of houses [ ]

C3. Does the scarcity of freshwater affect the health status of the people in the community/district? Yes [ ] No [ ]

C4. If yes in C2, how? ……

C5. Do the effects on the health of people have any impact on their economic output? Yes [ ] No [ ]

C6.If yes in C5, why? ……

C7. What are some of the water borne or related diseases that have been complained of for the past months……

C8. Do people in the community/district spent more time in searching for water during the season of water scarcity? Yes [ ] No [ ]

C9. Does the time spent in drawing water affect the economic output of the people? Yes [ ] No [ ]

C10. Do people in the community/district travel long distances in a day to fetch water? Yes [ ] No [ ]

C11. If yes in C8 how?.....

C12. Is the personal hygiene of the people in the community/district affected due to water scarcity? Yes [ ] No [ ]

C13. If yes in C11, how? …….....

C14.From your assessment, what is the poverty level of the people in the community/district? (i) Very high [ ] (ii) High [ ] (iii) Low [ ] (iv) Very low [ ]

C15. Is the scarcity of freshwater a contributing factor to the poverty level in the community/district? Yes [ ] No [ ]

C16. If yes in C14, in what ways can the sufficiency of freshwater reduce poverty in the community/district? .....

C17. What major economic activities in the community/district are hampered due to scarcity of freshwater in the season of water scarcity?.....

C18.Has your community/district experience conflict due to water shortage? Yes[ ]No [ ]

C19. If yes, in C17, did it negatively affected the;

Community members relationship [ ] Trading activities [ ]

Community - community relationship [ ] Farming activities [ ]

C20. Do people from the district travel out during the dry season? Yes [ ] No [ ]

C21. If yes in C20 give reason……

C22 Migration of the youth contributes to the area poverty? Yes [ ] No [ ]

C23. If yes in C22 explain……

C24. If no in C22 explain ……

C25. Do you hold meetings in the district/community to discuss water issues? Yes [ ] No [ ]

C26. Do men and woman have equal say in water management decision? Yes [ ] No [ ]

C27. If no, in C26, who dominates? Men [ ] Women [ ] Children [ ]

Section D: Management of water resources

D1.Which of these is affected seriously by the scarcity of water?

(i) Male adults [ ] (ii) Female adults [ ] (iii) Children [ ]

D2. How are the following affected by the scarcity of water?

(i)Adult male (ii) Adult female (iii) children

D3.Do the community has management plans for water bodies? Yes [ ] No [ ]

D4.Who is/are involved in freshwater resources management decision in the community/district? Tick all that apply.

(i) Men (ii) Women (iii) Children (iv) Community water and sanitation committee

(v) District water and sanitation team of the Builsa District Assembly

D4i.How is freshwater conserved in the community/district?

(i) Building irrigation dam (ii) Construction of weirs across water courses

(iii) Construction of dams (iv) Damming rivers

D5.How is freshwater sources managed or protected in the community/district?

(i) Periodic siltation [ ] (ii) providing vegetative covers [ ]

(iii) non- farming activities along water courses [ ]

D6.Do you agree that effective water resources Management should include the management of: (i) land use [ ] (ii) vegetative cover [ ] (ii) waste disposal [ ]

D7.Do you agree that freshwater management should involve users and policy-makers? Yes [ ] No [ ]

D8. If yes in D7, why?.....

D9. If no in D7, why?.....

D10. Do you agree that women should be equipped and empowered to positively participate at all level in water resource management decision-making? Yes [ ] No [ ]

D11.If yes in D10, why?.....

D12.If no in D10, why?.....

D13.Do you agree that if water is seen as an economic good and price as such water resource will be efficiently managed? Yes [ ] No [ ]

D14.If yes in D13, why?.....

D15.If no in D13, why?.....

D16. Complete the table by ticking appropriately and stating your reason(s)

Managing water as an economic good will lead to:	Yes	No	Reason(s)
Achieving efficiency			
Equitable use			
Encourage conservation			
The protection of water resource			

D17.Tick appropriately the process involve in the community/district domestic water cycle. Abstraction [ ] Treatment [ ] Supply[ ] Waste water treatment [ ] Removal and discharge of waste water into water bodies[ ]

D18.Is the domestic water supplies in the community/district reliable?Yes [ ] No]

D19. If yes in D18, what management practices are in place……

D20.If no in D18, are there any management inefficiencies?.....

D21.What are some of the traditional practices that promote water conservation and efficient management of water resources? ……..……..

D22.state three efficient ways of conserving water in the community/district

……

D23.Which of these method do you think is more efficient way of harvesting runoff during the rains? Construction of rock bunds [ ] earth bunds [ ]

D24. In what ways can dead water resources be revived (i)…… …… (ii)……(iii)……..

D25.Are water resources more threaten of being destroyed? Yes [ ] No [ ]

D26. If yes in D25, why? .....

D27.If no in D25, what management practices are in place to protect them?.....

D28. Is tree planting a practice in the area to protect water bodies? Yes [ ] No [ ]

D29.Is farming along water courses a common practice? Yes [ ] No [ ]

D30. Is bush burning a common practice in the area? Yes [ ] No [ ]

D31. If yes in D30, why?.....

D32.What measures can be put in place to check the following practices;

farming along water courses and along slopes……

bush burning …….

D33.Tick those who have some interest in management of water resources in the community/district. (i) Domestic users [ ] (ii) farmers [ ] (iii) others specify……

D34. How can water resource be managed well in the community/district? ……

APPENDIX II

TWENTY-SEVEN YEARS MONTHLY RAINFALL RECORDINGS IN KASENA-NANKANA AND BUILSA DISTRICTS

Table 1: Monthly rainfall for 27 years in Kasena-Nankana and Builsa District Meteorological area

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Year	Mm	Mm	Mm	Mm	Mm	Mm	Mm	Mm	mm	Mm	Mm	mm	mm
1980	0	0	0.3	74.5	95.9	64.7	177	309	98.4	69.2	0	0.3	889
1981	0	0	2	42.7	62.7	198	167	258	84.4	3.9	0	0	818.7
1982	0	TR	79.6	36.5	161	81.5	131	243	236	51.5	1	0	1021
1983	0	0	0	20.5	98.2	140	120	261	78.6	62	1	0	781
1984	0	0	8.7	97.5	188	84.5	98	222	116	36.7	0	0	851.8
1985	0	0	0	2.6	64.4	165	231	306	182	14	0	0	964.5
1986	0	0	9.4	37.8	113	179	249	142	448	41	5.8	0	1225

1987	0	0	85.5	9.3	31.8	274	177	413	96.5	46.1	0	0	1133
1988	0	0	26.6	130	31.9	142	123	247	187	0.7	26	0	914.5
1989	0	0	11.2	28.4	32.3	162	184	354	298	48.2	0	32	1150
1990	0	0	0	14.7	136	48.9	233	250	126	9.9	13.7	34	865.7
1991	0	TR	34	43.1	148	67.9	165	357	83.5	81.1	0	0	979.7
1992	0	0	TR	58.8	153	153	244	212	154	58.6	0	0	1033
1993	0	0	TR	46.5	75.2	137	173	170	174	12.5	1.6	0	789.1
1994	0	0	32.3	12.7	116	62.4	114	428	101	84.7	0	0	951.2
1995	0	TR	5.7	41.6	44.6	142	94	231	55.7	72.5	0	0	686.7
1996	0	0	1.1	47.4	195	207	108	301	207	38.4	0	0	1104
1997	0	0	7.5	34.8	156	204	91.3	195	179	73.3	0	0	940
1998	0	20	0	20.8	135	77	128	282	146	47.9	0	0	855.6
1999	0	4.1	1.5	29.6	118	108	313	456	258	77.9	0	0	1365

2000	1	0	0	2.8	53.7	229	238	282	158	0	0	0	964.5
2001	0	0	0	30.3	125	131	177	336	156	4.2	0	0	959.7
2002	0	0	0	65.1	105	94	193	211	122	85.3	20.2	0	896.2
2003	0	1.8	0.9	22.3	95.8	207	183	284	239	100	6.1	0	1140
2004	0	0	28	177	74.3	140	260	210	119	34.7	2.2	0	1044
2005	0	4.5	TR	20.7	13.7	226	179	189	88.3	28.7	0	0	750.3
2006	0	3.8	4	82.4	55.6	118	194	183	153	83.2	0	0	876.9
Totals	1	34	338	1230	2679	3842	4741	7334	4343	1266	77.6	66	u

TR traces of rain which were not recorded

Source: Ghana Meteorological Service, 2006