AN AGE OF THIRSTY PEOPLE: EXPLORATORY NOTES ON FUTURE WATER-SCARCITY AND WATER CONFLICTS IN SUB-SAHARAN AFRICA

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1. INTRODUCTION

Signs that our planet is starting to run up against the limits of available fresh water, are evident in many parts of the world. During the previous century, demand for fresh water has grown twice as fast as human population growth - largely because of the Green Revolution in agriculture and rising living standards for many of the planet's people. At the turn of the century, a number of regions were entering a period of chronic water shortages, including much of Africa, northern China, pockets of India, Mexico, the Middle East and parts of western North America. Predictions are made that if nothing is done, two thirds of humanity will suffer from a moderate to severe lack of fresh water by the year 2025 (Sadeq 1999:18). Depending on the outcome of varying demographic scenarios, several countries are facing the difference between potentially manageable water stress and outright water-scarcity by the year 2025.

At the end of the previous millennium, some 26 countries globally were considered to be "water-scarce" - i.e. countries with less than 1 000 cubic meters of water available to each person per year (Robbins 1998:2). Increasing droughts, in the wake of global warming, could well intensify water shortages. It is believed that droughts that currently have only a 5% frequency, may increase to 50% by 2050 (Myers & Kent 1995:42). In Africa in particular, water is likely to become the most pressing issue in decades to come as droughts and a rapid growing human population join forces to deplete available fresh water resources.

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In the arid realm, prevailing water-scarcity and recurrent drought aggravate the competition over water supplies between the various water use sectors. During the Sahel[3] drought of the early 1970s - caused, amongst others, by heavily overgrazing - communal clashes frequently occurred when migrating headsmen disregarded national boundaries and grazed their herds on arable farmers' lands. Such conflicts are becoming more frequent in the entire sub-Saharan Africa region. The 1996-7 drought in Kenya, for instance, was associated with increased insecurity due to inter-clan/tribe cattle rustling, as well as conflicts over limited pastures and water resources within some dryland locations (Ogallo 2000:57). Suffice it to say that in the future, as demand increases and resources become scarcer, water will increasingly become the limiting factor in social and economic development across the subcontinent. Water is a regional political issue in Southern Africa due to the fact that about 70% of the region's total surface water supplies is shared between two or more countries (SADC 2000). Little wonder that competition is heating up between countries, between different users within regions, and between human beings and nature. The potential for conflict in many regions across the world is so serious that the United Nations Commission on Sustainable Development dedicated its annual meeting in 1998 to discussions on how to avoid a freshwater crisis.

Arising from the above considerations, the intent of this article is to reflect on the vulnerability of sub-Saharan Africa - and that of southern Africa in particular - as one region that is particularly prone to conflicts emanating from and instigated by increasing water shortages. Amongst others, the social and environmental factors that exacerbate the vulnerability of the region are elucidated, as it is argued that any strategy(ies) aimed at mitigating the threatening water crisis is inextricably intertwined with solutions to the socio-economic and environmental problems of the region. Before the situation in sub-Saharan Africa is analysed, however, it is necessary to briefly contextualize the international scene with respect to water-scarcity.

2. WATER-SCARCITY AS AN EMERGING INTERNATIONAL CRISIS

Theoretically the earth possesses enough freshwater resources to sustain life on a global level. With the annual worldwide withdrawal of water amounting to slightly more than 4 000 km^3, when compared with the annual renewable supply available in rivers and streams of 12 000 -14 000 km^3, humankind does not seem to be consuming water in an unsustainable manner (Ohlsson 1995:6). However, global statistics are misleading and do not take account of the unequal distribution of freshwater resources, leaving the world in what Miller (1996:455) defines as water

[3] The Sahel is a string of countries extending along the southern fringe of the Sahara from Mauritania to Somalia.

"haves" and "have-nots". Climatic conditions determine the available water supplies, leaving temperate climates with a relative high level of water security. Large parts of the globe, however, are semi-arid, arid and desert regions (hereafter collectively refered to as the arid realm), many of which play host to developing countries, and are areas where water is a very scarce and vulnerable resource.

One of the greatest single influences on fresh water availability, is the number of people competing for the resource. Rapid population growth, amongst others, explains why the highest degree of vulnerability has been recorded in the developing nations, and those in Africa in particular. In fact, as many as 2 billion people in the developing world – one third of the world's population - live in areas with chronic shortages of water (cf. Smith & Niedermeier 1996). Ever increasing populations and rising standards of living[4] boost demand for limited quantities of water, and intensify competition and tension between users. With the world's population increasing by approximately 83 million every year - 99% of this increase occurs in the less developed countries - the number of people vulnerable to a natural hazard such as drought is increasing at an alarming rate. Increased industrialisation and development after the Second World War further placed additional demands on water resources on national political levels (Miller 1996:547-58).

In 88 developing countries, hosting 40% of the world's population, the number of people experiencing a shortage of renewable water is placing a serious constraint on development. Already approximately 5 million people - the vast majority of them in developing countries - die each year from drinking infected water and diseases caused by a lack of sanitation and water for hygiene. Exacerbating the problem is the fact that since 1940, world demand for fresh water has roughly quadrupled as human population numbers have doubled (Engelman 1997:29; also see figure 1). In the period between 1971 and 2000, demand for fresh water has doubled in nearly half the world's countries (Myers 1998:21). Already some 600 million people worldwide experience chronic water-shortages, and the total is projected to reach 3 billion by 2025 largely because of population growth. More than 1 billion of those to be affected in 2025 are likely to be in Africa, comprising two thirds of the continent's projected population (Cohen 1995:42). In the most vulnerable regions of the world, an estimated 460 million people (or 8% of the

[4] Within the context of developing nations, and particularly those in Sub-Saharan Africa, the discussion here concerns itself with the vulnerability of increasing *population numbers* to drought and water-scarcity. However, when it comes to an analysis of water deficits (and the depletion of other vital resources), the role of *overconsumption* of such resources in sustaining materialistic lifestyles is of equal importance. For example, the largest energy and water user - the USA - with an annual net population increase of 2,6 million, put more pressure on the world's resources than India, with an annual increase of 17 million (cf. Engin 1998; cf. Pelser & Van Rensburg 1997).

global population), are short of water, and another 25% of the planet's inhabitants are heading for the same fate (Sadeq 1999:18).

The area of irrigated land worldwide almost doubled in the first half of the previous century to meet the demands of a growing population that was developing economically and consuming more food per capita. Between 1950 and 1990, the land under irrigation more than doubled again (Engelman & LeRoy 1993). Simply in terms of supplying food to the growing population, it is estimated that developing nations will have to increase their agricultural land by 50% in the next thirty years (Redelinghuys & Pelser 2000:9). At the same time, however, a few countries such as Malta and Botswana, have opted to rely on imported food in part to save water. Although this reduces the need for irrigation water, it also limits options if imported food becomes expensive. However, worldwide the agricultural sector remains the doininant user of fresh water resources, largely because of the continuous demands an ever-growing human population exercises upon food supplies. On average, 69% of the total annual water withdrawal is used by the agricultural sector (mainly for irrigation), 23% goes towards the industrial sector and the remaining 8% goes towards domestic purposes and the filling of reservoirs. The allocation of water resources is highly dependent on the level of industrial development. In North and Central America agriculture accounts for 49%, industry for 42% and domestic uses for 9% of all water use. In Europe the industrial sector uses 55% as opposed to the 34% of the agricultural sector. On the other hand, the agricultural sector in Africa accounts for 90% and the industrial sector for a mere 4% of water withdrawal. Water use in Asia mirrors that in Africa with 85% allocated to the agricultural sector and industry using 8% (Miller 1996:457; Ohlsson 1995:6-9). Since much of the world's irrigation, urbanisation and industrialisation are characterised by unsustainable patterns of water consumption, prospects for the future are bleak.

3. REGIONAL VULNERABILITY TO WATER SCARCITY

The above situation in the international water arena immediately poses the question: When does water scarcity become a serious problem?

3.1 Differentiating between "water-stressed" and "water-scarce" countries

To allow for a comparative analysis between different countries and regions, three categories of water availability are commonly designated (cf. Rosegrant 1995; Dinar & Keck 2000). The first category - **water abundance** - is reserved for countries with more than 1 700m³ of water available per capita per year. Countries with fresh water resources of 1 000 to 1 700 m³ per capita per year face **water stress**, with major problems occurring in drought years. Countries are considered **water-**

scarce when internal renewable water resources are less than 1 000 m^3 per capita per year. Below this threshold, water availability is likely to become a severe constraint on socio-economic development, environmental quality, and human health and well-being. When fresh water supplies drop below 500m^3 per person per year, a situation of **absolute scarcity** exists (Engelman & LeRoy 1993:12).

Currently, some 31 countries are classified as water-stressed, of which 20 are considered water-scarce. Of these 20 countries, 15 are typified by rapidly growing human populations (Engelman 1997:30). By 2025, between 10 and 15 nations will be added to the water-scarce category, bringing the estimated number of water-scarce countries to as many as 35 (see table 1). By 2020, the number of people living in conditions of water stress or water scarcity could be as high as 2,9 billion or as low as 1,2 billion, depending on the rate of population growth over the next two decades (Engelman 1997:30).

It is estimated that more than half of the world's accessible renewable fresh water is already being used, indicating the problems the world may face if population doubles (Engelman 1997:30). Many African nations in particular are struggling to balance declining per capita water supplies with the demands of rapidly growing populations. In 1955, Djibouti was the only sub-Saharan country already troubled by water scarcity. In 1990, the number of sub-Saharan countries that were classified as water-scarce has grown to seven (see table 1), and South Africa was listed as water-stressed.

TABLE 1: WATER-SCARCE COUNTRIES IN 1955, 1990 AND 2025 (PROJECTED)

Water-scarce countries in 1955	Countries added to scarcity category by 1990	Countries added to scarcity category by 2025 under all UN population growth projections	Countries added to scarcity category by 2025 only if they follow UN medium or high projections*
Malta	Qatar	Libya	Cyprus
Djibouti	Saudi Arabia	Oman	Zimbabwe
Barbados	United Arab Emirates	Morocco	Tanzania
Singapore	Yemen	Egypt	Peru
Bahrain	Israel	Comoros	
Kuwait	Tunisia	South Africa	
Jordan	Cape Verde	Syria	
	Kenya	Iran	
	Burundi	Ethiopia	
	Algeria	Haiti	
	Rwanda		
	Malawi		
	Somalia		

Source: Engelman & LeRoy 1993

* Cyprus will have more than 1000 m^3 of renewable fresh water annually per person in 2025 if it follows either the UN low or medium population growth projection. Zimbabwe, Tanzania and Peru will avoid falling below 1 000 m^3 per capita *only* if their population growth rates follow the UN low projection.

Based on the medium population growth projections of the United Nations, the number of water-stressed and water-scarce countries in sub-Saharan Africa will increase from eight in 1990 to 21 in the year 2025 (see table 2). In approximately two decades from now, all countries in southern Africa will experience either water stress or absolute water scarcity. In a country such as South Africa it is predicted that total water demand will increase by more than 50% by the year 2030 (Ballance & King 1999:20). Depending on "worst-case" and "best-case" scenarios, it is further estimated that large parts of South Africa - particularly areas that are intensively cultivated - will start to experience the equivalent of permanent drought somewhere between 2002 and 2040 (Yeld 1997:46).

TABLE 2: PROJECTED WATER-SCARCE AND WATER-STRESSED COUNTRIES OF SUB-SAHARAN AFRICA IN 2025

Water-scarce countries (less than 1000 m³/capita)*	**Water-stressed countries (1 000-1 700 m³/capita)***
Burundi (269)	Burkina Faso (1237)
Cape Verde (258)	Ghana (1395)
Comoros (620)	Lesotho (1057)
Djibouti (9)	Madagascar (1 185)
Ethiopia (842)	Mauritius (1 575)
Kenya (235)	Mozambique (1 598)
Malawi (361)	Nigeria (1 078)
Rwanda (306)	Tanzania (1 025)
Somalia (363)	Togo (1 280)
South Africa (683)	Uganda (1 437)
	Zimbabwe (1 005)

Source: Dinar & Keck (2000)

* The values per capita are shown in parentheses.

The water-scarcity data of the United Nations serve as a warning to several African countries to give particular consideration to meeting the increasing demand for water - especially in the fast growing urban areas of the continent - in the next two decades. An important aspect to keep in mind is the fact that total water resource calculations (such as those for tables 1 and 2) include still unavailable groundwater. This means that many arid and semi-arid countries in Africa are now actually highly vulnerable to water shortages even though per capita resources are quite ample.

3.2 How vulnerable is sub-Saharan Africa?

Water resources vary widely between different regions of the world (see table 3). Africa and the Middle East are much drier compared with other regions. Asia - excluding some countries in South Central Asia - the Americas, and the former Soviet Union all have substantial water resources. According to table 3, the regions most vulnerable to water scarcity appear to be North Africa and the Middle East. The lowest rates of water consumption - expressed as the percentage of withdrawal to available resources - are found in the Pacific Islands, South America, West Africa, and Mexico.

TABLE 3: REGIONAL VARIATION IN WATER RESOURCES

Region	Water resources km³/year	Withdrawal Km³/year	Per capita withdrawal (m³/year)	Withdrawal/ Resources (%)
North Africa	34,62	13,45	561,29	89,21
West Africa	92,65	0,55	81,89	1,18
East Africa	36,39	0,68	97,13	4,81
Southern Africa	173,85	2,12	221,71	5,30
South Asia	1 176,75	101,30	248,25	5,19
Southeast Asia	575,76	10,44	322,10	7,82
Centrally planned Asia	964,00	158,24	794,33	13,25
Middle East	88,82	21,00	995,93	74,42
OECD[5] Asia Pacific	255,75	29,93	426,32	9,28
Central America	302,62	5,03	517,17	4,72
OECD North America	1 417,50	260,60	1 531,50	17,01
Mexico	994,00	27,60	1 059,00	2,78
Southern South America	1 960,50	13,43	565,50	1,26
Northern South America	439,63	3,45	1 302,88	2,67
Eastern Europe	162,33	10,44	739,17	6,16
OECD Europe	121,82	17,24	704,06	18,26
Former Soviet Union	4 684,00	353,00	1 330,00	7,54
Pacific Islands	291,67	0,04	26,67	0,04

Source: Downing & Bakker 2000:215

The data in table 3 clearly suggest that national vulnerability to drought and water scarcity diverges along familiar lines of developed, newly industrialised, transitional, and developing countries. Large parts of Africa, for instance, are vulnerable on all counts, especially when indicators such as food security, per capita income, and agricultural research investment are brought into consideration (cf. Downing & Bakker 2000). As opposed to Africa, OECD countries suffer drought, but can manage the impacts. It is, however, important to keep in mind that even countries with relatively high water availability may experience problems because of regional disparities or a very high water demand. The higher stress benchmark of approximately 1 700m³ per capita per year is therefore a "warning light" to nations whose populations continue to grow.

Sub-Saharan Africa is the driest continent-sized region in the developing world, with drought the principal type of natural disaster. Drought - irrespective of its definition - occurs frequently and severely in many countries as a result of the extreme rainfall variability in the extensive arid and semi-arid areas of Africa and the poor

[5] The Organisation for Economic Cooperation and Development (OECD) was formed in 1961 and consists of 25 industrialised countries in western Europe and North America, as well as Japan, Australia and New Zealand.

moisture retention capacity of most African soils. It is estimated that at least 60% of the region is vulnerable to drought, and as much as 30% can be regarded as highly vulnerable (Benson & Clay 2000:288). In fact, sub-Saharan Africa is the only dryland in the world to have experienced a long drought, with a 21% decline in annual rainfall over the past 100 years. In addition to this, rainfall has also become less predictable (UNCCD 2000).

An assessment of Sub-Saharan Africa illustrates the importance of factors such as population pressures, agricultural stresses, unemployment and poverty as prominent variables exacerbating the vulnerability of countries in the region. As far as Southern Africa in particular is concerned, Rupiya (1998:10-11) identifies three main causes of water scarcity in the sub-region. Firstly, rainfall levels have declined steadily over a period of 95 years. The region is extremely drought-prone with an average of two severe droughts occurring every decade and inadequate rains just below drought conditions registered every four years. Secondly, the cessation of war and armed conflict in many parts of the region has increased the consumption of water. Large development projects followed the peace processes which further increased water usage in individual countries. Thirdly, the high population growth and increasing urbanisation in the region also contribute to water scarcity, in that governments must provide safe water and sanitation for more people, while at the same time providing sufficient water supplies for the economic sector.

Already Africa's water resources for agriculture are inadequate. Only 4% of the cultivated land in Africa is irrigated, notwithstanding the fact that Africa devotes almost 90% of its water consumption to agriculture, mostly for irrigation (Paarlberg 1996:127; Engelman & LeRoy 1993). Much of Africa's water is wasted, and most is lost in those countries that can least afford it. The poorer countries of Africa use about twice as much water per acre as the richer nations of the industrialised world do, but manage to achieve crop yields that are only one third as high (The Economist 1992a:13). In many countries of sub-Saharan Africa, and especially in those applying ancient or traditional farming methods, half of all water evaporates or seeps away through unlined ditches.

Despite the considerable proportion of water consumed by the agricultural sector, per capita agricultural production in the region has declined by an average of 2% annually since 1970. The overall increase in food production (i.e. *not* per capita) is fluctuating between 2% and 2,5% per year -- well below the population growth rate of approximately 3% and more per year. Although grain yields have more than doubled since 1950, the rapid population growth in the region means that per capita grain production is lower than in 1950, and food output per capita is expected to decline by a further 20% by the year 2010 (Myers & Kent 1995:69). In sub-Saharan

Africa as a whole, the number of malnourished people passed the 200 million mark in the early 1990s, and at least 50 million are actually starving. As much as 40% of the region's population is malnourished for part of each year (Paarlberg 1996:129). Some 49% of the 10 million annual deaths among children under 5 years of age in Africa are associated with malnutrition (UNCCD 2000).

Sub-Saharan Africa experiences some of the worst human-made environmental problems in the developing world. Desertification is widespread and significant: Of those most threatened by desertification anywhere in the world, some 80% are in sub-Saharan Africa (Myers & Kent 1995:68). On the southern edge of the Sahara, some 647 500km² of once productive land – an area the size of Somalia - have been turned into desert over the past 50 years. As yields have failed to increase on existing farmlands, farmers in the region have been forced to cut down forests or move into more fragile lands to expand production. As a result, Africa loses approximately 12 million acres of forest every year, primarily as a result of clearance for agriculture (Paarlberg 1996).

In southern Africa in particular, huge areas of the region's natural terrestrial ecosystems have already been destroyed and replaced with artificial agricultural systems, greatly reducing or even nullifying the ability of the land to control and influence its own climate and chemistry. The inevitable results are soil erosion, reduced water supplies, deforestation, and other biomass loss and diversion. In South Africa, desertification has already affected 250 000 hectares and approximately 55% of the country is in danger of desertification (Hugo, Viljoen & Meeuwis 1997:133). In Botswana and Namibia, cattle and sheep ranches have expanded into marginal areas on the desert fringes, exposing vast areas that already had only sparse grass cover (Booth *et al.* 1994:9). In Malawi, the lush forests and woodland in the countryside have disappeared, leaving barren, infertile field in their stead (Kalipeni 1994:6). Morah (1996:56) also points out that in Tanzania, firewood has become so scarce that each household spends 250-300 working days per year simply for gathering its wood supply.

If it is considered that some seven out of ten people in sub-Saharan Africa are employed in the agricultural sector, then the impact of land degradation really points at an alarming situation. The problem extends to national and regional economies through reduced agricultural yields, added impetus to rural-urban migration, poverty, food scarcity resulting in malnutrition, diseases and ultimately famine with staggering loss of human life (Pelser & Kherehloa 2000). Little wonder that all of this is reflected in the fact that sub-Saharan Africa is the region with the most widespread poverty. Of the 36 poorest countries in the world, 29 are in sub-Saharan Africa, and around two thirds of the populace endure absolute

poverty. Unemployment and underemployment already run at a level of at least 40% (Myers & Kent 1995:71). Considering the aforementioned, it comes as no surprise that some scientists regard sub-Saharan Africa, and southern Africa in particular, to be one of the most human-modified regions on the planet (Yeld 1997:48). The role of social factors and human impact on land degradation, has most certainly significantly exacerbated the region's vulnerability to drought and water scarcity. This, amongst others, holds serious implications for agricultural sustainability, economic development and socio-political stability in the region.

Water allocation patterns, especially in developing countries in the arid realm, are likely to change in the near future as competition over water on a national political level increases. Falkenmark and Lundqvist (1995:186) identify three areas that are likely to change: Upstream use of water resources will be expanded at the expense of downstream use; priority will increasingly be placed on urban and industrial development at the expense of rural and agricultural development; and the increase in population with its corresponding increase in demand for the provision of safe water and sanitation. These three areas will in future limit the availability of water in general, and for the agricultural sector (especially irrigated agriculture) in particular.

4. CONFLICT BETWEEN WATER USERS

Resource scarcity can exacerbate pre-existing tensions and even instigate new ones, and water is no exception. The fact that both surface and groundwater resources often ignore political boundaries makes fresh water both a regional and an international political issue, because independent states compete with each other over the quantity of supplies (especially in the arid realm) and/or over its quality (especially in more temperate regions with high levels of industrial development). With more than 200 river and lake basins bordered by two or more countries and aquifers crossing international borders, the potential for increased regional tensions over shared resources in the face of increasing population numbers, is substantial. Worldwide at least ten rivers flow through six or more countries, with the Danube River touching the territory of more than a dozen countries (Engelman & Le Roy 1993:8). The Niger, for example, flows through ten countries, the Nile through nine, the Zambezi through eight and the Amazon through seven (Wolf 1998:251-2; Stanley Foundation 1992:19; Anderson 1988:2). According to Tolba and Rummel-Bulska (1998:48), more than a third of the world's population lives in international river basins, while more than 75% of the land of about 50 states lies within these areas.

It comes as no surprise therefore that clashes over water permeate several regions of the world, ranging from conflicts between urban and rural water users in the western United States to sporadic armed clashes in the Middle East[6]. United Nation's estimates in the early 1990s suggested that there is a real danger of war erupting in at least ten areas around the world as a direct result of international competition over water sources (Cylke 1993:58). Tension over access to water is not only restricted to international borders though. In the United States, conflict has long been brewing between farmers (who use 83% of California's water, but produce less than 3% of the state's economic wealth) and the huge cities of southern California (San Diego and Los Angeles), which draw water not only from northern California, but also from the Colorado River. The rest of the discussion, however, concerns itself with an overview of water conflicts on the international scene, and those in southern Africa in particular.

4.1 International conflict over water resources

The fall of the Berlin Wall in 1989 and the end of the Cold War shortly afterwards have introduced the need to redefine what constitutes national security. Within the Cold War context, security was mostly defined in terms of military security and a state's ability to defend itself, especially with regard to nuclear weaponry. The 1973 oil crisis compelled governments to include international economic considerations when it became evident that the world was economically interdependent. In the absence of Cold War tensions and the threat of a full-scale nuclear war, the 1990s have ushered in a period in which environmental issues are increasingly included in national security considerations due to the growing realisation that states are environmentally interdependent as well (Mathews 1989:162; Myers 1989:23; Agnew & Anderson 1992:214).

The realisation that environmental issues are key international security issues in turn has focused a great deal of attention on water as a strategic resource within the national and international political set-up. The growing political awareness that water is a unique resource for which there is no substitute and that the demand for water will likely increase in the near and distant future, has resulted in a growing body of literature warning of future water wars. However, academics such as Wolf (1998:251-65) have responded negatively to these predictions and have pointed to the historical absence of a full-scale war that resulted because of competition over water resources. Wolf (1998:258-61) emphasises the point that since World War II only seven minor skirmishes were waged over water and that while water wars

[6] Although (access to) water is by no means the only source of the ongoing conflict in the Middle East, it certainly is intertwined in the array of social, political and environmental factors instigating tension and conflict in the region.

might look like the likely outcome in several international disputes, authors in general neglect to pay attention to the on-going dialogue and negotiations that take place between warring states. In his view, existing water treaties show a willingness among states to co-operate even at times of existing political tensions such as the Mekong Committee that was created in 1957 and continued to function despite the Vietnam War.

Gleick (2000a), on the other hand, holds the position that while water has not been the sole source of violent conflict, there is overwhelming historical evidence detailing conflicts and tensions over water resources, the use of water systems as weapons during war and the targeting of water systems during conflicts caused by other factors. He and others working on the Water Conflict Chronology at the Pacific Institute for Studies in Development, Environment and Security identified six categories of different types of water conflicts:

- *Control over water resources* (state and non-state actors): where the conflict is rooted in water supplies or access to water.
- *Military tool* (state actors): when a nation or a state uses water resources or water systems as a military "weapon".
- *Political tool* (state and non-state actors): when water resources are misused for political purposes.
- *Terrorism* (non-state actors): when water resources/systems become targets in activities by non-state actors aimed at destabilising the state.
- *Military targets* (state actors): when water resources/systems become targets of military actions by nations/states.
- *Development disputes* (state and non-state actors): when water resources/systems are a major source of dispute in the context of economic and social development.

Tensions over control and use of water are mounting around the world, as several international incidents indeed testify. After devastating floods had killed more than 3 000 people in South Asia in 1993, the Bangladesh government renewed demands that India and Nepal build dams to control the Ganges and Brahmaputra rivers upstream from Bangladesh. The decades-long conflict between India and Pakistan over Kashmir has its roots partly in control over the water-rich region at the foot of the Himalayas. Likewise, in arid central Asia, shared waters became the catalyst for clashes between the newly independent nations of Kyrgyzstan, Tajikistan, Kazakhstan, Turkmenistan and Uzbekistan. Where water constitutes an international border, as it does on all the major continents, changes of land due to erosion and sedimentation can also cause disputes, as was illustrated by the 1966 border war between China and the Soviet Union.

In the past ten years water resources were frequently used as military and political tools during disputes and armed conflict. During the Gulf War (1991), for example, Iraq intentionally destroyed most of Kuwait's desalination plants during their retreat, while Baghdad's modern water supply and sanitation system was targeted during many bombing raids of the Allied Coalition. In the mid-1990s the Turkish President, Turgut Ozal, threatened to restrict water flow from the Euphrates River to Syria in an attempt to force the Syrian government to give up its support to Kurdish rebels operating in southern Turkey. Access to irrigation rights on the Cauvery River in India has for the past three decades been the cause of violent conflict between the Karnataka and the Tamil Nadu (Gleick 2000b).

Fresh water scarcity has been a particular source of conflict in the Middle East during recent decades. Relations between most of the countries in the Jordan River's basin have been marked by military conflict over its waters. Since the 1967 war, Israel has controlled most of the Jordan River's headwaters and basin, leaving insufficient water for Jordan's growing needs (Engelman & Le Roy 1993). To sketch an even bleaker picture, the Israeli population is projected to grow from 6,4 million in mid-2001 to about 9 million in 2025 (WPDS 2001). The current population growth rate in Jordan (2,2%) is even faster than that of Israel (1,6%), and the total population of the former is projected to increase by 128% by the year 2050 to overtake that of Israel (WPDS 2001). This situation quite clearly illustrates that, as the demands of growing populations approach the limits of renewable resources, water could provide the flash point for conflict in regions with longstanding ethnic and political rivalries. Some analysts have therefore suggested that water could replace oil as a major cause of war in the near future. The Middle East, where such water sharing tensions abound, is considered a hot spot for such conflicts.

4.2 Water conflicts in Southern Africa

Despite attempts of the Southern African Development Community (SADC) to promote the equitable usage of international water systems and the peaceful resolution of water-related tensions in the region, political tension over the utilisation of water resources between Botswana and Namibia has increased in the past decade - tension that could eventually escalate into armed conflict if the two warring parties do not reach an agreeable settlement. In 1997 Botswana raised a public outcry when Namibia, Africa's driest nation, announced emergency plans to divert water from the Okavango River to relieve drought conditions. Botswana was concerned that the intended project could hurt the country's foremost tourist attraction and top revenue generator, namely the Okavango Delta. On the other hand, Namibia, with

only 240 m^3 water available per capita per year, experiences serious water shortages. Despite the introduction of water conservation measures along with the utilisation of mine water and recycled sewage, the country has insufficient resources to meet the demands of a growing population (it has a 3% population growth rate) and the expanding industrial and agricultural sector. Botswana also has insufficient water resources for all the competing sectors with only 780 m^3 water available per capita per year. Despite the arid nature of their environments, both Botswana and Namibia have ample water resources in the northern parts of their countries where both the Zambezi and Okavango Rivers are found (Anon 1997:46; Jenvey 1997:16).

The water dispute between Botswana and Namibia underlines the political problems associated with shared water resources in the arid realm. Due to critical water shortages all riparian states want to utilise water resources in their territory to its maximum, at times regardless of the impact on other riparians (even more so if there is no other economically feasible alternative to explore). The danger of unilateral development and utilisation actions in shared waters is that it can lead to a situation where other riparian states feel that they have politically no other option than to defend their part of the shared waters through military means. The deteriorating relations between Botswana and Namibia over water resources contributed a great deal to the Botswana government's decision in 1996 to increase its defence capabilities by drastically upgrading military hardware. The military build-up in Botswana served as an effective deterrent for Namibian plans to divert the waters of the Okavango. By 1997, the Namibian government denied that it would go ahead with the project without the approval of Botswana, and decided to shelve the project until the outcome of a feasibility study for the whole Okavango River Basin is known. This, however, is just a short-term solution, the result being that the future possibility of armed conflict between these two countries over water resources will remain unless a mutually acceptable agreement can be reached. This agreement will have to include Angola since political stability in that country (though at this stage a distant ideal) will negatively impact on the existing utilisation of the Okavango waters (Le Roux 1997:117-29).

5. CONCLUSION

Notwithstanding the potential for conflict in many regions, there are nevertheless signs that nations are willing to co-operate with neighbours for their own well-being and stability. In 1997, Israel and Jordan signed a water-sharing agreement, although implementation has seriously lagged. Earlier, in 1996, India agreed to increase the flow of the Ganges to its downstream neighbour, Bangladesh. In Southern Africa, Namibia, Botswana and Angola entered into UN-brokered talks

on planning for future water needs in the Okavango basin. While a large number of water-related treaties have been signed to date, coordinated management of international river basins is still the exception rather than the rule, and water remains at the centre of conflict in many parts of the world.

In the Southern Africa region, the SADC has recognised the threat scarce water resources pose to vulnerable political relationships between states in the region. In an effort to reduce the risk of water-related conflicts in the region, the SADC facilitated the negotiation and signing of the SADC Protocol on Shared Watercourse Systems in the mid-1990s. The protocol lays the foundation for regional co-operation in water resource management and development, and acknowledges the right of all riparian states to utilise the common water resource. General principles of the protocol include the following: Member states

- must respect and apply the existing rules of international law relating to the utilisation and management of shared watercourse systems, and must abide by the principles of equitable utilisation;
- must maintain a proper balance between resource development, and conservation and enhancement of the environment to promote sustainable development;
- shall exchange available information and data pertaining to the shared watercourse system;
- shall utilise shared watercourse systems in an equitable manner and provide adequate protection to these systems;
- must notify other potentially affected states and competent international organisations of any emergency originating within their respective territories, and
- undertake to take all measures necessary to prevent the introduction of alien aquatic species into shared watercourse systems which may have detrimental effects on the ecosystem (SADC 2000).

Whether or not this Protocol, like many other international water treaties, will ensure peaceful co-operation and equitable utilisation of the region's shared watercourse systems, remains to be seen. Until such co-operation can be established, governments can be expected to pursue even the most radical options to ensure that their populations do not fall victim to thirst.

BIBLIOGRAPHY

Agnew C & Anderson E 1992. **Water resources in the arid realm**. London: Routledge.

Anderson EW 1988. Water: the next strategic resource. In: Starr JR and Stoll DC (eds). **The politics of scarcity: water in the Middle East**. Boulder: Westview Press, pp. 1-21.

Anon. 1997. Botswana and Namibia: thirst. **The Economist** 344(8024), 5 July, p. 46.

Ballance A & King N 1999. **State of the environment in South Africa - an overview.** Pretoria: Department of Environmental Affairs & Tourism.

Bell MM 1998. **An invitation to Environmental Sociology**. London: Pine Forge.

Benson C & Clay E 2000. The economic dimensions of drought in sub-Saharan Africa. In Wilhite DA (ed.) 2000. **Drought: Volume I**. London: Routledge, pp.287-311.

Booth A, McCullum J, Mpinga J, & Mukute M 1994. **The state of the environment in southern Africa.** Johannesburg: The World Conservation Union and the Southern African Development Community.

Cohen JE 1995. **How many people can the earth support?** London: WW Norton.

Cylke FK 1993. **The Environment**. New York: Harper.

Dinar A & Keck A 2000. Water supply variability and drought impact and mitigation in sub-Saharan Africa. In: Wilhite DA (ed.) 2000. **Drought: Volume II**. London: Routledge, pp. 129-48.

Downing TE & Bakker K 2000. Drought discourse and vulnerability. In Wilhite DA (ed.) 2000. **Drought: Volume II**. London: Routledge, pp. 213-30.

Economist (The) 1992a. **The first commodity** 322:13-4.

Economist (The) 1992b. **The rains that failed** 322:56.

Engelman R 1997. **Why population matters**. Washington: Population Action International.

Engelman R & LeRoy P 1993. **Sustaining water: Population and the future of renewable water supplies**. Washington: Population Action International. [online] URL: http//:www.cnie.org/pop/pai/image1.html

Engin T 1998. Water: Realities for the 21st century. **Vital speeches of the day**. LXIV(12):365-8.

Falkenmark M & Lundqvist J 1995. Looming water crisis: new approaches are inevitable. In: Ohlsson, L (ed.). **Hydropolitics: conflicts over water as a development constraint**. London: Zed Books, pp. 178-212.

Gleick P 2000a. **Water conflict chronology: introduction**. URL: http://www.worldwater.org/conflictIntro.htm

Gleick P 2000b. **Water conflict chronology**. URL: http://www.worldwater.org/conflict.htm

Hugo ML, Viljoen AT & Meeuwis JM 1997. **The ecology of natural resources management: The quest for sustainable living**. Pretoria: Kagiso.

Jenvey A 1997. Water wars. **New African** (351), April, pp. 16-7.

Kalipeni E 1994. Population growth and environmental degradation in Malawi. **Africa Insight** 22(4):273-82.

Le Roux CJB 1997. Botswana and Namibia. Are they heading for a possible arms confrontation? **Journal for Contemporary History** 22(2):117-29.

Mathews JT 1989. Redefining security. **Foreign Affairs** 68(2):162-77.

Miller GT 1996. **Living in the environment: principles, connections, and solutions** 9th edition. Belmont: Wadsworth Publishing Company.

Morah BC 1996. The population challenge to achieving sustainable development in Southern Africa. In: Styger P, Meyer S, & Saayman A. (eds.). **Conflicting challenges in development**. Johannesburg: Development Society of Southern Africa, pp. 41-74.

Myers N 1989. Environment and security. **Foreign Policy** (74):23-41.

Myers N 1998. Global population and emergent pressures. In Polunin N (ed.) 1998. **Population and global security**. Cambridge: Cambridge University Press, pp. 17-46.

Myers N & Kent J 1995. **Environmental Exodus: An emergent crisis in the global arena**. Washington: Climate Institute.

Ogallo LA 2000. Predicting drought in Kenya: Prospects and challenges. In: Wilhite DA. (ed.) 2000. **Drought: Volume I**. London: Routledge, pp. 52-67.

Ohlsson L 1995. Introduction: the role of water and the origins of conflict. In: Ohlsson, L (ed.). **Hydropolitics: conflicts over water as a development constraint**. London: Zed Books, pp. 1-28.

Paarlberg RL 1996. Rice bowls and dust bowls. **Foreign Affairs** 75(3):127-33.

Pelser AJ & Van Rensburg HCJ 1997. Ter wille van oorlewing: Waardes en voorwaardes vir 'n volhoubare toekoms. **Tydskrif vir Geesteswetenskappe** 37(3):164-77.

Redelinghuys N & Pelser AJ 2000. Environmental refugees in developing nations: exploring the causes and impact. **Acta Academica** 32(1):1-26.

Redmond KT 2000. Integrated climate monitoring for drought detection. In: Wilhite DA (ed.) 2000. **Drought: Volume I**. London: Routledge, pp. 145-58.

Robbins E 1998. Water, water everywhere: innovation and cooperation are helping slake the world's thirst. **The environmental magazine**. Sept/Oct 1998. [online]. URL: http://www.emagazine.com/september-october_1998/0998feat1.htm

Rosegrant MW 1995. Dealing with water scarcity in the next century. **2020 Vision Brief 21**, June 1995. [online]. URL: http://www.cgiar.org/ifpri/2020/BRIEFS/NUMBER21.htm

Rupiya MR 1998. Water as security. In: Cock J & McKenzie P (eds). **From defence to development: redirecting military resources in South Africa**. Cape Town: David Philip, pp. 10-1.

SADC 1994b. **Proposed SADC policy and strategy for environment and sustainable development: toward equity-led growth and sustainable development in Southern Africa.** Maseru: SADC Environment and Land Management Sector.

SADC. 2000. **SADC shared watercourse systems protocol.** Maseru: SADC. URL: http://www.africanwater.org/sadcptcl.htm

Sadeq HT 1999. A rare and precious resource. **The Unesco Courier** 52(2):18-20.

Stanley Foundation 1992. The new politics of thirst. **World Press Review** 39(11), November, pp. 18-21.

Tolba MK & Rummel-Bulska I 1998. Global environmental diplomacy. **Negotiating environmental agreements for the world.** Cambridge, Mass: The MIT Press.

UNCCD (United Nations Convention to Combat Desertification) 2000. **Human health severely affected by desertification and drought, says the World Health Organization.** URL: http://www.unccd.int/publicinfo/pressrel

Wilhite DA & Vanyarkho O 2000 Drought: pervasive impacts of a creeping phenomenon. In: Wilhite DA (ed.) 2000. **Drought: Volume I.** London: Routledge, pp. 245-55.

Wolf AT 1998. Conflict and cooperation along international waterways. **Water Policy** 1, pp. 251-65.

WPDS (World Population Data Sheet) 2001. Washington: Population Reference Bureau.

Yeld J 1997. **Caring for the earth: South Africa - a guide to sustainable living.** Stellenbosch: WWF-SA.