WATER UTILIZATION AND POPULATION DEMOGRAPHY IN SOUTH AFRICA: KEY ETHICAL AND HUMAN RIGHTS ISSUES

Dr. Brian Mugabi

324591

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Declaration

I, Dr. Brian Mugabi student number 324591 am registered for as a candidate for the degree of MSc Med (Bioethics and Health Law) in the year 2009. I hereby declare the following:

I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.

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This work has not been submitted to any other institution or university for any degree or examination purpose.

Signature: Dr. Brian Mugabi

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Dedication

This research report is dedicated to my mother, the late Lydia Bakahirwa.

With thanks to Dr. S.G.B Kinyatta, and the rest of my family and to Ms. T. Mokgothu and Aizire, who encouraged and motivated me at every step.

Abstract

Access to sufficient water is a constitutionally recognized right in the Republic of South Africa as well as being a Universal Human Right. Despite this however, the world wide population numbers are ever growing and water is known to be finite. The Constitution's Bill of Rights gives South African citizens the right to reproductive choices. South Africa is a water stressed country, with three forces feeding into availability of freshwater, namely; climate change, demographic factors, and policies. Currently, the problem of accessing safe freshwater is under question. This is presents a problem as the Constitution also addresses the right to a healthy environment.

Uncontrolled population growth is detrimental to environmental integrity. It is arguable as to whether it is possible to conserve the environment, and at the same time realize human reproductive rights as envisioned in the Constitution. In this research report I reflect on the state of water and environmental resources in view of the right to procreate. I suggest that environmental education could play a major role in finding "the right balance".

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Preface

As members of the global community, one of the most critical challenges we currently face is that of the management of Earth's water resources. Although there are some variations, predictions generally are that the human population will increase by three billion or more over the next 50 to 75 years and the numbers of persons living in urban areas will double (UNCHS 2004). This will place a great burden upon available water supplies particularly as about one third of the world's human population already live in countries (such as South Africa) which are considered as 'water stressed'; that is, where consumption exceeds 10% of the total supply (P&P 2008). If present consumption trends continue, the United Nations' Global Environmental Outlook (GEOa 2009) predicts that by 2025 that two out of every three people on Earth will live in 'water-stressed' conditions. According to many authors, human overpopulation and related activities are the cause of the unprecedented pressure on Earth's natural resources (see for example: Callicott & da Rocha

1997; Watson, et al. 2005; Pearce 2008)[1].

South Africa's right of access to water is embodied in its Constitution.[2] Section 27(1) (b) of the Constitution states, 'everyone has the right to have access to sufficient water'. Section 27(2) requires the State to take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of the right.

The Universal Declaration of Human Rights (1948) gives every

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[1] These activities include e.g. food consumption, manufacturing, traveling, warring, general consuming, and breeding, which if unchecked may lead to pollution, over exploitation of natural resources, and habitat destruction. With increasing population growth and changes in consumerist practices and production, industrial and household refuse accumulates. In addition to other non-biodegradable substances that are disposed of in the water, they simply do not disappear. Industrial toxic waste and pollutants are discharged in ground surface water making it unsafe for human and non–human life (van Bogaert: 2008)

[2] The Constitution of the Republic of South Africa as adopted by the Constitutional Assembly on 8 May 1996 and amended on 11 October 1996.

individual the right to reproduce and to enjoy self-determination concerning family size. In addition, the South African Constitution includes explicit guarantees of reproductive freedom as articulated in the following sections:

"12 . . . (2) Everyone has the right to bodily and psychological integrity, which includes the right: a. to make decisions concerning reproduction; b. to security in and control over their body; and c. not to be subjected to medical or scientific experiments without their informed consent."

and;

"27. (1) Everyone has the right to have access to: a. health care services, including reproductive health care."

The problem I grapple with in this paper concerns the tension between a growing and resource-consuming human population given the right to access sufficient water and the right to be free to procreate versus water as a scarce resource. Globally, in the face of increasing tension concerning the availability of fresh, clean water and human population pressures I suggest that these rights are in variance.

I make a case for environmental education using Brian Norton's

‘enlightened’ anthropocentric ethical approach to the problem combined with effective implementation of prudent policies. If these methods are implemented, we may be able to better address these complex problems. I frame my work in the context of Africa with a focus on Sub-Saharan and South Africa.

Chapter 1: Water and Water Utilization

….Water, water everywhere and not a drop to drink ...

~Samuel Taylor Coleridge (1772 – 1834)

As the Earth's human population and concurrent consumerism increases, debates concerning the availability of water, goods and foodstuffs increase (Borlaug 2004). Above all else, there is exceeded growth in the demand for water. The Earth is composed of 97% seawater and 3% freshwater. However, 87% of the global freshwater is not accessible; that is, 0.4% of global water (SEEAW 2006). As human populations continue to grow, more and more countries are facing water shortages (Falkenmark 1993: 12).[3]

Viewed on an aggregate level, in 2004, Rijsberman calculated that the renewable freshwater supply on a global level was around nine and fourteen trillion m3 and usage at around four trillion m3 (based

[3] While that particular reference may be considered "dated," it is included to note that for a very long time, people have been writing concerning the water shortage.

on year 2000 estimates). So, it would appear that it is possible for a larger human population to carry on with an adequate supply of freshwater in the near future. The problem however is that the availability and quality of freshwater are not evenly distributed geographically or temporally throughout the world. To add to this, it is in the most environmentally marginal regions such as Sub-Saharan Africa and Asia that water access is the lowest (Liberatore & Zilgalvis 2008; UNEPAa 2000; UNEPAb 2001). Here it should be mentioned that there are on-going debates concerning the classification of water when viewed from different perspectives (viewed as a chemical substance, by quality & level, structural changes, etc.). This can sometimes lead to confusion when discussing the topic of water. For the purpose of this paper, I will employ the terms generally used to identify a type of water problem: "water-shortage, water-scarce, water-stressed & water-security". Some of these terms also include water measurement.

1) Water shortage will describe an absolute shortage where levels of available water do not meet certain minimum requirements. A problem is that often the actual water quality that defines the minimum may vary from place to place.

2) When the term water scarce is used, it is as a relative concept describing the relationship between a demand for water by the human population and industry and its availability. It is relative because the demands for water may vary from time to time and country to country. For example, a country such as Uganda may be classified as suffering water-shortage but, because of low industrial and irrigation utilization, would not be classified as water-scarce.

3) When we hear of the term “drought” this has a direct relationship with an area being water-stressed. Essentially, water-stress relates to the symptomatic consequence of over-sectoral water usage above ten-percent of the supply, a decline in water quality due to e.g. poor water purification infrastructure, crop failure & diminished food production capacity. Finally;

4) Water security is a goal as it refers to reliable and accessible water supply over time. The quality of the water supply is not a factor - it is the predictability of access - which is important.

A ‘water-scarce’ area although a relative concept, has been measured as a situation wherein, due to availability and demand, the water supply falls below 1000 cubic meters of water per person per

year (Vörösmarty, et al. 2000). Several authors argue that more than 31 countries – mostly in Africa and the Near East – now are in or will soon face water-scarcity or conditions of water-stress (see: Falkenmark & Widstrand 1992; Gardner- Outlaw & Engelman 1997).

Water security implies that each individual living on Earth will have access at all times to sufficient, safe water in order for each of them to lead a health productive life and sustainable livelihood. Thus, the twin needs of water access and quality somehow must be met. However, there are large obstacles to overcome to meet this goal.

On a global level, UNICEF (2008) estimates that of one in every ten people living on Earth, two have no sanitation facilities and utilize fields, bushes, water sources or open land to dispel their body wastes and more than one uses sanitation facilities that do not have hygiene services which are able to separate excreta from human contact (Falkenmark 1990). To add to the problem, in developing countries with the projected human population growth and declining availability of freshwater, the food security of more than one billion people is under threat (Speidel 2000: 552).

Water availability is a function of supply. This depends largely on

factors such as terrain, vegetation, climate, and crop-animal food production practices as well as distribution. Distribution of water in many Sub-Saharan countries is an immense problem as without proper facilities, water may be useless to humans and ecosystems. For example, in many countries on the African continent, it is a common happening that sewage treatment facilities are inadequate, non-functional, or simply non-existent (Gleick 1996; Saywell 2008). In many African countries, a great amount of domestic and industrial effluents reach surface water bodies untreated. Thus, contaminated water serve as the only source of water for communities.

An example of this is Lake Victoria in Uganda. As reported by Judge (2003) and others (WBCSD 2009), untreated industrial and domestic pollutants from the communities surrounding Lake Victoria have resulted in raw sewage and chemicals flowing into the lake because of the faulty or nonexistent sewerage treatment plants. All such factors feed into larger problems as the ecology of Lake Victoria drastically altered resulting in the demise of some fish species and other aquatic life caused by massive outbreaks of the water hyacinth. In turn, this resulted in the livelihood of communities being inexorably damaged, as they could no longer make a living catching

and selling fish. The availability of water is a function of supply, but available water may be useless if the basic needs of humans and ecosystems are not met.

Of course, different parts of any society use water for a variety of purposes; for example, in daily human and animal consumption and in industries such as agriculture and energy. The need for and type of water required by humans and ecosystems may vary according to e.g. climatic conditions, lifestyle, technology, and educational level (White, Bradley & White 1972). Some of these variants are mainly under human control, others less so such as the number of times a day one bathes versus an individual's consumption of water as a physiological necessity to higher climate temperature.

Water-stress may occur in places with plenty of freshwater. In such cases, the availability of freshwater to final consumers is hampered by pollution and lack of resources such as water purification and sewerage systems. In South Africa, three major forces feed into the availability of freshwater.

These are 1) Climate change, 2) Population growth and demographic shifts, and 3) Policy concerning the management of

water resources.

1.1 Climate change

Climate change is already occurring globally so except for implementing policies and actions which alleviate or curb harmful practices, it remains a given. Studies indicate that there is a high likelihood of a reduction in rainfall around the South Africa which could lead to decrease in the mean annual runoff and recharge from several of the rivers in the country (Turpie, et al. 2002: 6). In addition, there are reports indicating widespread pollution of rivers from human waste all around the country that seems to implicate the ability of the existing sewage treatment plants to manage the increase in waste effluents from the growing human population (Cull 2009).

Currently, humans use more than one-half of all accessible surface water. By 2025, it is suggested that human usage will increase by 70 percent. When this occurs, the quality and quantity of aquatic ecosystems will be severely reduced (Postel, et al. 1996: 786). This is because of the exchange (freshwater-saltwater) and flow of watercourses. Population increase means that more demand is put

onto environmental resources in terms of consumption as well as waste management and containment of resultant pollutants. According to Pearce (2009: 33), rivers worldwide are already experiencing enormous demand from human activities.

Vegetation cover is an important factor as it contributes to climate patterns since it influences annual rainfall as well as atmospheric carbon dioxide and oxygen cycle. While it is recognizable that environmental degradation is a global problem, the effect of clearing more land for agriculture or industry, or the selling of forests will have a far-reaching effect on the African continent and elsewhere. Subsistence farming and pastoralist practices are the main structure of many economies in Africa but education concerning the knowledge that natural vegetative cover contributes to climatic change is not in place. The consequences of wiping out natural vegetative cover are likely to include e.g. climate changes such as drought and dust storms, food insecurity, famine and widespread mortality (UNEPA a 2001; UNEPA b 2001).

Collier, et al. (2008: 341-342) report that impact of climate change on Africa is likely to be severe because of adverse direct effects,

high agricultural dependence, and limited capacity to adapt. Direct effects vary widely across the continent, with some areas (e.g. eastern Africa) predicted to get wetter, but much of southern Africa getting drier and hotter. Crop yields will be adversely affected and the frequency of extreme weather events will increase (ibid). Adaptation to climate change, it is suggested should result in private-public sector collaboration involving “relocation of people, changes in the sectoral structure of production, and changes in crop patterns” (ibid). This would be a monumental undertaking.

1.2 Water Pollution

Pollutants caused by human activities include plastic waste; a single pollutant kills up to one million sea birds, one hundred thousand sea mammals and countless fish each year. Sea creatures killed by plastic decompose, where as the plastic does not. This creates a vicious cycle since plastic remains in the ecosystem to kill repeatedly. Furthermore, harmful algal blooms, caused by an excess of nutrients - mainly nitrogen from agricultural fertilizers as well as decomposed biota - have created nearly one hundred and fifty coastal deoxygenated ‘dead zones’ worldwide, ranging from one to

seventy thousand square kilometres (UNEPA a 2000). In some regions, pollution is so severe that national and local governments have outlawed harvesting of marine resources because they are deemed unfit for human consumption.[4]

Water sources are constantly contaminated and polluted by agents that are deposited intentionally or that find their way there washed by rain water, gravitational flow or sip through the soil. Common pollutants include human or animal waste; disease-producing organisms; radioactive materials; toxic metals such as lead or mercury; agricultural chemicals such as pesticides, herbicides, or fertilizers; acid rain; and high-temperature water discharged from power plants, often called "thermal pollution"(Egboka, et al. 1989).

It is common to find sewage flowing on the streets and open drainages of many urban centres in the developing world, which

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[4] A number of synthetic chemicals are known to persist in the environment such as halogenated hydrocarbons, dioxins, and organochlorines such as DDT and PCBs. This is because they are non-biodegradable and they accumulate in the biological food chain upwards until they pose risks to human health. As an example, the Indigenous communities along the course of St. Lawrence River are prohibited from hunting the Beluga whales under Canadian law, because of the high levels

finally converge, into cumulative streams that finally empty their contents into fresh water sources. Yet it is here where fertility rates are still appreciably high. Due to high population densities and urban development pressure, half of all coastal ecosystems are degraded and a tide of pollution is rising in the world's seas. Ocean fisheries are being overexploited, and fish catches are down (Hinrichsen & Robey 2000).

According to Tsiho (2007), the pollution of rivers, lakes and aquifers from domestic and industrial wastewater discharges, mining runoff, agrochemicals and other sources in now a growing threat to water resources in most developing countries, particularly in Southern Africa. One of the most important sources of water pollution in South Africa is municipal water treatment plants which are overwhelmed by industrial and domestic waste effluents. It is reported that fourteen wastewater treatment works in the Eastern Cape province of South Africa are exceeding their capacity to treat raw sewage (Cull 2009). This high level of spillage of fecal matter flows into major rivers in the country.

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of pollution (World Bank 1993; Pullen and Hurst 1993).

These developments raise serious questions as well as concerns regarding the state and safety of water sources in the country (DWEA 2009). The Olifants River in the Kruger National park provides an example of alleged pollutant harms as the recent crocodile deaths are suspected as being attributable to heavy metal contaminated water (Lubick 2009). Moreover, it is suspected that livestock in the heavily affected areas may be at risk according to a SA Governmental Digest (Environment) report in 2003. As cattle are bred as part of the food-animal industry, thus consumed by humans, the impact of this contamination may continue in now-unforeseen ways.

1.3 Water and Agriculture

The agricultural demand for increased food production has a direct relationship with population size and lifestyle. As populations grow so does the need for feeding larger numbers, which requires such technologies that in turn, may lead to environmental degradation. Agricultural activities rank second in pollutant practices and it is projected that if current trends continue, the world's entire stable river flow would be needed just for pollutant transport and dilution by

the middle of the 21st century (FAO 1990).

Concerning agriculture and water resources, as more and more people are born then the need to feed them grows. Thus, water is increasingly needed for crop irrigation. Water bodies in particular take a disproportionate share of these either directly or indirectly. Examples of the former include both domestic and industrial uses of water as well as discharging waste effluents into water bodies, exploitation as food source, and crop irrigation. An example of indirect damage because of food production is that the effects of insecticides and fertilizers eventually reach water systems. In addition, global warming affects freshwater due to the excessive evaporation attributable to an increase in overall average temperatures. This is mainly a result of anthropocentric activities.

It is reported that water use in Africa, as in other developing regions, is dominated by agriculture. Africa has the highest percentage use by agriculture of any major region and, conversely, with the exception of South Africa, the lowest percentage of water consumed for domestic or industrial uses (Stiles 2003: 31-33).

"During the past three centuries, the amount of Earth's

> *cultivated land has grown by more than 450 percent, increasing from 2.65 million square kilometres to 15 million square kilometres. A related process, deforestation, is also critically apparent: A net decline in forest cover of 180 million acres took place during the 15-year interval 1980 to 1995, although changes in forest cover vary greatly across regions" (Pimentel, et al. 1996).*

The process of clearing of forests and draining of swamps to give way for human settlements and other anthropocentric activities deprives other living of their ecological niches. During the past three centuries, the amount of Earth's cultivated land has grown by more than 450 percent, increasing from 2.65 million square kilometres to 15 million square kilometres. A related process, deforestation, is also critically apparent: A net decline in forest cover of 180 million acres took place during the 15-year interval 1980 to 1995, although changes in forest cover vary greatly across regions. This loss in acreage of forest cover is much more seen in the developing regions than in the developed world (ibid). Forests are natural water regulators because their roots act as nature's sponges, soaking up

at the same time releasing it slowly all through the year. In this way, river flow is more consistent. In addition, these processes replenish groundwater supplies, reduce soil erosion, and release moisture into the atmosphere. Removal of forest cover leads to croplands erosion and degradation, waterways silting up, frequent floods, disappearance, and above all, climate change (PIPb 1999).

The integrity of these physical features is vital for natural processes that maintain water quality and aquatic ecosystems. Unfortunately, with increasing population sizes it is plausible to reason that the risk to water resources is yet to peak. For example in some areas of southern Africa, up to 50 per cent of wetlands have been transformed by draining for agriculture, and infrastructure development; use of fertilizers and pesticides; over exploitation; the effect on the Caprivi wetland system (in Namibia) for example has resulted into transformation of close 25 per cent of its original size (Chenje 2000).

“While the world grows twice as much food as it did a generation

ago, it takes three times as much water to do it."[5] Reports indicate that water tables are plunging across India, with a dozen more countries following suit, yet China - the most populous country on earth cannot feed it's people because of the serious shortage of water (Pearce 2008: 35) .

In addition to requiring enormous amounts of water in the process of irrigation, the use of agrochemicals containing nitrate compounds contribute to Eutrophication of surface freshwater bodies such as lakes and dams. Eutrophication can be defined as a process that occurs when excess nutrients stimulate the growth of algae, which, when they die and decay, rob the water of oxygen. This problem is common in the industrialized world but likely to pose a crisis in the less developed countries where governments' investment and priorities are as elsewhere compounded by scarcity of resources and political will (PIPa 1998).

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[5] Pearce (2009:33) further argues that whereas India is the poster child of the green revolution that elevated it from being the centre of famine 40 years ago, to being able to feed itself today, this is at a great cost. For example, farmers consume about 100 cubic kilometres of underground water which is more that the rains can replace.

1.4 The State of Water Resources

According to the DEAT (2000), the state of terrestrial, freshwater, and marine environments have declined over the last 100 years in almost all aspects. This is attributable to the following processes; rapid population growth, intensive agriculture, urbanization and industrialization.

Inadequacy of water supply and scarcity of fresh and clean water are a worldwide phenomenon with contributing factors including growing populations shifting to urban areas, contamination of surface water and groundwater, frequent droughts (especially in Sub-Saharan Africa) the extreme global warming and the uneven distribution of water resources. Whereas it is difficult to assign a simple association of a causal effect relationship, it is possible to attribute it to a demand – supply association.

From this premise, we can then theorize that the demand is increased by an increase in the world's population because of rapid population growth and concurrent human activities. According to (UNEPAb 2000),

> *Southern Africa is mostly semi-arid, and experiences variation in rainfall, both over time and between countries. This* sub-*region is also expected to experience further variability in rainfall, reduced precipitation, and increased evaporation, because of climate change. With a rapidly growing population, and demands from the domestic, agricultural, and industrial sectors for water, freshwater availability is a priority concern for the sub-region.*

Continued population growth results in an accelerating demand for water: Global water consumption increased six-fold between 1900 and 1995, more than double the rate of population growth (WHO 2002; WAEA 2004).

Rivers in various parts of the world are at a risk of drying up, such the Indus in Pakistan, and the Murray in Australia. Widespread droughts as well as the mere demand to increase crop production would require irrigation which puts strain onto water resources. There is evidence of increase of this practice and the nature of demand that it exerts onto water availability.

Although the supply of freshwater is scientifically known to be finite,

demand is soaring as population grows and use per capita rises. By 2025, when world population is projected to be eight billion, 48 countries containing 3 billion people will face water shortages (WAEA 2004). The World Bank reports that 80 countries now have water shortages (WB 2007). These shortages threaten population health and economies while 40 percent of the world — more than 2 billion people — have no access to clean water or sanitation. In this context, one must consider the potential for greater conflicts as countries via for water resources.

The UNEPA (2001) reports that Africa in particular lacks the procedures for resolving or avoiding disputes over water despite the continent having over fifty international water basins. The nations of the Nile basin are currently locked up in negotiations aimed at having water-sharing rights and agreements changed to fit their circumstances. Amongst these nations is Egypt. Reports indicate that it depends heavily on the Nile River, deriving around 87% of its total water resources (Tenywa 2009).

Currently there are military conflicts that are attributable to water access and rights, for example, the Israel-Palestine conflict in the

Middle East, and the Darfur conflict in the Sudan (Lonergan & Brooks 1994; UNEPA 2000). Moreover, reports indicate that the situation of the agreement reached between India and Pakistan over the river Indus now has the potential to trigger conflict due to ongoing disagreements over how to use the waters of this river (Patterson 2008). Studies have hypothesized that "the likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change" (Carius, et al. 2005).

This is because sudden physical changes or reduced institutional capacity is more conducive to disputes. Key examples of this breakdown include:

1) uncoordinated development of a major project that affects flow (such as a dam) in the absence of a treaty or commission; 2) "internationalized basins" such as in post-Soviet Central Asia; and

3) general animosity among parties. This approach gives us a set of indicators to monitor potential hot spots, and work ahead of the "crisis curve" to promote institutional capacity in advance of intractable conflict" (ibid: 14).

Among the five countries likely to run short of water by 2025 three are in Sub-Saharan Africa namely Ethiopia, Kenya, Nigeria (PIP 1998). According to Ashton (2000), the situation in Africa is informed by a combination of factors namely; high rates of population growth and concurrent increases in the demand for water. These factors have resulted in some Sub- Saharan countries having water scarcity. Water-scarcity has an impact upon further development. Furthermore, if population trends and patterns of water use continue, there is a risk that additional countries in Africa will exceed the limits of their economically usable, land-based water resources by 2025 (ibid). And the cumulative effect of over consumption, pollution, and contamination will result in the degradation of water quality.

To change what may appear inevitable, the role of government should be to provide the information, incentives, and economic environment to facilitate positive changes. However, adaptation will be impeded by Africa's fragmentation into small countries and ethnic groups, and by poor business environments (Collier, et al. 2008: 346).

Indicating some public-private participation, The Rand Water

Company of South Africa (SSD RW 2009) identifies five anthropocentric activities that they consider to be the major causes of water pollution in South Africa:

- mines (especially abandoned);
- industry, poor/improper waste management;
- municipal wastewater treatment works; and
- diffuse pollution from human settlements.

They also indicate that there is evidence of increased incidents of pollution that places great pressure on existing infrastructure, treatment, works, and hospitals (ibid). As a human health concern, it is important to note that worldwide over two million children die of water related diseases (diarrhea is still the number one cause of child mortality, not HIV/AIDS). Contaminated water is a major contributor to childhood diarrhea. It is postulated that with South Africa already bearing the blunt of HIV/AIDS, poor drinking water quality will have an adverse effect on HIV infected persons. Because of their compromised immune systems, they are more susceptible to the acquisition of water-borne diseases (NewsRx 2006).

Human consumption patterns also affect water sources as well as its utilization. As stated by United Nations Environmental Protection Agency (2001:24).

> *Over-consumption is destroying our resource base: profligate energy consumption is driving up global temperatures; over harvesting is destroying fish stocks; overexploitation of forest resources is affecting both the terrestrial and the marine environment; industrial and agricultural chemicals are destroying the ozone layer and poisoning the food chain; and water resources are being depleted where they are most needed.*

The effects of these land-based activities are then transmitted to seas and oceans via rivers. This poses a threat for marine habitats such as coral reefs as well as affecting other marine ecosystems leading to changes in numbers and distribution of phytoplankton. It is estimated that 70 percent of ocean fisheries is either is dangerously over-exploited or over-fished; the vacuum is being filled with jellyfish blooms and other previously unseen species in many regions of the world (UNEPA a 2001; Hinrichsen, et al. 1997).

There is a worldwide recognizable trend of the disappearance of marine species and at times permanent migration of some from their established niches to new ones. The probable factors behind these observations are thought to result from environmental degradation and change in global climate. For example, it is reported that approximately twenty percent of the fish now swimming in the Mediterranean, including barracuda, are types that have migrated from the Red Sea as the water temperatures there have risen (Kingston 2007).

Other dangerous changes also occur because of human activity. For example the effects of diverting water from the Nile River, leading to the build-up of sediments trapped behind dams and barrages, has resulted in the shrinkage of the fertile Nile delta. As a result, it is reported that of 47 commercial species of fish, about 30 have become extinct or virtually extinct and consequently the delta fisheries that once supported over a million people have been wiped out (Abramovitz 1996; Hinrichsen, et al. 1997; PIP 1998).

The following is the outline of the assessment of the freshwater problem by the World Health Organization (2000) and the United

Nations Environmental Programme (1999):

> *Scarcity and misuse of fresh water pose a threat to development and protection of the environment. Human health and welfare, food security, industrial development, and ecosystems on which they depend are all at risk unless water and land are managed more effectively than they have been in the past. Global freshwater resources are threatened by rising demands from many quarters. Growing populations need ever more water for drinking, hygiene, sanitation, food production, and industry. Climate change, meanwhile, is expected to contribute to droughts.*

The occurrence of water scarcity and the water crisis in many regions of the world is a matter of time. It is predicted that climate change will adversely affect freshwater resources in southern Africa with overall reduction in rainfall, by as much as 10 per cent across the whole sub region, and up to 20 per cent in parts of South Africa (WWF 2000). According to Cairns (2004:4),

> *… rapid population growth has exacerbated climate change and led to depletion of groundwater aquifers, old growth*

forests, ocean fisheries, and agricultural lands …

As an example, we may consider Lake Chad, in Central Africa which is reported to have shrunk from 25,000 square kilometres to just 2,000 square kilometres in a period of three decades - Attributable to periodic droughts along with massive diversions of water for irrigation (Jauro 1998:4; PIP 1998; Abramovitz 1996).

South Africa's population including industrial, domestic, and agricultural users is highly dependent on a reliable supply of water. A reduction in rainfall amount or variability, or an increase in evaporation (due to global warming) would further strain the already limited amount of water resources. An increase in rainfall or a reduction in plant water use (due to a higher atmospheric concentration of carbon dioxide) could ease the problem slightly (SAWS 2005).

However, as South Africa is geographically a water-scarce area, and in view of uncertain weather patterns, long-term predictions tend to lean towards drought in many areas in South Africa (Sym 2008). A study on the water situation in the country indicate that there exists a combination of factors including reduction in freshwater inputs which

combined with sea level rise is expected to impact on estuaries, affecting the production of estuarine and inshore marine fisheries resulting from climate change.

Projections of rainfall around the country show that there are expected changes which could lead to reduction in the mean annual runoff and recharge from several of the rivers in the South Africa. These changes are anticipated to affect flow of freshwater into estuaries thus changing estuarine ecosystems (Turpie, et al. 2002:6).

The current environmental consensus is that the global climate situation is the consequence of human activities including production of harmful substances that are leading to environment degradation. Some of these substances are greenhouse gases which when released into the atmosphere prevent radiant heat from escaping from the earth's atmosphere thus warming the earth's surface.

The main culprits in this group of substances are carbon dioxide, methane, and nitrous oxide. The earth's surface is warming due to greenhouse gases emissions, largely from burning and use of fossil fuels for anthropocentric benefits; however, there are other activities

such as volcanic activities and natural gas from water bodies too that are responsible. Anthropogenic sources of greenhouse gas emissions are mostly from energy use; these are largely as a result of economic growth, fossil fuels used for electricity generation, and weather patterns affecting heating and cooling needs.

Such activities as well as processes are inevitable as population numbers grow. Population increase alone is only one aspect; consumerist practices and the migration of population from rural to urban areas also are contributing factors. South Africa's industrial growth in both mining and production are the leading causes of pollution in the country; followed by improper waste management, failing municipal wastewater treatment works, ecologically unsound agricultural activities and diffuse pollution from human settlements (SSD RW 2009).

Chapter 2: Population growth and demographic shifts

Freedom in a commons brings ruin to all

Garrett Hardin (1915 –2003)

Population can be defined as the number of any species occupying a given area under consideration. For the purposes of this discussion, "population" will refer to the human population. As of 2006 (Statsa), the population of the Republic of South Africa was estimated at 48.7 million, a 20.54 percentage growth rate from 40.4 million in 1994. The report (ibid) states that the population of Gauteng province alone is approximately 10.5 million people, which represents 21.5 percent of the South African population.[6]

Demography is the scientific study of the characteristics of human populations. It relies heavily on statistical data, collecting, interpreting, and presenting the information to determine trends. The information received may be managed in a variety of ways. For example, demographic studies may be used to forecast future trends

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[6] This "explicitly accounts for HIV and AIDS" (Statsa 2008:4).

which may serve to assist in the planning of the management of potential problems.

Demographers may study why things happen and what the consequences are, including the effects of population on the environment. This is self-explanatory as consumption patterns, development choices, wealth distribution, government policies and technology all are factors which may mediate or exacerbate the effects of demographic change on the environment. The precise impact of a given change depends on the interplay among all these factors. Population dynamics include phenomena such as population size and population growth rate, migration, age structure, household size and gender balance (IICN 2008). Human population dynamics and behaviour can lead to environmental change and likewise the state of the environment effects human existence.

Increased population growth spells a problem for a country because it implies an increased need for e.g. food, water, infrastructure, and services. This puts pressure on any existing facilities. This is particularly important as the highest growth rates are in the developing world.

In South Africa, in spite of the HIV/ AIDS pandemic, there was still an estimated growth rate in 2008 of 1.06 (Statsa 2008: 6). In 2001, the estimated growth rate was 1.25 (ibid). This figure differs from that of UNICEF (2008) which estimates the South African annual growth rate at 1.7 %. This annual growth rate is a decline from 2.4% growth in the three decades before 1990. While this value is the lowest on the African continent, it is still high by world standards (UNFPA 2006). Linking this to water, the sub - Saharan population growth rate was 2.6% per year in 2000, yet the continent is one of the two regions of the world that face absolute or seasonal shortage of water (GEO 2000).

Concerning South Africa, the fertility rate declined from 2.9 children in 2001 to 2. 7 children in 2006 (Statsa 2008:2). UNICEF's (2008) report indicates a fertility rate of 2.7 children in 2007. This decline in fertility rate is most likely a result of deaths occurring due to HIV/AIDS as South Africa has a skewed population distribution due to HIV/AIDS mortality. UNICEF (2008) reports that 38% of the population is aged below 18 years while Statsa (2008) states about one-third (32%) of the population in South Africa is younger than 15 years - such a young population has the potential of maintaining a

population-growth momentum. In addition, the young age of the population makes them particularly vulnerable to consumerist practices due to local and global marketing campaigns.

Any human population growth has an effect on the environment. The South African population is growing, which infers greater demands on the natural resources and environmental services, as well as increasing the amount of waste and pollution (DEAT: 2005). In addition, the spatial population distribution is affected by the distribution of natural fresh water, which is not evenly shared by all parts of the country (Tsiho 2007). In addition, safe clean water for domestic use is not available to all the inhabitants (ibid).

The overall South African life expectancy is reported as 50.7 years with 49.0 years for males and 52.5 years for females (Statsa 2008: 5). These figures reflect the HIV/AIDS impact on the country's human population.

There has also been an enormous movement of people in South Africa, particularly from rural to urban areas as well as migration from other countries. Internal migration increased with the highest number of internal migration from Limpopo and the North East

Provinces to Gauteng (Statsa 2008: 5) This concentrates the pressures on the water usage and access and can lead to problems of e.g. sanitation and pollution that directly affect human and ecosystem health and quality of life (De Sherbinin 2006; PIP 1998).

What is termed “population dynamics” includes control and involves demographic transition; the latter comprises of three components namely: fertility, mortality, and epidemiological transition. Having seen the population shifts resulting from the HIV/AIDS pandemic in fertility and mortality, in the next section we will overview the problem of population shifts and epidemiological transition.

2.1 Population shifts and epidemiological transition

Epidemiological transition refers changes in disease patterns from a high prevalence of infectious diseases to non-communicable disease. Attempts to control disease networks have traditionally been under the purview of public health. During the early days of Western colonization and imperialism, public health practices in ‘conquered’ lands depended to a greater or lesser extent on commercial interest, but the overall mortality rates of people in such countries remained extremely high (Watts: 1997: 7).

However, in the West during the 19th and 20th centuries there was a general improvement in mortality from infectious diseases (although there was no simultaneous decline in their incidence). It is hypothesized that this decline in mortality was attributable to various factors based on technology, principally the application of sound public health practices (such as sanitation, urban planning, improved food hygiene, water purification and medical practices, notably the use of antimicrobials (Gostin 2000: 20). Fortified by such assurances, Western public health systems in the mid-20th century fell into decline as emphasis shifted to the so-called degenerative diseases or diseases of 'ageing societies' (Raleigh1999: 983).

Of course, this 'great conquest' was seen in the ethnocentric perspective of the West, ignoring the developing world and based naively on the premise that no new pathogens would emerge and on failure to realize that drug resistance has the potential to profoundly affect the treatment of emerging, re-emerging, and even 'old' infectious diseases. The advent of HIV/AIDS epidemic especially its high prevalence in the Sub-Saharan region has served to reverse many of the previous and potential health gains.

2.2 Migration Patterns

During the past century, migration became commonplace amongst South African rural men looking for employment in urban and mining centres, and this continues on today (Lurie, *et al.* 2002). While admitting that migration of women is a neglected area of research, Camlin (2008) reports that an African Centre study found that women appear to migrate more frequently to areas closer to home than do male migrants. In other words, they would move to informal settlement areas, smaller towns and trading areas. The same study noted that South African women tended "to stay closer to rural homesteads, while men migrate mostly to urban areas, and return home less frequently if at all" (ibid). Omelaniuk (2006), writing a World Bank report states that on a global level more women are migrating and the shift is generally to urban areas. In South Africa, as elsewhere in the world, internal migration generally follows a rural to urban pattern.

Globally, the Earth's population is increasingly urbanized. As recently as 1960, only one-third of the world's population lived in cities. By 1999, the percentage had increased to nearly half (47

percent). It is projected that by 2050, 67% of the world population, approximately four billion people will be living in urban centres. In Africa alone, it is expected that 43% of the population will be living in urban areas by 2010, which is almost three times the percentage urbanization at the start of the 20th century (UNPD 1997). These numbers are projected to increase to 54% by 2030 (UNCHS a 2001).

The main concern for policy makers regarding migration is the issue of trans-border migration; South Africa in particular is not a stranger to this phenomenon. Large numbers of people from neighboring countries are attracted into the country by the better economic amenities and often are fleeing oppressive regimes. Because of the regional destabilization, the potential exists of triggering an immigration-driven population growth which may be too rapid for the available infrastructure and public utilities to cope.

It is known that changes in population sizes as well as age and demographic distribution pose a challenge for the harmony that exists between humans and the earth's ecological systems (Cairns 2001:172). When such structures are under stress, and as less-

developed regions cope with a growing share of population, pressures intensify on already dwindling resources within these areas. Secondly, migration shifts relative pressures exerted on local environments, easing the strain in some areas and increasing it in others.

Finally, urbanization, particularly in less-developed regions, frequently outpaces the development of infrastructure and environmental regulations, often resulting in high levels of pollution (Hunter 2008). [7]

Important too, changes in affluence among populations of different region result in increased consumption and often wastefulness. These activities have a potential of accelerating the rate at which environmental resources are exploited and degraded.

2.3 Over-Population, Population Density, and Water-borne Diseases

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[7] Concerning South Africa, the following is quoted from the City of Johannesburg website (2009) "Flora Mokgohloa confirms that Johannesburg's air exceeds acceptable levels of air pollution, especially in terms of green house gases such as carbon monoxide, nitrogen dioxide and ozone, as well as *particular* matter. " NB: I think the correct word is *particulate* matter.

According to the UNEPAI (2001:24) report, over 80 per cent of all diseases in the developing world are attributable to unsafe water and poor sanitation because often times rivers downstream from large cities are little more than open sewers.

It is difficult to distinguish precisely between contamination and pollution but the later occurs in such high doses or concentration that it renders any medium very hazardous and damaging to life. The former on the other hand is regarded as being of a lesser degree but the medium concerned may also be rendered unusable. Water sources are constantly being contaminated and polluted by agents that are deposited intentionally or that find their way there washed by rain water, gravitational flow or sip through the soil. Common pollutants include human or animal waste; disease-producing organisms; radioactive materials; toxic metals such as lead or mercury; agricultural chemicals such as pesticides, herbicides, or fertilizers; acid rain; and high-temperature water discharged from power plants, often called "thermal pollution" (Egboka, et al. 2007).

High microbial contamination is a risk to humans and other living

organisms. This risk includes accumulation of the toxic substances up the food chain and or infectious diseases causing agents (microbial). The commonest water borne diseases are cholera and typhoid, which are caused by *Vibrio cholerae* and *Salmonella typhi* respectively. Viruses may also live and flourish in water such as hepatitis A, and *enterovirus* as well as protozoan and metazoan viruses. The potential of severe outbreaks of water borne diseases in South Africa is very high. The Cholera outbreak of 2008 in and around the country is a good reminder of such a scenario, and given the reported contamination of rivers in the country, it is likely to recur.

Rapid growth of human population will certainly worsen the situation yet there are no mitigating solutions planned to solve the problem. In addition, more people may contribute to the creation of additional informal settlements lacking waste disposal and sanitation facilities. These facilities are overwhelmed by the industrial and domestic effluents (the later mainly comprises of human waste). Human waste usually refers to fecal matter and excreta especially urine. The problem of human waste can be mitigated by reducing its production by using waterless urinals and compositing toilets. In addition, in the

absence of sewage systems it is possible to use septic tank systems and or sewage lagoons especially for small populations without risking contamination and disease.

According to PIP (1998), polluted water, improper waste disposal, and poor water management are causing serious public health problems worldwide with water born diseases. Such water-related diseases include malaria, cholera, typhoid, and schistosomiasis which harm or kill millions of people every year. Reduction of water borne diseases resulting from human waste contamination has been a major accomplishment of human civilization.

This has been possible through the practice of hygiene and sanitation, including the development of sewage systems and plumbing. However, these achievements are fragile and can be reversed if environmental mismanagement is not checked. Furthermore, overuse due to demand and pollution of water supplies are putting a heavy burden on the natural environment and pose increasing risks for many species and in some cases are leading to extinction of some species. It is simply a matter of practical observation: in places where the human population is large and

where sanitation facilities are absent or nonfunctional there is a greater chance for water-borne disease outbreaks to occur than in a sparsely populated area. In addition, when populations are dense, the opportunity exists for the greater spread of an infectious disease.

Chapter 3. Rights in Variance

We have been God-like in our planned breeding of

our domesticated plants and animals,

but we have been rabbit-like in our unplanned breeding of ourselves.

Arnold Toynbee (1852-1883)

We never know the worth of water till the well is dry.

Thomas Fuller (1608-1661)

3.1 The right to make one's own decisions concerning reproduction

In South Africa, human rights as well as rights to a healthy environment are enshrined in the Constitution thus implying that the State has a duty and responsibility to ensure that these rights are realized, albeit progressively.

Sections 12 .2 & 27.1 of the Bill of Rights refers to human reproductive rights, 27(b) of the Constitution's Bill of Rights addresses the right of access to water and under section 24, the right to a healthy environment is stated. Section 24 (b) in particular deals with integrity of the environment and biodiversity.

Globally, there is a growing realization that population control could provide a solution to many environmental dilemmas (Callicott & de Rocha 1997: 67). As Malthus (1803) put it, since population tends to grow geometrically, so then the per capita share of the world's goods must steadily decrease, for ours is a finite world. This seems to have influenced Hardin (1995: 331) as he states, "A finite world can only support a finite population". Editors Callicott & da Rocha (1997) in their book Earth Summit Ethics identify that while a discussion on global population growth was scheduled at the Rio Convention concerning population and development (1992), few attended and a notable absence was recorded from governments and religious organizations.

The curbing of growth in segments of human population or the human population generally, is a topic fraught with emotion. One may understand this, as many population control practices throughout history have been coercive, imposed in unjust ways and thus are rendered illegitimate, unethical. In many ways, countries, religions, and cultures rely upon growing populations for further distribution of their ideologies. However, there have been population programmes put into place whilst not without criticism; raise an

interesting point - control of the *number of offspring*.[8] It is to that particular point I now turn.

First, we will be obliged to accept that the right to "make decisions concerning reproduction" equals "the right (or not) to procreate". In the context of this discussion concerning disadvantages of the human population growth to the environment, we will also have to narrow this again to "the right to procreate." If we accept that there is this right, should it follow that there is a right to produce as many children as one desires? This question is raised because many authors seem to suggest that it is an infringement on one's liberty if their number of offspring is limited. For example, Bayle's (1976: 42) states that

> *A human right to procreate involves an obligation on others not to limit a person's liberty to decide when and how many children he will have.*

Article 16 of the United Nations Universal Declaration of Human

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[8] Most notable is China's 'one child policy' which began in 1974 in an attempt to control China's population. For a concise commentary, see Kane and Choi's article, China's one child family policy.

Rights (1948) supports this, giving each individual the right to reproduce and self-determination concerning family size.

The South African Constitution[9] includes explicit guarantees to reproductive health in the following sections:

"12 . . . (2) Everyone has the right to bodily and psychological integrity, which includes the right: a. to make decisions concerning reproduction; b. to security in and control over their body; and c. not to be subjected to medical or scientific experiments without their informed consent."

"27. (1) Everyone has the right to have access to: a. health care services, *including reproductive health care*."

All governments have a responsibility to ensure the wellbeing of their citizens. Therefore, in one view, when faced with environmental crises' it would seem justified to intervene and restrict or control procreation.

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[9] Adopted by the Constitutional Assembly on 8 May 1996 and amended on 11 October 1996.

Generally, we can say problems concerning ever-growing human populations are recognized. However, the mixture of cultures, religions, politics, and enshrined human rights globally represent major barriers to any real endeavor to suggest that human population growth should be 'moderated'. This noted, one may wonder as to the consequences of such rights and declarations when faced with climate change and shrinking natural resources. From the foregoing, it is clear that all countries share an anthropocentric view and as such, it is almost impossible to realize these rights without hurting the environment.

Raz (1988) tries to present a definition of rights that best pertains to moral, political, and legal discourse. In simple terms, 'rights grounds of duties in others'. This means that a need for an enactment of a right would not be necessary unless the circumstances are such that a duty is required.

Moreover, a duty in response to a right can only exist if it is not "counteracted by conflicting considerations." He (ibid: 165) suggests that a general human right is

> *... only a prima facie ground for the existence of a*

particular right in circumstances to which it applies …

This is underscored by the reciprocity thesis, or the idea that only members of the same community can agree on the weight of various considerations affecting the right-duty relationship. If we consider situations, in which members of one community claims duties from nonmembers we see that these claims are made based on the existence of rights which are considered by the claimants as *"universal".* The idea Raz puts forward is that such duties only correspond to rights if that are "not based on the interests of the beneficiaries of these duties" *(ibid*: 170). Looked at in this way, the surrogate argument to reciprocity is that rights may exist without the actual awareness of the agent who is bound by duties based on these rights.

In a rights-context, this raises questions of responsibility, supposedly a correlative of rights, but often ignored in human rights discourse. The focus appears to be placed on 'rights' over any acceptance of responsibility. For example in a recent article (Goodenough 2009) concerning China's one child policy, the USA's Secretary of State Hillary Clinton is reported as stating:

> *It is a violation of human rights when women are denied the right to plan their own families, and that includes being forced to have abortions or being sterilized against their will.*

While we may accept this statement as 'true', we should also ask about the context in which she spoke, for example, is the planning of families always under the 'control' of women, who has the responsibility to choose, and why. Viski (2008) provides this question: "if the right to avoid starvation is a human right, who exactly is bound to provide nourishment for countless hungry mouths?" This is actually a complex question and from the perspective of Raz (1998), one need not dismiss certain rights as claims. Rather, the reflection associated with interrogating the question should lead to an understanding of who is bound to fulfill the duties that certain rights entail. Moreover, the rights claims should be viewed in a cultural, socio-political, environmental context.

An additional observation concerning rights that Raz (ibid: 166) proposes is that the

> *implications of a right ... and the duties it grounds,*

depend on additional premises and these cannot in principle be wholly determined in advance.

This observation, particularly in the context of an unknown future, ground rights and responsibilities in a particular time and place. For example, ideas about what is right and good have always had a time and place dimension.[10] For this reason, Raz believes that rights can be described as dynamic in character. Importantly, if rights are by definition dynamic, the term "universal rights" would be inconsistent with this definition. Rights cannot be universal and dynamic, or universal and prone to future uncertainties, or universal and influenced by circumstance.

Concerning procreation, there are moral and legal issues included in this right and in spite of these considerations, there may be limits placed on it. Some of the limits rise from competing interests

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[10] For example, in the time of Aristotle, only male Greeks were considered as "citizens", slavery was the norm and women were excluded from political discussions. Conjecture about what good or normative abstractions concerning the way to live a good life, have always been grounded in particular historical, social, and political contexts. The idea that rights did not always exist in philosophical thought, (much less the idea of universal rights) are modern concepts.

(Wellman 2005:135-136). The interests included in human rights can be in conflict. Claims, whether presented as rights or not, may conflict. So may the traditions, institutions, and authorities that endorse a claim as a right (Kamenka 1998: 480).

The majority of the arguments in the rights-responsibility arena concern the intra-agency of human responsibility and value. In the context of the responsibility not to procreate under certain circumstances, Wellman (2005) writes,

> *… there is probably the duty not to procreate when one knows or ought to know that one is unwilling or unable to rear, or arrange for others to rear, one's child adequately.*

What Wellman (ibid) refers to are proper human factors such as care and concern, food, shelter, clothing and education. However, what may also be considered is that a child should live in a physical environment conducive to positive growth, from e.g. protection from pollutants and assurance of fresh water, to the chance to enjoy the beauty of the environment.

Another consideration raised is in the context of the socio-political order, as Bartlett (2000: 68) puts it,

> *… Democracy cannot survive overpopulation. Human dignity cannot survive it. Convenience and decency cannot survive it. As you put more and more people into the world, the value of life not only declines, it disappears. It does not matter if someone dies. The more people there are, the less one individual matters.*

The right to procreate / reproduce is an important right which for a myriad of reasons would be almost impossible to overturn. However, as I have pointed out, it is possible to limit the number of offspring.

The problem is that when a right has been infringed upon (or it appears to have been infringed upon) it goes beyond the law in debating the interpretation of the right in question. In an open democratic society, a court is not able to decide in abstract. Rather, clear evidence must be presented which determines why changes should be made. Such facts or evidence still must be “reasonable and justifiable in an open and democratic society based on human dignity, equality and freedom” (Currie and de Waal 2006: 167-168).

That being said, I suggest that in the current context of South Africa it is highly unlikely that those in political power would consider educating people concerning the environmental and social necessity of a smaller and better-distributed population.[11]

3.1 The right to access sufficient water

South Africa is the only country in the world where the right of access to sufficient water is embodied in its Constitution. Section 27(1)(b) of the Constitution states that everyone has the right to have access to sufficient water. Section 27(2) requires the State to take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of the right. In addition, the South African Constitution provides for "an environment that is not harmful to health and well-being."

This right is fulfilled by the duty of government to provide for the minimum standards that define a non-harmful environment by way of

[11] Perhaps it is because e.g. the democracy is new, still bound to past political oppressions, that the South African society is increasingly split in economic terms (viz. children provide for parents in old-age), and that religion / belief systems would reject the notion.

legalization.

This right is specified in Section 24 of the South African Constitution:

"Everyone has the right …

(a) to an environment that is not harmful to their health or well-being; and,

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that;

(i) prevent pollution and ecological degradation

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Historically, water issues have been associated with contentious legal approach of ownership in addition to rights relating to its use. Over the last 100 years, the legal status of water in South Africa has evolved with law and judicial reforms. Previously, emphasis was put

on the distinction between privately and publicly owned water; the former owned by the landlord and the latter by the state dating back to the 1912 Water Conservation Act. All this has now changed with the Constitutional order because in terms of the National Water Act 38 of 1998, water belongs to all the people of the nation since it is a natural resource (Pienaar and van der Schyff 2007:181-183).

As previously mentioned, population size, growth rates and density are important as they effect and affect environmental resources such as water bodies, forests, and air. As the population increase and settle (particularly in urban areas), more demand is put on the environment and its resources.

One of the main tasks of the authorities is to ensure access of all South Africans to enough water to meet their basic human needs and ensure that water systems are preserved. “Water should constitute an untouchable reserve” (Jooste and Claassen 2001:283).

Unfortunately, the significance attached to water and other environmental resources are largely for anthropocentric reasons and benefit. So, a question arises, Is it possible to have a sustainable environmental policy that only favors one kind of biota (humans) but

whose activities are implicated in much of the changes in the environment? Even the relevant Act responsible for the protection of the environment does not spell out the intrinsic importance of environment for its own sake but for the benefit of human kind; for example 'sustainable, equitable and efficient use'.[12] [13]

Jooste and Claassen (2001:283) argue that; "the terms 'use' refers not only to consumption and recreational use, but also to discharge of anything that may affect, inter alia, the sustainability of use." Given the current human population in the Republic and the projections of its future growth, the current state of water resources and climate change, we may expect that activities are likely not to ensure a sustainable use of water and so environmental degradation is likely to continue.

Even then, the issue remains that the importance attached to the

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[12] See: the National Environmental Act 69 of 2004, of South Africa. Section 11 especially (j) and (l) "… the sustainable use of indigenous biological resources ..."

[13] "Integrated water resource management is a process for co-coordinated planning and management of water, land, and environmental resources. It takes into account the amount of available water (surface and groundwater), water use, water quality, environmental and social issues as an integrated (combined) whole to ensure sustainable, equitable and efficient use …"

integrity of the environment is tagged to the benefits that humans derive from it. These policies are largely anthropocentric and yet if we are aware of the complex systems necessary for human survival (in which the integrity of ecosystems is a major factor), these policies need to have an ecocentric tone in design and implementation.

Certainly, it may be arguable that the best approach to managing the environment properly is one that reflects environmental justice, respect for all life, and respect for bio-diversity.

Sections 12 .2 & 27.1 of the Bill of Rights refers to human reproductive rights, 27(b) of the Constitution's Bill of Rights addresses the right of access to water and under section 24, the right to a healthy environment is stated. The reasons for inclusion of these rights are that the results of doing so represent good for humankind. For example, Section 24(b) states, in part, that "to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that…" Then the dilemma remains regarding having these human rights realized for their own sake but to also ensure environmental sustainability. The problem is finding the right balance; that is

protecting the environment and yet not to infringing on the basic rights as stipulated in the Constitution.

The main hindrance could be sentiments that are based on the restrictions of access to water that the majority South African faced during the apartheid. This is not to say that there is any wrong in having the right of access to water, however the issue is how well the right can be realized in view of increasing human population numbers and consumerist practices and yet not harm the environment.

The right to access water entitles each South African to sufficient, safe, acceptable, physically accessible, and affordable water for personal and domestic uses. This right does not infer that the water has to be provided without cost to the consumer. Rather, it should be availed at a rate affordable to the most disadvantaged members of society. In addition, the water should be of good quality, free from elements that might harm a person's health. It is recommended that a minimum quantity of approximately 50–100 litres per person per day be availed every individual.

The right to water is a prerequisite for the realization of other human

rights, including the right to the highest attainable standard of health and the rights to adequate housing and food (HRDF 2009).

In South Africa, the National Standards and Measures to Conserve Water DWAF (2001) recommends provision of enough water defined as basic water supply as follows 25 litres per person per day or 6000 litres per household per month. This is derived from the right as provided for by the Constitution of the Republic of South Africa: Section 27(1)(b) of the Constitution states that everyone has the right to have access to sufficient water.

Water is essential for all forms of life and health of humankind – but water is finite. It is probably impossible to realize these rights in light of ever-increasing population sizes and yet be able to protect the environment. In addition, given that the Constitution is the supreme law in the country, it is arguable that the unalienable human rights enshrined therein should always take precedence over any concerns for the environment.

Since access to water is a basic right as enshrined in the Constitution, it implies that the state has an obligation to avail all its citizens with access to water irrespective of where they live or their

ability to pay for the service.

Based on this, it is conceivable that individuals could take legal action against the state if water access is denied. According to Section 1 of the Water Services Act of 1997, basic water supply is defined as; "the prescribed minimum standard of water supply service necessary for the supply of sufficient quantity and quality of water to households, including informal households, to support life and personal hygiene."

This was tested in a landmark ruling in 2006 in a court in South Africa in which it was determined that inability to pay is not a good enough reason to disconnect someone's water supply. In its ruling, the courts determined that every household must be provided with a minimum of 50 litres of water per day, (increased from earlier ruling of 25 litres) even if they cannot afford it (Conteh and Khalfan 2008).[14]

The challenge is realizing these rights despite increasing demand of clean water as population and industry requests rise and at the

[14] See also DWAF (2001). Paragraph 3S, Regulations Relating to Compulsory National Standards and Measures to Conserve Water.

same time protect ecosystems and biological diversity as envisaged in the Water Act.

These are rights at variance. The human population cannot exist without sufficient clean freshwater-while humans hold the unbridled right to and continue to reproduce at will.

Chapter 4. Ethics and the Environment

A very Faustian choice is upon us: whether to accept our corrosive and risky behavior as the unavoidable price of population and economic growth, or to take stock of ourselves and search for a new environmental ethic.

E. O. Wilson

The environment is defined as the "natural world in which people, animals and plants live" (Oxford Dictionary 2006:490). From an environmental ethics point of view, the definition would include the non-living environment here on earth and the atmosphere. Anything that harms the environment has an effect on all living organisms-including humans.

> *For man, the environment is instrumental and auxiliary though fundamental and necessary (Rolston III 1991).*

Ethical issues regarding environmental matters are most often punctuated with and hijacked by political concerns of the different parties involved in the interest of the citizens of their respective nations yet inability to address these issues in their entirety risked

every life. The resolutions that are aimed at protecting the environment in many cases wind up reflecting anthropocentric interests rather than those that benefit the environment in itself. For example even when attempt are made towards conserving the environment, still the efforts are hijacked solely for the sake of human beings.

The Rio Declaration serves as a good example in which anthropocentric interests overtook the concerns of conserving the environment, yet the conference was dubbed the “Earth Summit” (Rolston III & Light 2003: 111). Issues of environmental concern such as ecological sustainability, and sustainable development contain a number of ambiguities and need to be resolved (Cairns 2004:182).

There are different schools of environmental concerns depending on the inclination towards either the environment (e.g. ecocentric, biocentric) or human beings (anthropocentric), with many shades of each in between. A fair and just environmental ethic, I suggest, would have to balance the needs of humankind as well as those of the environment; not just for the benefit of the former but for the

sake of the environment as having an intrinsic value.

So then an argument can be justified if it favors restricting human reproduction to save the situation, since in today's world of welfare states under the United Nations campaigns to feed everyone, efforts may result into detrimental effects on the environment if human population growth is not checked. It is these same international bodies that send apparently contradictory signals when their guidelines fail to clearly pronounce themselves on such issues as population explosion as well give guidance on how to end it. Yet still, the reproductive rights are more likely to take precedence over environmental rights.

According to Norton (2003:164), there are certain kinds of human behaviour that a destructive to the environment, such as "improper waste management, overpopulating the earth with humans, destruction of other living species, and pollution."

A true environmental ethic should be concerned with the integrity of nature and well-being of other biota for their own sake. However, as

Taylor 2003:74 [15] argues, humans have a deontological responsibility:

> *"…to protect the integrity of the natural ecosystems, preserve the endangered species, and avoid pollution…"*

Whereas it is difficult to argue for rights of ecosystems in their natural form since rights go with responsibilities, duties, and claims, it is expected of humans to conduct themselves in a morally acceptable way.[16] Taylor seems to agree however that as much as it is difficult to ascribe rights to the non-human environmental entities, it is acceptable that are given a moral value from moral agents

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[15] Taylor argues that from the life-centered theory of environmental bioethics, humans have a duty that are 'prima facie moral obligations' owed to the other members of the Earth's biotic communities such as wild animals and plants.

[16] Rolston III 2003: argues that; "[the use of the language of] rights is a way of celebrating and guarding what is essentially human"; they protect certain human values thought especially important." Rights, he argues are used to protect values that are inseparably entwined with personality.

(human beings).

On the other hand however, there are ethical principles that exclusively human-centred. Take for example what Rahaman and Varies (2005) consider as the six universal ethical principles that are directly acceptable to the issue of water, namely:

"The principle of human dignity: there is no life without water and those to whom it is denied are denied life. The principles of participation: all individuals especially the poor and women must be involved in water planning and management.

The principle of solidarity: water continually confronts humans with their upstream and downstream interdependency.

The principle of human equity: taken to mean rendering to all persons their due and which describes perfectly the challenges in river basin management today.

The principle of the common good: water is a common good and without proper water management human potential and dignity are diminished for all and denied to some.

The principle of stewardship: much of water management is about finding an ethical balance among using, changing and preserving our water resources and land."

These principles are clearly based on an anthropocentric approach to environmental ethics.

Opposing this view, ecocentrism is a theory of environment ethics that is concerned with the integrity and well-being of the natural ecosystem for their own good and sake. From this point of view, efforts to conserve water should be aimed primarily at e.g. the preservation of the good wellbeing of freshwater and marine ecosystem for their own sake, and not just for that of human beings. This is to say that these entities have a moral value and should be accorded some form of consideration that ensures their existence and protection from degradation (Taylor 1986). This human responsibility to the environment should be *prima facie.*

Arguably, it may not be possible to preserve ecosystems in there natural form especially given the growing population sizes but necessary steps should be taken towards conservation. Degradation of waterways and pollution of freshwater is contrary to the obligation

that I suggest human beings have towards the environment. Once again this can be attributed to rights enjoyed by humans, specifically in this case, property rights whereby a property owner my not find it strange to dispose of waste into a steam that flows through their property, at a point where such owner views the water in the stream as their property (Hardin 1995: 332). There are obvious reasons why human beings have failed to fulfill this obligation. These include unchecked population growth, wasteful consumption habits, and greed.

According to Hardin (ibid: 331), human growth must stop at point in time because the world being finite can only support a finite population. This population in addition has to in some way to adjust the wasteful use of diminishing resources. Furthermore, the problem of population growth can not be solved by technical methodologies, especially as the people responsible for addressing the problem are "…trying to avoid the evils of overpopulation without relinquishing any of the privilege they enjoy."[17]

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[17] Hardin (1995:330) further argues that the population growth problem is a dilemma that has no technical solution.

Globally, there is a growing realization that there is declining availability of clean freshwater. This is partly because of climate change leading to perennial droughts in some region; in addition to large numbers of human beings meant to share dwindling supplies. As population, sizes grow and exceed the carrying capacity of the area, the environment and resources are pressured by consumption of material resources. In addition, people all over the world have become steadily richer over the last few decades. Furthermore, monetary wealth has increased, so have consumption and therefore a need for more resource utilization.

Hardin (1995) acknowledges that some are taking more than their fair share of the earth's resources by having too many children. "If we want to keep the rest of our freedoms we must restrict the freedom to breed." This is likely impossible because again it would be in contravention of Universal Declarations and in South African situation, Constitutional rights. Decisions and choices regarding reproduction and family size must rest on individual choice.

However, Hardin raises the point that it is wrong not to question such declarations if they are found to be inconsistent with the state

of the world: “freedom is the recognition of necessity” (ibid: 335).

The ultimate solution to water and other environmental problems lies in curbing human population growth as well as a global shift in consumer practices. Stabilization of human numbers, a possibility within the next forty years, would dramatically improve the prospects for saving wild species and the ecosystems in which they live and evolved (Cincotta, et al. 2000). This preferably should go hand in hand with a change in our approach to environmental management from monolithic to holistic approach.

Enlightened anthropocentrism as an environmental ethic, exposed by Norton (1983: 139; 2003: 163) recognizes amongst other points that grossly overpopulating the world with humans is a human behaviour that can or could damage the environment (ibid).

How then do we approach this much-needed control of population numbers and activities? In the South African context, it would violate the human rights that are enshrined in the Constitution of the Republic. Perhaps to begin with, the masses need to be educated about these issues, and then the people can understand that it is imperative that some changes be effected.

Cousteau (Quote cited by Wooldridge, F 2009) argues that;

> *We must alert and organize the world's people to pressure world leaders to take specific steps to solve the two root causes of our environmental crises - exploding population growth and wasteful consumption of irreplaceable resources. Over-consumption and overpopulation underlie every environmental problem we face today.*

Slowing population growth would help improve living standards and would buy time to protect natural resources. In the end, to sustain higher living standards, world population size must stabilize especially in the developing world where growth rates are still high (Frejka 1981:1). There must be a balance between the demand and supply of the available natural resources to ensure sustainability of the ecosystems and biodiversity. This balance must be approached in various ways including reassessing the rights enjoyed by human kind at the expense of biotic and non-biotic environments. In taking an environmentally sensitive approach to human population growth, the task should be to stabilize and then reduce population because it

drives the extinction of species, destruction of ecosystems, and production of greenhouse gases. Population growth is population growth whatever its source, whatever its cause, wherever it happens (Foreman 2007). According to Cairns (2004: 174), the decision to control population growth may be an emotional one but it is the kind that has to be made ultimately.

Unfortunately, environmental conservation is generally considered a low priority compared with meeting the needs of a rapidly growing population for jobs, food, housing, health and education. This in turn reflects widespread misunderstanding of the important role of healthy ecosystems in sustaining a growing population. One of the obstacles to is the political intonations and connotations that accompany population (birth) control.

While population growth has slowed, the absolute number of people continues to increase. This argument is not popular with religious groups who are against contraception. Those in the developing world could argue that population size is not a problem while pointing a finger at the United States, which contributes 25% of the world's carbon dioxide emission, yet its population is approximately

5% of the world's total population (EIA 2006). This is true, yet spite of these considerations; I suggest that Norton's (1995) idea of an enlightened anthropocentric ethical approach to environmental matters has great merit. This is because while he retains the intrinsic value of human beings, he does not place this as his first principle. Rather, his focus is on what is in the *best interests* of humans. It is in the best interests of human beings to survive and we cannot survive without the Earth and all her bounty.

An enlightened anthropocentric ethics**,** Norton argues, asks us to recognize the moral validity of our preferences and move from felt preferences – our desires - to 'considered preferences' (ibid: 183).[18] We can move from our felt preferences and enlighten them. For Norton and others, environmental education is the key. Ideally, this education should be followed (or accompanied by) personal and collective action, a type of activism geared to heighten the awareness of environmental problems in order to influence the political will to elicit positive change. In these times where natural

[18] These are roughly our basic needs.

resources are dwindling and ‘we need more constructive or revisionary thought to exceed, liberate, and craft a synthesis of modern and premodern truths and values, nothing is more important than environmental ethics education’. Following Norton (ibid: 191), this would be framed as an enlightened rational worldview of ideals in which felt preferences may be criticized and the values and principles regarding the human species’ relationship to nature are established.

Concluding Remarks

The world has witnessed a population explosion in the last three decades, which was thought would trigger widespread famine but thanks to the 'green revolution' the threat was diverted but at an enormous price to water resources.[19]

There is a growing realization that sheer numbers of humans inhabiting the earth are detrimental to environmental resources and the ecosystems. Slowing of human population growth is one of the most hopeful avenues among others that can be use to change the global trends affecting our complex physical environment. The stabilization of human numbers, a possibility within the next forty years, would dramatically improve the prospects for saving wild species and the ecosystems in which they live and evolved (Cincotta, et al. 2000).

It is not possible that one can fail to notice the pressure exponential

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[19] For example, massive irrigation schemes that have left some fresh water bodies completely decimated (Pearce 2009:33-35).

increase in population has on the environmental resources and the demands for more energy supply. Despite the possible objections against such proposals, it is clear that some kind of control or stabilization of population growth is necessary and the sooner the better. Family planning programmes supported by the political and civil establishments could go a long way in stemming un-controlled population growth. For these programmes succeed nevertheless they need political backing. Other various ways have been suggested through which the water demand and supply problems can be addressed. According to PIP (1999), “The world needs a Blue Revolution to conserve and manage freshwater supplies in the face of growing demand from population growth, irrigated agriculture, industries, and cities - just as the Green Revolution transformed agriculture in the 1960s. A Blue Revolution will require coordinated responses to problems at local, national, and international levels.” This is especially true in the harmonization management of international water-basins. Another option though a very costly one is desalinization of seawater so that it is available for utilization (domestic and industrial).

Efforts should also include preventing the spread of HIV/AIDS since

it has a multi-faceted relationship with freshwater. In home-based care and in healthcare facilities, demands for freshwater are high due to the sheer numbers of people infected with HIV associated diseases. A suppressed immune system and contaminated water contribute to disease acquisition. Water, hygiene and sanitation services are vital to public health initiatives. In addition, national governments need to prioritize environmental issues as matters of national security. Education and advocacy against wastefulness aimed at proper use, preservation and efficient use of water as well as proper waste management are key environmental educational objectives. Consideration should be made to review the current Universal and Constitutional rights afforded humankind if fulfilling them produces more overall harm than help. Specifically the Sections of the Constitution that are concerned are Sections 12(2), 27(1) and Section 27(2).

The Word Health Organization (2000) and the United Nations Environmental Program (1999) suggest water as a resource can be best managed in the following ways;

- Policymakers need to determine how to supply water

without degrading the natural ecosystems that provide it.

- Existing low-tech approaches can help prevent scarcity, as can ways to boost supplies, such as improved methods to desalinate water.
- Governments at all levels need to start setting policies and making investments in infrastructure for water conservation now.

Gore (2006: 305-311) tells us that each of us can do something to change the current trend of global environmental and climate changes. Such efforts and contributions would include ways aimed at conserving expenditure of energy for example; use of energy saving equipment and home appliances, have unnecessary lights switched off, use of public transport instead of self – chauffeured cars, that is "get around on less." But he does not involve himself in a deep discussion concerning human population growth.

The South African government can reverse the trend in water degradation and the pending scarcity by among others by e.g. promoting the advantages of having smaller families, stopping wastefulness, and reviewing the relative laws in the context of the environmental crisis we face today. Education concerning the value

of nature should be a requisite for all human beings. It is important that all people are aware that we do not exist alone as a species. Rather we are all a part of larger networks of living things and all that exists is albeit in different ways connected.

Population issues are not only demographic. They also involve economics, the environment, politics, laws, policies and values. Rights are vitally important for the protection of the most vulnerable of our species. But the insistence of separating human rights from environmental reality I suggest is risky. The rights given to humans as far as reproduction go and the right to a healthy environment are at variance.

What we should strive for is to ensure the quality of human life, and to be knowledgeable about what it means to take part in and existence that is both human and nature. We should strive for an enlightened anthropocentric view and have the foresight to realize that not all of our rights can be realized. We should recognise that that we are bound up in the lives of other living things, dependent for our survival on our environment, and to realize we are all connected in Earth's complex systems.

References

- (AAS) Australian Academy of Science. 2005. *Population and the Environment: The Global Challenge.* (Accessed June 2008). Available at http://www.infofohealth.org/pr/m15edsum.shtml

- Abrams, L. 2000-2001. Water scarcity. *Water Policy International.(*Accessed June 2009.) Available at:http://www.africanwater.org/drought_water_scarcity.htm

- Abramovitz, 1996. *Imperiled waters, impoverished future: The decline of freshwater ecosystems*. Washington, D.C. Worldwatch Institute: 5-66.

- Ashton, P.J. 2000. Southern African water conflicts: are they inevitable or preventable? In: *Water Wars: Enduring Myth or Impending Reality*. H. Solomon & A.R. Turton (Eds), Africa Dialogue Monograph Series No. 2, The African Centre for the Constructive Resolution of Disputes (ACCORD), Durban, South Africa: 62–105.

- Aylward, B.A. & Barbier, E.B. 1992. Valuing environmental functions in developing countries. *Biodiversity and Conservation,* 1: 34-50.

o Barrow E. & Jeanrenaud, S. 2008. *Linking Conservation and Poverty Reduction: Landscapes, People and Power.* (Accessed June 2009) Available at: http://www.iucn.org/what/livelihoods/?uNewsID=22002009

o Bartlett, AA. 2000. Democracy cannot survive overpopulation. *Population and Environment,* 22 (1): 63-71.

o Bayles, M. 1976. Limits on the right to procreate. In: *Ethics and Population.* M. Bayles (ed.) Cambridge MA: Schenkman Publishers.

o Black, R. 2009. *Water - another global 'crisis'?* Environmental Law Prof Blog: Access to water and sanitation is the largest driver of human development. (Accessed June 2009). Available at: http://lawprofessors.typepad.com/environmental_law/2009/02/access-towater. html

o Borlaug, NE. 2004. Perspectives in world food and agriculture 2004. In: C. G Scanes & J. A. Miranowski, (eds*). Feeding a world of 10 billion people: our 21st century challenge.* Des Moines: Iowa State University Press.

o Cairns, J. Jr. 2004. Sustainability Ethics. World Population

Growth and Migration. *Mankind Quarterly,* 45 (2).

- Cairns, J. Jr. 2001. *How many people will nature permit? Ethics in Science and Environmental Politics.* Blacksburg. Virginia Polytechnic Institute and State University. 169-194.

- Callicott, J.B. & da Rocha F. Jr. (eds) 1997. *Earth Summit Ethics.* Albany: State University of New York Press

- Camlin, C. 2008. *Gender, Migration & HIV/AIDS. An Africa Centre Research Report.* (Accessed June 2009). Available at: http://www.africacentre.ac.za/Umbiko/Issue10JanJun2009/CarolCamlinGenderMigrationHIVAIDS/tabid/152/Default.aspx

- Carius, A. Debelko, G. D, Aaron, T.W. 2005. *Water, Conflict, and Cooperation.* (Accessed July 2009.) Available at: http://www.wilsoncenter.org/news/docs/carius_Debelko_wolf.pdf.

- Chenje, M., Chivas, M., King, A.S., et al. 2002. *Wetlands for agricultural development : A FAO document.* (Accessed May 2009). Available at: http://www.fao.org/docrep/003/X6611E/x6611e02b.htm

- Chenje, M., Chivas, M., King, A.S., et al. 1996. *Water in*

Southern Africa. A report by SADC, IUCN, and SARDC. M. Chenje and P. Johnson (eds). Geneva: United Nations Environmental Protection Agency Publication.

- Cincotta, RP., Wisnewski, J. & Engelman, R. 2000. Human population in the biodiversity hotspots. *Nature, 404*: 990–992.

- City of Johannesburg. 2009. Flora Mokgohloa: making Jozi greener. (Accessed August 2009). Available at: http://www.joburg.org.za/content/view/972/131/#ixzz0V8ymZAWu

- Coleridge, S.T. [1798] *The Rime of the Ancient Mariner.* (Accessed August 2009.) Available at: http://etext.virginia.edu/stc/Coleredge/poems/Rime_Ancient_Mariner.html

- Collier, P., Conway, G, Venables, T. 2008. Climate change and Africa. *Oxford Review of Economic Policy,* 24(2):337-353.

- Conteh, S and Khalfan, A. 2008*. Analysis of the Judgment of the High Court of South Africa in the pre-paid water meter case. Summary of Judgment delivered 30/4/ 2008.* (Accessed June 2009). Available at:

http://www.cohre.org/store/attachments/RWP%20%20PHIRI%20CASE%20ANALYSIS%202%20May%2008.pdf

- Constitution of the Republic of South Africa. 1996. (Accessed May 2007) Available at: www.info.gov.za/documents/constitution/index.htm

- Cousteau, J-Y. (Quote cited by Wooldridge, F.) 2009. Serious realities we face as a civilization. (Accessed July 2009) Available at: http://www.australia.to/index.php?option=com_content&view=article&id =10053:serious-realities-we-face-as-a-civilization&catid=125:frostywooldridge&Itemid=244

- Crawford, R.J.M. & Barnes, W. 2000. Marine renewable resources, ecosystems and marine culture. In: L.Y., Shackleton, S.J. Lennon, & G.R. Tosen, (eds). *Global Climate Change and South Africa.* Cleveland, OH: Environmental Scientific Association Publishers.

- Cull, P. 2009. Sewage plants exceeding treatment capacity. *The Herald.* (2009/07/28) (Accessed August 2009). Available at: http://www.epherald.co.za/article.aspx?id=448697

o Currie, I., and de Waal, J. 2006. *The Bill of Rights Handbook.* Cape Town: Junta Publishers.

o (DEAT) Department of Environmental Affairs and Tourism (RSA) 1999. *National State of Environment Report 1999.* Pretoria: South African Government Press.

o (DEAT) Department of Environmental Affairs and Tourism (RSA). 2005. *State of the Environment: Population Growth.* Accessed June 2009. Available at: http://soer.deat.gov.za/themes.aspx/m=332#

o De Sherbinin, A. 2006. *Water and population dynamics: Local approaches to a global challenge.* American Association for the Advancement of Science (Accessed May 2009) Available at: http://www.aaas.org/international/ehn/waterpop/

o Dompka, V. 1996. *Human population, biodiversity and protected areas: science and policy issues.* American Association for the Advancement of Science (AAAS). (Accessed May 2009) Available at: http://www.aaas.org/publications/

o (DWAF) Department of Water Affairs and Forestry. 2003. *Guide to the National Water Act, 15 of 1998.* DWAF: Pretoria.

o (DWAF) Department of Water Affairs and Forestry 2001. National Standards and Measures to Conserve Water SA. *Government Gazette.* Available at: www.info.gov.za/documents/regulatory

o (DWAF) Department of Water Affairs and Forestry 2001. Regulations Relating to Compulsory National Standards and Measures to Conserve Water. *Government Gazette.* (Accessed June 2009). Available at: www.info.gov.za/documents/regulatory

o (DWAF) Department of Water Affairs and Forestry. 2001. Guide to the National Water Act, 15. *Government Gazette*. (Accessed June 2009). Available at: www.info.gov.za/documents/regulatory

o Department of Energy (USA). (EIA) *Energy Information Administration News (USA).* 2006. (Accessed June 2009). Available at: http://www.eia.doe.gov/environment.html

o Egboka B. C. E., Nwankwort, G. Orajaka, P. et al. 2007. Principles and Problems of Environmental Pollution of Groundwater Resources with Case Examples from Developing Countries. *Environmental Health Perspectives,* 83: 39-68.

o Falkenmark, M. 1990. Population Growth and Water Scarcity:

The Predicament of Tomorrow's Africa. *Population and Development Review,* 16 (Supplement): 81-94.

- Falkenmark, M. 1993. Water scarcity: Time for realism. *Populi,* 20(6): 11-12.

- Falkenmark, M. & Widstrand, C. 1992; Population and water resources: A delicate balance. Population Bulletin, 47(3): 1-36.

- (FAO) United Nations Food and Agricultural Organization. *Focus on Lake Chad*. (Accessed June 2009). Available at: http://www.fao.org/nr/water/news/chad.html1990

- Fisher, R. Jeanrenaud, S. Maginnis, et al. 2008. *Landscapes, People and Power.* NY: Earthscan Publishers.

- Frejka, T. 1981. Population Dynamics and Prospects. Assessment for Jamaica. Population Council (New York): The Council.

- Gardner-Outlaw, T. & Engelman, R. 1997. *Sustaining water, easing scarcity: A second update*. Washington, D.C.: Population Action International: 2-19.

o (GEO) UNESCO Global *Environmental Outlook 2009. Water in a Changing World – The United Nations World Water Development Report 3 :2.* Geneva: United Nations Environment Programme

o (GEO) UNESCO Global Environmental Outlook 2000. *The State of the Environment.* Geneva: The United Nations Environmental Programme (UNEPA) publication.

o (GEO) UNESCO Global Environment Outlook. 1999. *The state of the environment; freshwater.* United Nations Environment Programme. (Accessed April 2009) Available at: http://www.who.int/heli/risks/water/water/en/index.html

o Gleick, PH. 1996. Basic Water requirements for Human activities: Meeting Basic needs. *Water International*, 21: 83-92.

o Goodenough, P. 2009. *China Says 'One Child' Policy Will Be 'Strictly Enforced For Decades'* . (Accessed September 2009) Available at: http://www.cnsnews.com/Public/Content/article.aspx?RsrcID=51762

o Gore, A. 2006. *An Inconvenient Truth: The Planetary Emergency of Global Warming and what we can do about it.* New York: Rodale

Books: 305 – 311.

- Gostin, L. 2000. *Public Health Law: Power, Duty, Restraint.* New York and Berkeley, California: Milbank Memorial Fund and University of California Press.

- Hardin G. (1968) 1995. The tragedy of the commons. In: *People, Penguins and Plastic Trees*. C. Pierce and D. Van DeVeer (eds) NY: North Carolina University Press: 330-328.

- Hardin G. 1971. The survival of nations and civilizations. *Science,*

- 172 (3990):1297.

- Hardin G. 1974. Living on a lifeboat. *BioScience,* 24(10):561-568.

- Hardin G. 1976. Carrying capacity as an ethical concept. *Soundings,* 59:120-137.

- Hunter, L., 2008. Environmental Implications of Population Dynamics 'A complex relationship' Population and Environment. In: *Population Matters* (RAND monograph/report) (Accessed February 2009). Available at: http://www.rand.org/popmatters.

o Huitema, D., E. Mostert, W. Egas, S. et al. 2009. Adaptive water governance: assessing the institutional prescriptions of adaptive (co-) management from a governance perspective and defining a research agenda. *Ecology and Society,* 14(1): 26. (Accessed March 2008). Available at: http://www.ecologyandsociety.org/vol14/iss1/art26/

o Hinrichsen, D., Robey, B., & Upadhyay, U.D. 1997. Solutions for a Water-Short World. *Population Reports*, Series M (14). Baltimore: Johns Hopkins School of Public Health.

o Hunter, P.R., Colford J.M., LeChevallier, M.W. et al. 2000. (Panel) Waterborne Diseases Panel Summary from the 2000 *Emerging Infectious* Diseases Conference in Atlanta, Georgia. *Emerging Infectious Diseases Journal*, Vol. 7 (3) Supplement. : 544-545. (Accessed June 2009). Available at: http://www.cdc.gov/ncidod/eid/vol7no3_supp/hunter.htm

o (IEM) Department of Integrated Environmental Management South Africa. *Consolidated Environmental Implementation and Management Plan 2008*. (Series).(Accessed June 2009). Available at: http://www.dwaf.gov.za/iem.asp

o Fisher, R. Maginnis, S., Jackson, W., et al. 2005. *Poverty and conservation: Landscapes, people and power.* Landscapes and Livelihoods Series. Gland, Switzerland. (via ECOLEX) (Accessed June 2009). Available at:http://www.ecolex.org/ecolex/ledge/view/RecordDetails;jsessionid=82D5AE711F1E1B9B5EB3B56DDE8D448C?id=MON073708&index=literature

o Jauro, A. 1998. *Lake Chad basin commission (LCBC) perspectives.* Presented at the International Conference of Water and Sustainable Development, (Paris Mar. 19-21, 1998): 1-7.

o Jooste, S & Classen, M. 2001. Rationale for an ecological risk approach for South African water resource management. *Water SA*, 27(3). (Accessed May 2009). Available at http://www.wrc.org.za

o Jury, W.A. & Vaux, H. 2005. *The role of science in solving the world's emerging water problems.* (Accessed May 2009). Available at: http://www.pnas.org/content/102/44/15715.full.pdf

o Judge, J. 2003. *Outrage at pollution of Lake Victoria.* (Accessed June 2009) Available at: http://www.iema.net/index.php.

o Kamenka, E. 1998. Human Rights, Peoples' Rights. In: H. J. Steiner, P. Alston, & R. Goodman (eds). 2008. *Internal Human Rights in Context.* Oxford: Oxford University Press.

o Kane, P. and Choi, C. Y. 1999. China's one child family policy. *British Medical Journal*, 319 (215): 992-994.

o Kingston, T. 2007. Climate change brings malaria back to Italy. *The Guardian Rome.(*January 6). (Accessed June 2008). Available at http://www.guardian.co.uk/guardian/environment/2007/jan/06/Italy.

o Leopold A. 1966. *A Sand County Almanac, with Essays from Round River*. New York: Ballantine Books.

o Lim, V., Stubbs, JW., Nahar, N., et al., Politicians must heed health effects of climate change. *British Medical Journal*, 339: b3672 . (Accessed April 2009.) Available at: http://www.bmj.com/cgi/content/full/339/sep15_1/b3672

o Liberatore , A. & Zilgalvis, P. 2008. *Water, conflicts and human rights: some reflections.* (European Union Governance and Ethics Directorate General). Brussels: The EU.

o Lonergan, S. & Brooks, D. 1994. Watershed: *The Role of Freshwater in the Israeli-Palestinian Conflict*. Toronto: International Development Research Centre.

o Lubick, N. 2009. Mass deaths of South Africa's Nile crocodiles puzzle biologists. *Science Magazine,* (Accessed October 2009). Available at: http://current.com/1ctqe4c

o Lurie, M., Williams, B., Zuma, K. et al. 2002. The impact of migration on HIV transmission in South Africa. *American Sexually Transmitted Diseases,* 43:149-156.

o Malthus, T. 1803. *An essay on the Principle of Population; or, a view of its past and present effects on human happiness; with an enquiry into our prospects respecting the future removal or mitigation of the evils which it occasions.* London: Plenium.

o (HRDF) *Human Rights Dilemmas Forum*. 2009. (Accessed July 2009). Available at: http://human-rights.unglobalcompact.org/

o *National Environmental Act 69 of 2004 of South Africa*. Pretoria. *Government Gazette*. (Accessed May 2009). Available at: www.info.gov.za/documents/constitution/index.htm

o NewsRx. 2006. *Water quality improvement needed for persons with HIV/AIDS in South Africa. (*Accessed June 2009) Available at: http://www.newsrx.com/newsletters/TB-and-Outbreaks-Week/2006-09-26/0926200633324TW.html

o Norton, B. 2003. *Searching for Sustainability*: *An Interdisciplinary Philosophy of Conservation Biology*. Cambridge University Press.

o Norton, B. 1995. *Towards Unity Among Environmentalists*. Oxford, UK: Oxford University Press.

o Norton, B. 1984. Environmental Ethics and Weak Anthropocentrism, *Environmental Ethics,* 6: 131-148.

o (OC) Ocean Conservation. 2009. *Coalition of 48 leading conservation organizations calls on the next administration to protect Oceans.* (Accessed May 2009). Available at: http://www.oceanfdn.org/index.php?ht=d/sp/i/390/pid/390English

o Omelaniuk, I. 2006. *Gender, Poverty Reduction and Migration*. World Bank Paper. (Accessed June 2009). Available at: http://siteresources.worldbank.org/EXTABOUTUS/Resources/Gender.pdf

o (P & P) People and Planet. *Environmental Conditions 2008-2009.* (Accessed January 2009) Available at : http://www.peopleandplanet.net/doc.php?id=223

o Patterson, K. 2008. *The Endless Drought: Water Conflict in the Era of Climate Change*. The Simson Organization, Washington D.C. (Accessed July 2008). Available at: http://www.stimson.org/pub.cfm?ID=631

o Payet R., Obura, D. 2004. The negative impacts of human activities in the eastern African region: an international waters perspective. *Ambio*, 33(1-2):24-33.

o Pearce, D. 1992. Green Economics. *Environmental Values,* 1 (1) :3-14.

o Pearce, F. 2008. *When the Rivers Run Dry*: Water-The *Defining Crisis of the Twenty-first Century*. London: Optima Publishers.

o Pienaar, G.J. & van der Schyff, E. 2007. *The* Reform of Water Rights in South Africa. *Law, Environment and Development Journal.* (Accessed Jan 2009). Available at: http://www.lead-journal.org/content/07179.pdf

o Pimentel, D. & Wilson, A. 2004. *World Population, Agriculture, and Malnutrition.* (Accessed June 2008). Available at: http://www.energybulletin.net/node/3834#

o (PIPa) *Population Information Programme. 1998.* The Johns Hopkins School of Public Health. Population Reports, 26 (1). Baltimore.

o (PIPb) *Population Information Programme. 1999.* The Johns Hopkins School of Public Health. Population Reports. Baltimore.

o Postel, SL, Daily, GC & Ehrlich, PR. 1996. Human Appropriation of Renewable Fresh Water. *Science,* 192: 785-788.

o Pullen, S and Hurst, P. 1993. *Marine pollution prevention. WWF background report*. Gland, Switzerland, World Wide Fund for Nature: 3-7.

o Rahaman, M. and Varies, O. 2005. *The Ethical Perspectives of Water: Dilemmas and Future Challenge*. Helsinki: Helsinki University of Technology.

o Raleigh, V. 1999. Population and health in transition. *British*

Medical Journal, 319: 981-984.

- Raz J. 1988. *The Morality of Freedom*. Oxford: Oxford University Press.

- Raz, J. 2001. *Value, Respect and Attachment*. Cambridge: Cambridge University Press.

- Republic of South Africa. Government Gazette 22355 2001. *Regulation Gazette* 7079: 432 (8 June)

- Rolston III, H. & Light, A. (eds). 2003. *Environmental Ethics.* Oxford: Blackwell.

- Rolston III, H. 1991. Values in and Duties to the Natural World. In: *Ecology, Economics, and Ethics: The Broken Circle.* F. H. Bormann & S. R Kellert (eds). New Haven, Conn: Yale University Press: 73–96.

- Rogers, P. 2008. Facing the Freshwater Crisis. *Scientific American Magazine,* (August): 23-29.

- Rijsberman, F. 2004. *The Water Challenge*. Copenhagen Consensus Challenge Paper. Environmental Assessment Institute.

(Accessed April 2008) Available at:

http://www.coppenhagenconsensus.com

o (SAWS) South African Weather Service 2005. *Climate Change.* (Accessed May 2009). Available at:

http://www.weathersa.co.za/References/Climchange.jsp

o Saywell, D. 2008. Poor outlook, good practice: Assessing urban sanitation from the viewpoint of the low-income user. ID21, *Research highlights* (5). (Accessed May 2008). Available at:

http://nt1.ids.ac/21/static/2bDS1.htm

o (SEEAW) System of Environmental-Economic Accounting for Water. 2006. *Integrated water resources management.* NY: Workshop Notes.

o South African Constitution. 1996. Chapter 2 *The Bill of Rights* (Last modified: 06 March 2008). (Accessed January 2008). Available at: http://www.gov.za.

o South African Government (Environment). 2003. Towards effective waste management *Government Digest*, 22 (12). (Accessed May 2009). Available at:

http://www.environment.gov.za/NewsMedia/Articles/2003Aug14/waste_management_14082003.html

o Speidel, J. 2000. Environment and Health: Population, consumption and human health. *Canadian Medical Association Journal,* 163(5): 551-556.

o Speth, JG. 1997. *The Bridge at the Edge of the World.* New Haven, CT: Yale University Press.

o Stiles, Geoffrey. 1996. Demand-side management, conservation and efficiency in the use of Africa's water resources. In: E. Rached, E. Rathgeber, E.D Brooks, (ed). *Water management in Africa and the Middle East: Challenges and opportunities*. IDRC Books, Ottawa, Canada.

o (International Development Research Centre [IDRC]):3-38. Also available at: http://www.idrc.ca/en/ev-31795-201-1-DO_TOPIC.html

o (SSD RW) Water Wise Education Team, Scientific Services Division Rand Water. 2009. *Water Resources*. (Accessed June 2009) Available at: http://www.randwater.co.za/CorporateResponsibility/WWE/Pages/W

ater situation.aspx

- (STATSA). Statistics South Africa 2008. *South Africa mid year population estimate 2006*. (May 2008) Available at: http://www.statssa.gov.za/publications/statsdownload.asp?PPN=P0302&SCH=4203

- Sym, S. 2008. Climate Change. Guest lecturer, Environmental Bioethics Unit. Lecture notes.)

- Taylor, P.W. 1986. Respect for Nature: *A Theory of Environmental Ethics*. Princeton: Princeton University Press.

- Tenywa 2009. *Egypt defiant over River Nile waters*. The New Vision (Uganda newspaper). Kampala. Tuesday, 28th July, 2009. (Accessed July 2009). Available at: http://newvision.co.ug/

- Turpie, J, Winkler, R. ,Spalding-Fecher, J. et al. 2002. *Economic Impacts of Climate Change in South Africa*: *A Preliminary Analysis of Unmitigated Damage Costs.* Accessed (May 2009). Available at http://www.fitzpatrick.uct.ac.za/pdf/turpie02.pdf

- Tshilo S. 2007. Water Pollution in Southern Africa. *Gibbs*

Magazine,(Harare, Zimbabwe).

- (UNDHR) United Nations Declaration of Human Rights. 1948. *The Universal Declaration of Human Rights.* General Assembly of the United Nations. (Accessed April 2007). Available at: www.un.org/en/documents/udhr/.htm

- (UNEPAa). United Nations Environmental Protection Agency. 2001. *Sustainable Development: Our Future at Stake* (Accessed June 2008). Available at: http://www.UNEPA.org/OurPlanet

- (UNEPAb) United Nations Environmental Protection Agency. 2000. *(AEO) African Environmental Outlook. Past, present and future perspectives*. (Accessed May 2009). Available at: http://www.UNEPA.org/dewa/Africa/publications/AEO-1/004.htm

- (UNEPAc). United Nations Environmental Protection Agency. 2000.*Water and War.* (Accessed June 2008). Available at:http://www.UNEPA.org/OurPlanet/imgversn/154/lonergan.html.

- (UNEPAd) United Nations Environmental Protection Agency. 1999. *Marine and coastal areas - state of the environment.* GEO-2000. Global Environment Outlook. Nairobi, United Nations

Environment Programme.

- (UNICEF) 2008. *Country information*. New York. (Accessed May 2009). Available at: http://www.unicef.org/county report

- (UN Habitat). United Nations Human Settlements Programme. State of World Cities Report 2008/ 09. (Accessed May 2009). Available at: 2008http://www.unhabitat.org/content.asp?cid=6040&catid=7&typeid=5&subMenuId=0

- (UNPD)United Nations Population Division. 2008. *World Population Report.* (Accessed May 2009). Available at: http://www.un.org/esa/population/publications/wpp2008/wpp2008_highlights.pdf

- (USBC) United States Bureau of Census Report 1995. National Center for Health Statistics. Washington D.C.: USBC publication

- van Bogaert, DCK. 2009. *Environmental Bioethics: A Reader*. Steve Biko Centre for Bioethics: University of the Witwatersrand.

- Van DeVeer, D. Pierce, C. 2002. *The Environmental Ethics and*

Policy Book: Philosophy, Ecology, Economics. NY: Wadsworth Publishing.

- Vaux, H, 2004. A U.S. water research agenda for The Twenty-First Century. *Environment*, 44(4): 32-43.

- Viski A. 2008. Joseph Raz: Legal Theory and Human Rights. (Accessed June 2008) Available at: http://andreaviski.blogspot.com/2008/04/josephraz-legal-theory-and-human.html

- Vörösmarty, CJ., Green, P., Salisbury, J. et al. 2000. Global Water Resources: Vulnerability from Climate Change and Population Growth. *Science,* 289 (5477): 284-288. (Accessed March 2008). Available at: http://www.sciencemag.org/cgi/content/full/289/5477/284

- (WAEA) Water Affairs and Environmental Affairs Portfolio Committee 2004. *National Water Resource Strategy: Parliamentary hearings*. (Accessed May 2009). Available at: http://www.pmg.org.za/minutes/20041011-national-water-resourcestrategy-hearings

o Water Services Act 108 of 1997. *Government Gazette.* (Accessed May 2009). Available at: http://www.info.gov.za/view/DynamicAction?pagied=545&sdate=%

o Water Services Act 2001: Regulations: Compulsory national standards and measures to conserve water. *Government Gazette.* (Accessed May 2009). Availableat:http://www.info.gov.za/view/DynamicAction?pagied=607&1d=0

o *Water Act 54 of 1956.* Adopted by the Traditional Government of National Unity of South Africa. (Accessed June 2009). Available at: http://www.mawf.gov.na/Documents.

o Watson, R.T., Patz, J., Gubler, D.J., et al. 2005. Environmental health implications of global climate change. *Journal of Environmental Monitoring,* (9): 834-843.

o Watts, S. 1997. *Epidemics and History*. London: Yale University Press.

o (WB) World Bank. 2000. *World Development Report 2000/2001.* Oxford, Oxford University Press.

o (WBCSD) World Business Council for Sustainable Development. 2009. *Water Facts and Trends*. (Accessed May 2009). Available at: http://www.wbcsd.org/DocRoot/lD1tMGiLZ7NL9mBOL2aQ/WaterFactsAndTrends-Update.pdf

o (WCU) World Conservation Union. 2005. *Population dynamics and the environment.* (Accessed June 2008). Available at: http://cms.iucn.org/about/work/programmes/social_policy/sp_themes/sp_themes/index.cfm.

o Wellman, C. 2005. *Medical Law and Moral Rights.* Netherlands: Springer.

o White, GF., Bradley, DJ., & White, AU. 1972. *Drawers of Water*: *Domestic Water use in East Africa*. Chicago: University of Chicago Press.

o (WHO) The World Health Organization. 2002 *The World Health Report* : *Reducing Risks, Promoting Healthy Life.* Geneva, World Health Organization.

o Wiggins, S. 2000. Interpreting Changes from the 1970s to the 1990s in African Agriculture Through Village Studies. *World*

Development, 28 (4): 631-662.

- Wilson, EO. 1973. (Quotation – population issue). (Accessed May 2008). Available at: http://www.brainyquote.com/quotes/keywords/population.html#

- Xie, W. Z. Liua, D. J. Hunsaker, Y. S. et al. 2002. Interrelations of yield, evaporation, and water use efficiency from marginal analysis of water production functions. *Agricultural Water Management,* 56(2): 143-151.