SOCIO-CULTURAL STRATEGIES IN MITIGATING DROUGHT IMPACTS AND WATER SCARCITY IN DEVELOPING NATIONS

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ABSTRACT

A critical shortage of fresh water, particularly in developing nations, is likely to become one of the most pressing issues in decades to come as droughts and rapid growing human populations join forces to deplete available fresh water resources. This article highlights some of the most important mitigation strategies within socio-cultural contexts in the developing world that should be considered if we are to make progress in reducing societal vulnerability to drought and water scarcity. It is, amongst others, concluded that rural perceptions on water consumption and utilization should be recognized as part of a valid indigenous knowledge system, and should as such be accommodated in policy formulation. If ignored, the inevitable reform of current water policies may clash with cultural and religious beliefs in many communities, especially those in Africa.

1. ABOUT THE SOCIO-HYDROLOGICAL LANDSCAPE

Recent droughts in developing and industrialised nations and the concomitant impacts thereof have underscored the vulnerability of all societies to drought. Statistics released in 1995 by the International Decade for Natural Disaster Reduction indicated that drought accounted for 22% of the damage from disasters, 33% of the total number of persons affected by disasters, and 3% of the number of deaths resulting from natural disasters (Wilhite & Vanyarkho, 2000:246). The issue is complicated by the fact that the concerns about the trends in losses associated with drought – and natural disasters in general – in industrialised countries are magnified when placed in the context of developing countries. Africans, for instance, devote up to 88% of the water they use to agriculture, mostly irrigation, while highly industrialised countries in Europe allot more than half their water to industry and hydroelectric energy production (Engelman & LeRoy, 1993).

Signs that we are 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 population growth – largely because

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of the Green Revolution in agriculture and rising living standards for many of the planet's people. At the end of the previous millennium, some 26 countries globally were considered to be "water scarce" – *i.e.* countries in which less than 1 000 cubic meters of water are available to each person per year (Robbins 1998: 2). 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). Recent estimations project that by the year 2025 as many as 48 countries and 3 billion people will face chronic water shortages (Van Eeden, 2001:17). Some 700 million of these people – almost 25% of those likely to be affected – are living in Africa.

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. In 88 developing countries, hosting 40% of the world's population, the number of people that experience a shortage of renewable water is putting 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). In the most vulnerable regions of the world, an estimated 460 million people (or 8% of the global population), are short of water, and another 25% of the planet's inhabitants are heading for the same fate (Sadeq, 1999:18). Increasing droughts, in the wake of global warming, could well intensify water shortages. It is believed that droughts that have only a 5% frequency currently, 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.

What concern many scientists and policy makers are not only the diversity and complexity of drought impacts, but also society's low level of preparedness for future events. Furthermore, it is widely accepted that many of the impacts of drought are human-induced. Rather than viewing drought therefore as merely a natural or physical event, in reality it is the result of an interplay between a natural event and the demand placed on water supplies by human-use systems. It follows from this that drought clearly has both a natural and social component. The significance of drought should therefore not be isolated from its societal context. In fact, the scientific community is still discovering the complex inter-relationships between drought and society and

grappling with mitigation and management strategies that will lessen some of the impacts, particularly on the more vulnerable sectors of society.

Stemming from the above, the intent of this article is to highlight some of the most important mitigation strategies within socio-cultural contexts in the developing world that should be considered by extension officers and policy makers if we are to make progress in reducing societal vulnerability to drought and water scarcity. Amongst others, this requires a reiteration of some of the social and environmental factors that determine human beings' vulnerability to drought and water scarcity, particularly in sub-Saharan Africa. Although the analysis is set against the background of a global reality of threatening water shortages, the vulnerability of sub-Saharan Africa - and hence socio-cultural coping strategies in the region and in developing nations elsewhere – narrows the demarcation and mainly constitutes the framework for analysis. The literature review comprised a selection of articles, books, papers and on-line documents covering the period 1992-2000.

As a point of departure, the focus of this article calls for a brief clarification of the relationship between drought and water scarcity.

2. BIRDS OF A FEATHER: DROUGHT AND WATER SCARCITY

Because drought affects so many economic and social sectors, it has a different meaning to meteorologists, agriculturists, hydrologists, and economists. As a result, many disciplinary perspectives of drought exist. Complicating the search for a universal definition of drought even further, is the fact that the impacts of drought also differ spatially and temporally, depending on its societal context. Wilhite (2000a:8) thus feels obliged to conclude that "[a] universal definition of drought is an unrealistic expectation".

An operational definition of drought applied in South Africa broadly defines drought as "occurring at 70% of normal rainfall. It becomes a *disaster* or *severe* drought when two consecutive seasons experience 70% or less rainfall. A 'normal' drought … refers to temporary periods of moisture deficits of less than one year duration" (Bruwer, 1993:201). Like most operational definitions, this one also attempts to define the onset, continuation, and termination of drought episodes and thus constitutes the foundation of an early warning system. It also meets Wilhite's prerequisite for such definitions to be "region and impact or application specific in order to be used in an operational mode by decision makers" (2000a:9). On the other hand, a conceptual definition of drought used by Tannehill (in Wilhite, 2000:9) incorporates some key elements of drought, emphasising the intensity and duration of the event as

well as the need for regional bias: "[Drought is] a deficiency of precipitation from expected or normal that, when extended over a season or longer period of time, is insufficient to meet the demands of human activities, resulting in economic, social and environmental impacts".

Central to the above, and in fact all other definitions and classifications of drought[2], is the notion of a **shortage of water**. This is perhaps best confirmed by Redmond's forward and simple definition of drought as "a shortage of water to meet present needs" (2000:147). Bruwer (1993:201) also subscribes to the view that drought occurs when there is less water available than is needed, and not (necessarily) when there is less than expected. Das (2000) too is of the opinion that drought is essentially a "supply" and "demand" problem. He is almost adamant when stating that "any definition that does not include a reference to water 'need' *vis-à-vis* 'demand' must be regarded as inadequate" (Das, 2000:181). This interchangeable and inevitable relationship between drought and water scarcity will constitute the framework and platform for further discussions in this article.

3. SOCIETAL VULNERABILITY TO DROUGHT AND WATER SCARCITY

The risk that a society faces from drought is the product of not only the degree of exposure to the biophysical event, but also the social vulnerability of the specific society to the event. In short, vulnerability in this context refers to the characteristics of a group or community in terms of their capacity to anticipate, adapt to, resist, and recover from the impact of a natural hazard such as drought. Most scientists believe that society's vulnerability to drought and water scarcity is increasing for several reasons, the most important of which may be the increasing pressure of an expanding population base on limited water and other natural resources. 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).

The degree of vulnerability of different nations – and, in fact, different communities and households in the same country – vary significantly from one to another. This should be seen from the viewpoint that vulnerability is

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[2] *Conventionally drought has been classified and categorized according to four categories, i.e. meteorological, hydrological, agricultural and socioeconomic. For a detailed discussion of these four typologies of drought, see Wilhite (2000a).*

closely linked with social characteristics such as ethnicity, religion, stratification, gender and age – all of which influence access to power and resources (Downing & Bakker, 2000:223). In addition, regional and global pressures such as rapid population growth, urbanisation, foreign debts, civil strife, war, epidemic disease, and export promotion have an effect on local conditions. Although some of these pressures have a universal character; others again are specific to a certain region or society. 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. This scenario immediately poses the question: When does water scarcity become a serious question?

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 and 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 m³ per capita per year. Below this threshold, water availability is likely to become a severe constraint on socioeconomic development, environmental quality, and human health and well being. When fresh water supplies drop below 500m³ per person, 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 & Le Roy (1993)*
**Cyprus will have more than 1000 m³ 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 m³ 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 South Africa will

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)[3]	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 that should not be left out of sight is the fact that total water resources 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 (Dinar & Keck, 2000:133). Another aspect of regional water scarcity is the existence of several "hot spots" characterised, amongst others, by large populations and little available water. In such cases, even though the statistics of water availability do not necessarily point at any degree of water scarcity, localised situations can indeed create severe hardships. It is therefore clear that the structure of water demand in a country also strongly influences the socioeconomic impact of drought when it occurs.

[3] *Djibouti is regarded as the most water-scarce country in the world. In contrast, the average person in Iceland has available 74 000 times as much fresh water per year (cf. Cohen 1995).*

3.2 A breakdown of regional vulnerability to drought and water scarcity

Water resources vary widely between different regions of the world (see Table 3). Africa and the Middle East are much drier comparing 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 (km^3/year)	Withdrawal (km^3/year)	Per capita withdrawal (m^3/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	1176.75	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[4]: Asia Pacific	255.75	29.93	426.32	9.28
Central America	302.62	5.03	517.17	4.72
OECD: North America	1417.50	260.60	1531.50	17.01
Mexico	994.00	27.60	1059.00	2.78
Southern South America	1960.50	13.43	565.50	1.26
Northern South America	439.63	3.45	1302.88	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	4684.00	353.00	1330.00	7.54
Pacific Islands	291.67	0.04	26.67	0.04

Source: *Downing & Bakker (2000)*

The data in Table 3 clearly suggest that national vulnerability to drought and water scarcity diverges along familiar lines of developed, new industrialised, transitional, and developing countries. Large parts of Africa, for instance, are vulnerable on all counts, especially when indicators such as food security, per

[4] *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 Nieu-Zealand.*

capita income, and agricultural research investment are brought into consideration as well (cf. Downing & Bakker, 2000). As opposed to Africa, countries belonging to the Organisation for Economic Cooperation and Development (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 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.

An assessment of some of the most vulnerable regions illustrates the importance of factors such as agricultural stresses, population pressures, unemployment and poverty as prominent variables exacerbating the vulnerability of countries and regions. Hence these factors also demonstrate the scope for drought impacts and management in these regions. The principal areas at risk include (though are not confined to) much of Africa, South Central Asia, and the Middle East. The focus and scope of this article do not allow for a detailed analysis of the latter two regions. It is appropriate, however, to briefly assess the vulnerability of sub-Saharan Africa.

3.3 The vulnerability of sub-Saharan Africa to drought and water scarcity

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 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 (United Nations Convention to Combat Desertification, 2000).

Already Africa's water resources for agricultural needs are inadequate. Only 4% of the cultivated land in Africa are irrigated, notwithstanding the fact that Africa devotes 88% of its water consumption to agriculture, mostly for irrigation[5] (Paarlberg, 1996:127 and Engelman & LeRoy, 1993). Much of that water is wasted, and most is lost in those countries that can least afford it. The

[5] *Globally, agriculture drains approximately 69% of all fresh water consumption, with 23% of water withdrawals meeting the needs of industry and energy. Only 8% are used for domestic or household demands (Hinrichsen, Robey & Upadhyay, 1999).*

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, 1992:13). In many countries of sub-Saharan Africa, and especially 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 increase in food production overall (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).

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 above, 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 sustainability in the agricultural sector – and in particular for food security – in the region.

Vogel, Laing & Monnik (2000) point out that although South Africa is considered to be self-sufficient in terms of national food needs, many households experience food insecurity that are worsened during periods of droughts. Excessive poverty, chronic malnutrition, and a need for emergency food aid were common during the drought of the 1990s in the country. Several government intervention programmes and donor agencies (such as Operation Hunger and World Vision South Africa) helped to contain cases of malnutrition and related diseases. Although famine situations generally do not occur as a consequence of drought, prevailing conditions of endemic poverty and poor health in many of the rural areas in South Africa (and other developing countries) are greatly aggravated during drought years.

In sub-Saharan Africa, rural people are the most vulnerable to drought. Approximately 75% of the population in African countries are rural, the majority of whom are small farmers and produce about 70% of agricultural

output in the region (Ladele, 1999). These small farmers are largely poor and illiterate, and at the mercy of harvest failures, the loss of cattle or earning potential. Their direct dependence on a fast degrading environment cause them to dwell much on myths, religious ideas and cultural practices. Amidst realities of a rapid growing population, a declining food production per capita and increasing food insecurity, rural poverty has remained high and environmental degradation has worsened over the past four decades since the period of colonial independence. The rural poor of Sub-Saharan Africa are therefore people who have no real security against adversity occasioned by drought and water scarcities.

4. MITIGATION OF DROUGHT IMPACTS: THE SOCIAL DIMENSION

Although drought is a natural hazard, there is little doubt that human intervention can reduce social vulnerability to and impacts of drought. Several methods and approaches have indeed been developed to reduce drought impacts, including those that are related to the biophysical environment (such as improved forecasting and early warning mechanisms) and those related to drought mitigation among communities (such as cultural values that assist in reducing vulnerability and risk to drought).

Broadly speaking, the impacts of drought and water scarcity are mitigated by the level of insurance provided either by institutions such as the state (e.g. safety nets, public works, or free food distributions) or the individual and community (e.g. assets, reciprocal self-help mechanisms, or cultural values and networks). Drought mitigation strategies are therefore clearly distinguishable at both the macro and micro levels. There are few links between these two levels – particularly in developing countries – which severely compromises the effectiveness of drought preparedness and mitigation in these countries. Since the macro level mainly relates to institutional responses at the national level and thus *inter alia* state policies and programmes, this section will mainly focus on the socio-cultural aspects of drought mitigation, i.e. the micro or community level.

4.1 The socio-cultural dynamics of drought mitigation

Some communities in drought-prone areas have highly developed information systems that they use to predict disruptions in rainfall patterns and to identify appropriate strategies. At the local level, communities often possess detailed knowledge of the likely occurrence of drought and its effects. These people have developed over many decades, or even centuries, a broad

range of survival strategies to help them reduce the effects of drought, and recover once the rains have returned. Davies (2000:5) mentions that all local strategies – whether adopted at individual, household or community level – are part of wider contingency plans, reinforced by indigenous information and diagnosis. Although monitoring indigenous coping strategies is regarded an essential and effective element of drought management and the development of early warning systems, examples of actual strategies are rare and not well reported. In addition, monitoring coping strategies is a complicated process and necessitates detailed understanding of local livelihood systems. As a result, the monitoring of local coping strategies and development of indicators are often rejected by national policy makers and planners on the grounds of cost, time and lack of sound scientific requirements.

Although local people's contingency plans are ill documented, there is nevertheless evidence to suggest that the use of local strategies is far from random, but rather imbedded in well established cultural value systems and practices. In some cases, these practices are directly linked to a profound sacred status attached to many rivers, pools and water sources, as in the case of many indigenous communities in southern Africa. Since such perceptions constitute a powerful mechanism for protecting water resources and coping with drought, it is important to take note thereof. For this purpose a brief reflection on cultural drought adaptation strategies in southern Africa, Mexico and Brazil – illustrative of similar practices and strategies in the rest of the developing world – is necessary.

4.2 Cultural perceptions of water resources: Indigenous traditions and beliefs as drought adaptation strategies in southern Africa, Mexico and Brazil

Ancient civilizations such as the Semites and Babylonians regarded water as symbolic of life and God, a spiritual force that controlled life and existence and one to which prayer and propitiation must be made. Water was seen as a medium that was occupied by spirit entities that were respected, feared or revered. Similar ideas are still common today amongst many indigenous communities in Africa and America, and people will, for example, ask permission from the spirits of the stream before crossing it. In southern Africa in particular, the religious, cultural and spiritual significance that indigenous people attach to rivers and lakes have a powerful impact on the utilization and protection of natural water resources in the region (Bernard, 2000:2).

Many African religious functionaries regard water as a living force, a powerful symbol and medium for purification and healing. Among some members of the amaXhosa, propitiation rituals are still made to the river spirits prior to planting in spring. A portion of the seeds to be planted is placed on the surface of sacred water pools. It is believed that the water spirits will accept half of this seed and return the other half to be mixed with the remaining seed so as to enhance the fertility and yield (Bernard 2000:8). If none of the seeds disappear under the water surface, but just spread over the water, it is regarded as an indication that the ancestors and spirit world are offended by the misdeeds of the living. The community will then decline from planting, until social sanctions are introduced against the perpetrators and the blessing of the ancestors had been received.

In rural areas such as the Natal Midlands, the Venda region and the Eastern Cape traditional taboos exist among the communities regarding the extraction or use of natural resources surrounding rivers. Great care is taken to avoid disturbing or angering the water spirits. Common people are forbidden to go near sacred water sources, and only traditional healers associated with the water are allowed to approach such areas. This is to avoid any disturbance of the sacred Water Snake, mermaids and spirits of the water pools where they are known to exist. This injunction is reinforced with the belief that transgressors will be taken under the water never to return (Bernard, 2000).

Bernard (2000:9) continues to mention that killing or injuring any of the messengers of the sacred water (such as snakes, frogs, crabs or water birds) is also regarded as a great offence, and there are many groups in southern Africa for whom the eating of fish is strictly forbidden. It is believed that transgression of such taboos may result in the drying up of the water source and occurrence of droughts. Many communities also restrict the distance to which dwelling units can be erected near sacred water sources and where cultivation can take place. However, in many places the effects of modernisation and population pressure have cast a shadow over these traditional fears and restraints.

Indigenous social institutions and traditions also serve as a strategy in drought adaptation and risk management in countries such as Mexico and Brazil. In rural Mexico, cultural and religious rituals following the agricultural calendar invoke rain and other key influences on harvests, while traditional weather prediction techniques monitor the first days of the year or phases of the moon as ways to predict growing season weather (Liverman, 2000:41). To minimise the impact of drought or a failed harvest on community members, the harvest can be redistributed through cultural events, where local leaders

are responsible for sharing food with other members of the community. During periods of intense drought, some Mexican communities rely on traditional sources of famine food and liquid such as cactus and mesquite fruit. Although many of these drought adaptations survived through the ages, some scholars believe that drought vulnerability increased as a result after the arrival of the Spanish, bringing with them changes in land use and economy. In Morocco too, studies revealed that traditional drought coping strategies have been losing their effectiveness (Swearingen & Bencherifa, 2000:283). This is ascribed to increasing population pressure and more intensive use of agricultural land. In addition, increasing inequalities between producers have increased the vulnerability of poor households to the impacts of droughts.

Farmers in the Brazilian northeast, and in fact the rural population in general, put in an effort to search for signs of rains or droughts even long before the rainy season. These techniques vary from very simple to more complex and pseudoscientific. Whatever the degree of complexity, such experiences are an important aspect of the culture of the rural population and their popular faith (Magalhães, 1993:192). When the drought arrives – considered "official" if no rainfall has occurred by March 19, the day of St. Joseph – farmers start to adapt to the inevitable through a series of activities, ranging initially from stopping any dry land agriculture to eventually selling their lands and migrating as a last resort.

4.3 The role of traditional technologies and community mechanisms in coping with drought

Evidence exists to believe that populations in marginal environments are probably much better equipped to cope with periods of food stress and water scarcity than those accustomed to more secure conditions. Local communities in Mexico, for instance, developed many traditional technologies for coping with drought and mitigate the impacts of water scarcity. As in many semiarid regions, sophisticated irrigation systems have developed over many centuries to store and transport water over long distances to settlements and for agricultural use. Archaeologists and other observers have described pre-hispanic water control systems such as the *chinampas* – the highly productive raised fields in the wetlands surrounding Mexico City – and the *galeria* tunnels, which bring water from the hillside aquifers to the valley of Tehuacan, Puebla (Liverman, 2000:41).

The heterogeneity of the Mexican landscape and the high interannual climate variability historically also promoted a diversity of crop varieties, especially of maize. Today, many farmers still plant several different varieties of maize to

minimise risk from drought, frost and diseases. Traditional farmers in Oaxaca adjust to the semiarid conditions by selecting a maize variety appropriate to expected rainfall conditions, altering the ratio of maize and beans planted, and adjusting the planting density of crops (Liverman, 2000:40).

In a similar way, in many drought-prone areas of sub-Saharan Africa, crop farmers try to diversify into livestock, while pastoralists, again, may shift from cattle to goats (which have a higher resistance to drought) (Davies, 2000:6). At community level, adaptation mechanisms consist primarily of transferring assets or lending resources between richer and poorer households through a range of reciprocal ties (e.g. employing members of poorer households to work on richer ones' land in return for seed or a share of the crop), or in building up communal reserves that can be used in times of stress. There is, in fact an entire range of community-based coping mechanisms to help people withstand periods of severe drought. Amongst these are gifts of food to impoverished kin, credit to buy food and other necessities, and fostering of children by wealthier households. Even after a period of drought has ended, reciprocal mechanisms are maintained to redistribute assets in an attempt to aid the recovery of poorer households. These include the loaning of seed, tools and food; the loaning of cattle to reconstitute herds; and other informal forms of credit assistance. In India, the impact of drought on farmers is manifested in several socio-economic measures adopted by the rural community. More specifically, in times of severe drought they (i) reduce consumption, (ii) postpone social functions such as marriages, (iii) migrate to better areas with livestock, or sell stock, (iv) take consumption loans, and (v) sell assets like gold ornaments as a last resort (Das, 2000:193).

Davies (2000:6) observes that coping strategies in rural communities of sub-Saharan Africa are highly gender stratified: Women and men cope with drought in very different ways, reflecting their differing gender-based entitlements. Women, for instance, invest more heavily in social networks than men, especially in cases where their access to labour markets is restricted. Such networks then become important safety nets during hazardous times. This applies to all stages of drought management, but gender-based differences increase as the crisis deepens.

As Scoones *et al* (1996:194-95) point out, social networks of support are of particular importance for vulnerable households with limited alternatives, and can take a variety of forms. This is illustrated by a detailed case study in Chivi District in the Masvingo Province of Zimbabwe between 1990 and 1994. At the height of the drought, households continued to be connected together in clusters based around labour and draught sharing. These clusters usually

centred around close kin relationships, and food sharing within clusters was of particular importance for children, who could get food from a range of homes. With the abandonment of agriculture during the 1991-92 season, sharing of food or borrowing of money became critical for the very poor. Social networks as coping strategy are also vital in other ways. The marriage of a daughter may, for example, realise a bridewealth payment. Scoones *et al*, (1996:195) point out that although daughters were not pawned in order to raise income (as happened in the past), drawing on social obligations, affirmed by marriage related payments, can be an important source of support.

During periods of drought farming households increasingly rely on off-farm income to supplement their farming resources. This strategy involves, amongst others, temporary migration to urban areas by one or more family members during drought years. During the three-year drought in the Chichaoua region of Morocco in the early 1990s, about 80% of a typical rural family's resources came from outside the farm (Swearingen & Bencherifa, 2000:285). A comparative figure for Botswana during the drought of 1982-1990 was put at 68% (Sporton *et al*, 1999). Evidence from a number of sub-Saharan African countries also highlights the crucial role that inflows of remittances from migrant workers play to reduce vulnerability to drought. This practice often involves migration to a neighbouring country to work in the mining sector or to a coastal economy unaffected by drought, effectively spreading the benefits of drought insensitive activities to the drought affected areas (Benson & Clay 2000:301). Off-farm employment opportunities in some drought-prone regions in India provide near-immunity to the impacts of drought. Subbiah (1993:176) accordingly emphasises the gradual transfer of large numbers of workers from farm to non-farm jobs. In this way, by enhancing the value of agricultural raw materials, agro-based village industries will create employment and provide income security against droughts.

In the event of an extreme drought, the most vulnerable groups in rural areas face a problem of survival. Without a source of income they adapt to circumstances by looking at a range of alternatives. Magalhães (1993:190) points at the following strategies that have been adopted by vulnerable groups in Brazil, most of which may also apply to countries in southern Africa.

- Looking for another income-generating activity, although generally hardly any alternatives are available.

- Hunting wild animals (even rats and snakes) and collecting roots and cactus to eat was a common response during past periods of drought.
- Looting storehouses in nearby cities in search of food.
- Digging wells in dry river beds in search of water.
- Migrating to regions and cities where the drought is less severe.

As Sporton *et al* (1999) point out, during times of drought in developing countries, migration indeed becomes a very important coping strategy, facilitated by extended kinship and support networks.

5. CONCLUSIONS AND RECOMMENDATIONS

Emanating from the above discussion, at least three main principles (in the form of recommendations) can be outlined that should, from a social point of view, be considered by extension officers and management responses when it comes to policy formulation that will mitigate the impacts of drought and water scarcities. Although these principles are mainly derived from the analysis of sub-Saharan and southern Africa, they might well be applicable to most developing nations.

Firstly, since only about 0,01% of the Earth's water is readily available for human consumption[6], a large share of water to meet new demands will have to come from **programmes aimed at saving water** from current inefficient consumption patterns. This implies a comprehensive reform of water policies with cost implications for all users. Such reforms, however, may clash with, amongst others, cultural and religious beliefs in many communities that treat water as a free good. If not considered carefully, water policy reforms might therefore easily instigate conflict between indigenous communities and the authorities. Additional research is necessary to assist in the formulation of specific policies in any given country. At the same time however, it is recommended that rural perceptions on water consumption and utilization be recognized as part of a valid indigenous local knowledge system, and as such be accommodated in policy formulation.

Secondly, people's **social perceptions of drought** – or any other hazard - are made up of complex narratives of assumed cause and effect that suggest a multiple range of "truths" and "realities". Taking (rural) people's perceptions seriously is therefore of crucial importance for a number of very practical

[6] *About 97% of the Earth's water is salt water. Most of the remaining 3% is locked in glaciers and ice caps, causing only 0,01% to be available for human use (Hinrichsen, 1996).*

reasons. It is, first of all, widely recognised that technicians, scientists and policymakers do not have all the answers and that local understandings are important to sometimes help clarify the complexity of issues. In addition, for policies dealing with drought to be effective they must have legitimacy and the administrators must be trusted. Taking cognizance of people's risk perceptions is therefore not only recommendable, but also fundamental, as people will respond to what *they* believe to be the case, rather than according to the views of scientists.

Thirdly, existing **community structures and capacity**, particularly in the rural areas of developing countries, should be strengthened to assist communities in overcoming the difficulties associated with prolonged periods of drought and water scarcity. If special attention is given to women in development programmes, particularly in training and credit facilities, rural development can also reduce gender inequality while improving food security. This will also help to reduce the burden on urban areas to supply job opportunities to rural migrants during times of drought. For a community to become resilient, poverty must be eradicated and families must have a stable income to meet their basic needs and to enable them to face any economic crisis caused by drought.

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