

The Monopolization of Access to a Critical Natural Resource: The Case of Water in South Africa

A.R. Turton

26 Hugo Street, P.O.Box 302, Rant en Dal, 1751 South Africa
Fax: 27-11-665-3645, email: art@icon.co.za

KEY WORDS Indigenous knowledge; aridity; drought; water law.

ABSTRACT South Africa is undergoing a vigorous social transformation at present. One aspect that this transformation is designed to redress is the imbalances that resulted from Apartheid. Through a process of resource capture, the political elite of the past half-century monopolized access to water which is a critical natural resource in arid regions. This paper identifies the constraints within which arid states function. It focuses specifically on the role that indigenous knowledge plays in maintaining a culture of drought tolerance. Evidence is offered that suggests where settler intrusion was limited, indigenous knowledge survived and enabled a vibrant culture of drought tolerance to flourish. Conversely, where settler intrusion was higher, there is a corresponding lack of a culture of drought tolerance. The explanation for this is the fact that settlers originated from the wet North, and the knowledge that they brought with them was largely inappropriate for long-term survival in arid conditions. New water legislation may allow indigenous knowledge to again find its rightful place in society.

INTRODUCTION

This paper is intended to summarize the current changes that are taking place in the South African legal system regarding water. These changes are linked to the process of democracy that was ushered in with the release of Nelson Mandela (and other political prisoners) from incarceration, and the unbanning of liberation movements such as the African National Congress (ANC) and the Pan Africanist Congress (PAC). This process intended to normalize the political dynamics of South Africa, leading to the establishment of a new Constitution. This has impacted internally as well as internationally, and has served to fundamentally alter the pattern of resource distribution as in the case of water.

FOUR SIMPLE FACTS OF LIFE

An analysis of the role and function of water

in socio-political terms for any arid state reveals at least four simple facts of life. These facts act as a constraint within which water is mobilized, allocated and consumed within society. It is therefore useful to dwell for a moment on what these constraints are:

- **Water is finite.** There is a given quantity of water available to any state at any moment of time. Broadly speaking, this water is found in three main forms. Firstly, there is atmospheric water found in the form of humidity. This results in precipitation, of which there are various types, one of which is rainfall. Secondly, there is surface water. This consists largely of water that has run off the land as the result of precipitation and is found mainly in rivers, lakes and other man-made impoundments. Thirdly, there is ground water. This consists of the precipitation that has not run off the land, but which has percolated down into the soil, through the root zones of plants and finally into subterranean aquifers.
- **The hydrological cycle is universal.** A fundamental law of hydrology is that all water exists as part of a global hydrological cycle. At any one moment in time, there is a finite amount of water available in any one phase of this cycle. This cannot readily be altered by man, although he tries to do so through a variety of means. This endeavor is largely unsuccessful and at best enables a small portion of water to be retained for slightly longer in both spatial and temporal terms. Examples of this anthropogenic manipulation are cloud seeding, dam construction and artificial aquifer recharge. In the final analysis, all of these endeavors are subject to the universality of the hydrological cycle, which ultimately prevails. In essence, three aspects of the hydrological cycle are relevant to this discourse.

Firstly, it means that sovereign aspirations that a state may have regarding water are always defied in the end. If sovereignty had to be placed in a scale and counter-weighted against the hydrological cycle, the latter will always prevail over time. Secondly, the three forms of water noted as the first fact of life are linked through the hydrological cycle. Thirdly, the shifting patterns of global climate change impact on the amount of water available spatially and temporally to any one state or geographical entity. Recent awareness of El Nino is an example of this, where droughts in Australia and Southern Africa are accompanied by inundation elsewhere.

- **Water is life.** A universal truth is that no life can exist where there is no water available on a regular basis. The significance of this in arid regions is that access to water means that a person (or group of persons) can prosper and flourish. Scientifically, this is known as "resource capture" (Homer-Dixon & Percival, 1996: 6). Conversely, those to whom access is denied become marginalized socially, politically and economically and slowly whither away. Scientifically, this is known as "ecological marginalization" (Homer-Dixon and Percival, 1996: 7). For this reason, water becomes highly politicized in arid regions, simply because it becomes necessary to allocate or apportion water, implying that those who are favored by these decisions are better off than those who are not. Decision-making under such circumstances becomes imbued with political ramifications. As Prof. Tony Allan, an international expert on water in arid regions has said, "all waters are not equal: some are more political than others" (Allan, 1997: 6.1).
- **Aridity has a universal root cause.** It is not true to say that in arid regions there is no precipitation at all. The simple cause of aridity is that a high evaporative demand exists. Aridity can be defined as the relationship between precipitation and potential evapotranspiration, in which the naturally occurring precipitation is less than the loss to the atmosphere by evaporation or transpiration (Arnestrand & Hanson, 1993: 20). Simply stated, in arid regions more water evaporates

into the atmosphere than falls as precipitation, so the critical component of local or indigenous knowledge is how this fact is managed in daily life.

KNOWLEDGE IS CULTURE SPECIFIC

The history of South Africa has been impacted on heavily by the settlement of Europeans during the 17th and 19th centuries. Prior to these phases of settlement, the indigenous peoples had a culture that differed markedly from that of the settler. Two aspects were relevant in the pre-settler period.

- Firstly, the indigenous population was relatively small, which meant that they were not functioning on the threshold of sustainability at that moment in time. In fact, there was a relative water abundance during this period, simply because there was a low human population base that was being supported by the available resources.
- Secondly, the indigenous peoples had an understanding of what it meant to live within the constraints that the hydrological cycle had subjected them to. This was deeply ingrained in their culture and was protected by customs, such as the notion of communal use and non-ownership of water as a resource. Critical to this phase of history was the notion of sustainability. While the indigenous peoples probably did not understand this concept in the same way that it is being interpreted in contemporary times, they certainly knew that their very survival depended on protecting the resource. This protection (and hence sustainability) was given through cultural values that were used to allocate the resource.

Then came the settlers, who brought with them a number of values that impacted on the water discourse.

- Firstly came the paradigm of modernization. Inherent within this paradigm was the central belief that European values were of greater significance than indigenous African values. In other words, the belief that Europeans had evolved to a higher plane of existence than African tribesmen had, was widely held at that time. This was manifest in a number of ways.

The most obvious of these was the imposition of Christianity on the so-called heathen. Other manifestations of this paradigm were encapsulated in the agricultural practices that were introduced. The nett result of this settler value system was the fact that indigenous knowledge was regarded as being inferior, quaint or archaic and was thus widely rejected as being of any value. Part of this settler value system was the belief that any water that ultimately flowed into the sea was wasted (Davies *et al.*, 1993: 136). This value has largely prevailed to this day and is only now beginning to change. Evidence of this belief system is also found in Zimbabwe among commercial farmers of settler origin (Hickman, 1997).

- Secondly, the settlers tended to originate from the Northern Hemisphere. Prof. Malin Falkenmark, a hydrologist of international stature, has noted that, "problem definitions and proposed solutions may be undermined by temperate-zone paradigms and thinking" (Falkenmark, 1989: 118). What this means, in historical context, is that the settler value system was based on knowledge that had been developed in the wetter Northern Hemisphere and which was therefore largely inappropriate to the more arid South.
- Thirdly, a combination of the above two values resulted in a settler population that practiced a form of monoculture that was underpinned by a supply-sided approach to water management. Stated differently, the settlers tended to view water supply problems as being soluble by means of engineering technology such as dam construction. The early part of the 20th century saw an unprecedented upswing in the construction of dams in South Africa. This was a manifestation of this supply-sided value system, which ignored one of the root causes of aridity however. The nett result of this dam building initiative was that increasingly large volumes of water were stored in impoundments that were located in areas with a naturally high evaporative demand. As a result large volumes of this water were simply lost to the atmosphere and were thus not available for use. One of the largest impoundments in

Southern Africa serves to illustrate this point dramatically. A volume of water in the order of 20 to 25 per cent of the total flow of the Zambezi River is lost annually (Mac Donald *et al.*, 1990: 2.7) due to evaporation caused by the increased surface area of Kariba Dam. Evaporative losses from the Vaal Dam in Gauteng exceed precipitation every month of the year (Davies *et al.*, 1993: 142). The Omatako Canal in Namibia presents an even more extreme case, where 70 per cent of the water carried by that canal is lost to evaporation (Davies *et al.*, 1993: 168). Such practices are therefore clearly wasteful.

The settlers brought with them a notion of entitlement that differed fundamentally from that of the indigenous population. Over time, as the settlers claimed more of the land, and as the legal system changed, ownership and control over water became linked to land tenure. Access to and use of surface water became linked to riparian laws, which tended to place the rights of downstream users in a lower order of importance or priority. In short, under the Roman-Dutch law that prevailed, if you owned the land then you also owned the water that was under the land or flowing across it. This meant that relative abundance existed for a few, while the majority was faced with a real threat of water scarcity. In scientific terms, this is a process known as "resource capture" during which powerful social groups shift resource distribution in their favour (Homer-Dixon & Percival, 1996: 6) over time.

- One implication of the ownership of water was the fact that water tended to be misallocated in the economy. The following statistics are revealing in this regard (Turton, 1998: 143). In 1980, 54 per cent of the total water consumed in South Africa went to the agricultural sector, which in turn contributed a mere 6 per cent to the GDP. In contrast, the industrial sector consumed 11 per cent and contributed 45 per cent for the same year. During 1990, agriculture consumed 52 per cent of the total water and contributed 6 per cent to the GDP, whereas industry consumed 13 per cent while contributing 31 per cent to the economy during the same year. During 1995, agriculture consumed 72 per cent of all of the water while still only contributing 6

per cent to the economy, whereas industry consumed only 11 per cent while contributing 30 per cent to the GDP for the same year. The conclusion that can be drawn from this data series is that agriculture is inefficient at converting scarce water into a contribution to the overall economy of a state in an arid region.

- This alarming statistic was compounded by the fact that the largest consumers of water were commercial farmers of settler origin. By owning the land, they gained ownership of the water and thus could do with it as they pleased, even if it meant irrigating low yield crops with water that was essentially high value in terms of opportunity cost.
- The overall ideology of Apartheid exacerbated this problem during the second half of the 20th century. The reason for this was twofold. Firstly, the doctrine of Apartheid dictated that the white minority was the political elite of the country at that time. As such, a large portion of the constituency of the ruling Nationalist Party (NP) was made up of commercial farmers. It therefore made no sense for the central government to intervene in water allocation measures, that would undoubtedly be largely unpopular and would thus result in a loss of political support, for a regime that was already unpopular and therefore under constant threat. Secondly, as South Africa became increasingly isolated in political, economic and social terms, largely as the result of the increased levels of state violence that were needed to maintain the Apartheid system, South Africa became a garrison state with a prevailing siege mentality. The latter years of Apartheid rule were driven by an ideology that came to be known as the "Total National Strategy" which was based on a strong but misguided threat perception known officially as the "Total Onslaught" (Turton and Bernhardt, 1998). This resulted in economic sanctions being applied against South Africa, which in turn gave rise to the need to maintain national self-sufficiency in food-stuffs, even if it meant, "making the desert bloom". Under such conditions, notions of inefficiency are not widely accepted as be-

ing limiting factors, and a person espousing such a view could even be branded a traitor harboring an anti-nationalistic sentiment! Such was the impact of the prevailing threat perception at that time.

These historic dynamics had the combined effects of driving South Africa beyond the levels of sustainability, at least in certain instances. This is one explanation of the large-scale sheet erosion that Prof. De Beer (1998) showed during his presentation on the Northern Province of South Africa. Significant to this notion of sustainability, is the fact that because the hydrological cycle is universal (as noted during the introduction as the second simple fact of life), all forms of water are linked. Stated simply, if you overexploit water in an aquifer (e.g. by constantly using a borehole to irrigate a field), it will ultimately lead to a depleted flow of water in the nearby river or adjacent well. Modern GIS technology can illustrate this graphically (Storm, 1998). This resulted in the following:

- Incomplete knowledge as to the way in which aquifers would perform over time. This means that aquifer management has largely not been regarded in holistic terms, as each land owner could drill as many boreholes as he pleased, and once drilled, could abstract as much water as the borehole could provide, with no concern for the effect that this may have on other users of the same aquifer.
- Indigenous peoples became increasingly marginalized over time, often being forced into less productive parts of South Africa which came to be known as the "Bantustans" or "Homelands". Not only did blacks suffer from an imbalanced distribution of the quantity of land, but also they often received the most marginally productive land (Percival and Homer-Dixon, 1995: 8) which contributed to structural scarcity. These relatively depleted pieces of land were seldom consolidated into cohesive units. Onto this patchwork quilt of land, large populations were forced to live. In fact, Apartheid ultimately forced the majority of the population to live on just 13 per cent of the total land area (Homer-Dixon and Percival, 1996: 39), largely without access to clean running water. For example, during 1994, a survey conducted in

rural KwaZulu-Natal revealed that 76.2 per cent of the population only had access to water from springs and streams, none had taps in their homes, 15 per cent made use of communal standpipes, 1.6 per cent had access to reservoirs and 7.1 per cent had no access to safe potable water at all (Percival and Homer-Dixon, 1995: 12). This resulted in severe environmental degradation, some of which may well be of an irreversible nature.

WATER IS LIKE MONEY IN THE BANK

The process of "resource capture" that was evidenced in South Africa can be likened to money in the bank. This illustrates a number of pertinent aspects related to water.

- Firstly, access to the bank means that those with the necessary creditworthiness can mobilize funds that are channeled into projects that increasingly favour a select group. This gives rise to the often used truism that "the rich get richer while the poor get poorer". In this case, access to water means that prosperity is reasonably assured, and this prosperity in turn gives rise to increasing access to financial resources. This can be seen as a form of spiral, as more resources become captured and a greater number of persons become "ecologically marginalized".
- Secondly, water, like money in a bank, can be borrowed now to be paid back later. This is widely practiced for example in Botswana. Due to the prevailing aridity in that country, where some 94 per cent of the total surface water originates from outside its own borders (Gleick, 1993: 108), an important management strategy is the concept of "conjunctive use" (Arnestrand and Hanson, 1993: 33). This means that during wet years, proportionally more surface water will be used. Conversely, during years of drought, which is a completely natural phenomenon in Southern Africa, more groundwater will be used. In some years, groundwater abstraction will exceed aquifer recharge rates and can be regarded as "groundwater mining". In this case it is borrowed today against some future belief that the resource will be renewed or paid back.
- The important aspect to note however, is that water (like money) borrowed now, must be paid back in time and with interest. Failure to do this means that the borrower runs the risk of foreclosure. In water terms, this means the intrusion of salt water into aquifers, the progressive lowering of the water table and subsequent drying up of wells elsewhere, or total resource depletion in the case of dolomitic aquifers. This aspect, according to the author, is culturally ingrained in certain populations in Southern Africa, but not in others. As an example, Botswana has one of the most arid climates in the entire Southern Africa. It is also the least impacted in terms of settler population. It can thus be argued that their culture of drought tolerance (Turton, 1998: 114) is largely based on their understanding of this one crucial component of water management. This can be regarded as the manifestation of indigenous knowledge in the opinion of the author. With only a limited settler experience, Botswana seems to have retained this indigenous knowledge and uses it to manage drought very successfully. The opposite holds true in neighboring Namibia however. Both Namibia and Botswana have similar sized populations (Turton, 1998: 76) and both have a similar volume of water resources (Turton, 1998: 64). However, according to Moremi Sekwale, the head of the Botswana delegation to OKACOM, the body that manages the Okavango River Basin, Namibia consumes nearly twice the volume of water per capita when compared to Botswana (World Rivers Review, February 1997; Turton, 1998: 187). Namibia has a combined history of settler involvement along with a culture of relative water inefficiency. From this it can be concluded that the settler experience caused the erosion of indigenous knowledge regarding how to cope with water scarcity. This is evident in contemporary times in the form of a diminished culture of efficient water use in Namibia. The same argument can be used for Zimbabwe, which also has a strong settler history. In fact, it has been reported that during the 1992 drought that hit both Botswana and Zimbabwe, the latter fared the

worst (Arnestrand and Hanson, 1883: 11).

Thus it is being argued that the ability to successfully exist in arid climates, is the result of the interaction of at least three important components. These are:

- Firstly, cultural values impact on the management of daily life with less water. It has been argued that in Botswana, where there is the least historic evidence of settler disruption of indigenous knowledge, there is also the highest level of drought tolerance. Conversely, in Namibia and Zimbabwe, both having a high level of settler intrusion into the overall normative system that prevails today, there is a lower level of drought tolerance.
- Secondly, physical conditions also impact on the overall drought tolerance. For example, Botswana has been shown to be more drought tolerant than Zimbabwe, but the former also has deeper aquifers than the latter. The deeper wells are thus less prone to drought. It can thus be concluded that drought tolerance is not purely a cultural manifestation, but also a physical one.
- Thirdly, policy options determine the overall allocation of water within an economy. In South Africa, this was done in favour of white settler farmers, which resulted in gross misallocation of water within the overall economy. Over time, this resulted in significant levels of "resource capture" by commercial farmers, with a concurrent "ecological marginalization" of the non land-owning majority. Policy-making is also a manifestation of a cultural value system, so this can be linked with the first point.

NEW SOUTH AFRICAN WATER LAW

In the post-Apartheid South Africa, this is all changing however. Some of the most dramatic changes in socio-cultural terms can be found in the field of water management. With the normalization of the South African political process, a new constitution has been written. A normative basis of this constitution is the notion of equality. A significant departure from the previous constitution is focussed on the fundamental rights of the individual. This in turn has

given rise to a new water law, which differs fundamentally from the previous legislation. This process was started when the Department of Water Affairs (DWAF) issued a Discussion Document on Water Law Principles (DWAF, 1996). This gave rise to a vigorous public debate that resulted in the White Paper on Water Policy (DWAF, 1997). A summary of this (DWAF, 1997) follows:

- Principle 1 states that the water law will be consistent with the Constitution. Specifically, the water law will actively promote the values enshrined in the Bill of Rights.
- Principle 2 recognizes the fact that all water is linked in the hydrological cycle, with all water having consistent status in the law, irrespective of where it exists within that cycle.
- Principle 3 states that there is no ownership of water. All water shall be allocated either as a right (in the case of environmental and basic human needs only) or as an authorization for its use. No authorization shall be made in perpetuity (thus eliminating the dynamic of "resource capture" that prevailed in the past).
- Principle 4 does away with the riparian principle, and de-links the ownership of land from the ownership of water that is found on (or under) that land. This principle effectively counters the historic process of "resource capture" that was evident under Apartheid.
- Principle 5 recognizes the universality of the hydrological cycle and states that the basic unit of management shall be the catchment.
- Principle 6 notes that there is both a spatial and temporal inequality in the distribution of water within the hydrological cycle.
- Principle 7 states that the objective of water management is to achieve long-term environmental sustainability with social and economic benefit to accrue for the overall benefit of society.
- Principle 8 notes that water needed for basic human survival shall be reserved. (This is one of the only two cases where rights are given to water under the new law).
- Principle 9 notes that the only other right accorded under the new law shall be for the aquatic environment. Ecosystems are thus

regarded as legitimate consumers of their own water, which is a rather radical departure from the past. In other words, the only other rights that exist (other than for basic human survival) are for the maintenance of long-term ecological functioning within aquatic systems. This makes it illegal to shut off the flow of any river, as was the practice in the past. This is now factored into the management regime of all impoundments and has led to South Africa becoming regional leaders in determining what is technically known as the "Instream Flow Requirements" (IFR) of any river system. This also marries together various scientific disciplines in what has become to be known as the "building block methodology" (King and Louw, 1996) which has been pioneered by Dr. Jackie King and others at the University of Cape Town.

- Principle 10 notes specifically that the water accorded as a right in terms of Principles 8 & 9 shall be called the "Reserve". This water in the "Reserve" is the only water that is to enjoy priority of use by right. The use of all other water shall be subject to an authorization rather than a right.
- Principle 11 states that international watercourses will be managed in a spirit of mutual co-operation in such a way as to optimize the benefits to all parties. Of significance, allocations agreed upon for downstream users shall be respected.
- Principle 12 identifies the role of the national Government as the custodian of the nation's water resources. As such, the Government has the responsibility for the equitable allocation of water usage. (This also counters the "resource capture" of the past, but raises the prospect of a newer form of the same dynamic).
- Principle 13 notes that the Reserve (basic human needs and the needs of the environment) are to be given priority followed by water subject to international agreements. All other water will be managed by the Government using the criteria of public interest, sustainability, equity and efficiency of use in a manner that reflects the public trust obligation that the Government has been entrusted with.
- Principle 14 states that demand management will be used as a preferred option to ensure equitable access to water.
- Principle 15 notes that both water quality and quantity management are interdependent.
- Principle 16 says that water quality management options will include the use of economic penalties and incentives to reduce pollution. In short, the polluter will pay for the subsequent cleanup.
- Principle 17 links water management to broader environmental management approaches.
- Principle 18 states that the regulation of land use will be used as an instrument to manage water resources within an integrated framework.
- Principle 19 stipulates the manner in which an authorization for water will be made. This includes security, predictability and assurance of availability.
- Principle 20 states that when making an authorization, the Government will consider the investment that has been made in the development of infrastructure.
- Principle 21 notes that water use must limit danger to life and property due to the potential for manmade disasters.
- Principle 22 spells out the need for a simple institutional framework for the management of water resources.
- Principle 23 states that where appropriate, water management responsibilities will be delegated to a catchment or regional level in order to allow interested parties to participate.
- Principle 24 says that all beneficiaries of water related projects will contribute to the cost of establishing and maintaining such projects on an equitable basis.
- Principle 25 clearly stipulates that all citizens have the right of access to basic water and sanitation services necessary to support a healthy environment.
- Principle 26 links the regulation of water services to broader local government frameworks.
- Principle 27 separates the provision of water services from the development of water resources.

- Principle 28 protects the rights of the individual in the face of a monopoly situation developing regarding the provision of water services.

CONCLUSION

Southern Africa offers evidence, which suggests that indigenous knowledge regarding water resource management is an important component of an overall national water management strategy, for states in arid regions. In Botswana, a country that is very arid but which has only a limited settler experience, there is a vibrant culture of drought tolerance. This is not simply enforced by government alone, but seems to exist, at least in part, within the hearts and minds of the citizenry. This can be regarded as a manifestation of indigenous knowledge. In other parts of Southern Africa where there has been extensive settler intrusion into society over time, such as in Namibia, Zimbabwe and South Africa, there seems to be evidence that this indigenous culture has been wiped out. In such cases, there is the need for government to forcibly sanction a drought tolerance, which is often ineffective because it is not supported by a natural indigenous value system.

South Africa also offers an interesting example of what is known as "resource capture". In this case, European settlers extended their control over the country by means of systematically monopolizing access to crucial natural resources. Over time, land ownership became linked to water ownership, which led to "ecological marginalization" of the indigenous majority. The new democratic dispensation that has been established under the leadership of President Nelson Mandela, has actively sought to reverse these damaging trends. The new water law, actively developed and promulgated by the Minister of Water Affairs, Prof. Kader Asmal, reflects this. Distinctive elements of the new water law, still to be finally promulgated, are:

- The de-linking of land rights from water rights.
- The recognition of the only water that is reserved by right as that used by the ecosystem and that needed to ensure basic human survival. This is known as the "Reserve" and

is subject to the highest degree of protection.

- The elevation of water allocations agreed upon in terms of international treaties to a status just behind the water known as the "Reserve" and effectively above local consumers.
- The allocation of all other water by means of an authorization.
- Recognition that the hydrological cycle prevails.

The author optimistically believes that this will enable indigenous knowledge to possibly regain a rightful place in the overall normative order of South African society. This seems to be the case in neighboring Botswana, which demonstrates a deeply ingrained culture of drought tolerance which seems to be linked to the fact that they have not suffered an erosion of these indigenous cultural values as the result of a history of minimal settler intrusion.

One outcome of this new water law that the author is willing to predict, is the fact that white commercial farmers are likely to feel that they have been aggrieved and even specifically targeted as a group. This is driven, in the opinion of the author, by three main dynamics:

- Firstly, there is a sense of profound loss that the farming community experiences. This can be viewed as a psychological dimension. This loss derives from the fact that prior to 1994, they were an important constituency of the ruling political elite. This has now changed and they no longer enjoy that privileged status. Some even feel that they have been totally marginalized and abandoned in the process.
- Secondly, there is a belief within the commercial farming sector that they are being threatened by the various new legal reforms taking place. Included in this is the land and water reform initiative. The prevailing belief is that their livelihood is being threatened by stripping away the resource access on which it is based. Whereas they previously owned the water on or under their land, in terms of the new water law, they will have to apply for an authorization to abstract what they have always seen as their own resource. It is likely that many will not apply for this

authorization as a form of protest, so unless the government actively enforces this law, its credibility will be systematically eroded.

- Thirdly, the issue of farm killings is a burning one. Since 1994, there have been in excess of 500 murders on commercial farms in South Africa. The farming community believes that these killings are politically motivated, aimed at forcing them off their land, whereas the Government has denied this.

The combination of these three dynamics is likely to act as a severe test of the new water law reform. In the final analysis, the acid test will be to see whether the new law enables water to be managed in a holistic manner as a national resource, without undue prejudice or corruption. Only time will tell.

REFERENCES

- Allan, J.A. 1997. Personal discussion with the author on 15 August 1997 at the School of Oriental and African Studies (SOAS) regarding chapter 6 of a new book that he is writing and which he asked the author to comment on.
- Amestrand, M. and G.Hanson. 1993. *Management of Scarce Water Resources in Southern Africa. Main Report. Sustainable Use of Water Resources (SUWAR) Report No. D3*, 1993.
- Davies, B.R., J.H. O'Keefe and C.D. Snaddon. 1993. *A Synthesis of the Ecological Functioning, Conservation and Management of South African River Ecosystems*. Water Commission Report No. TT 62/93.
- De Deer, F.C. 1998. "Mountains as Cultural Resources: Values and Management Issues," paper presented at the 14th International Congress of Anthropological and Ethnological Sciences, Symposium on Resource Management through Indigenous Socio-Cultural Practices. July 26 - August 1, 1998. Williamsburg, VA. USA.
- DWAF. 1996. *Discussion Document on Water Law Principles*. Pretoria: Department of Water Affairs and Forestry.
- . 1997. *White Paper on Water Policy. South Africa*. Pretoria: Department of Water Affairs and Forestry.
- Falkenmark, M. 1989. "The Massive Water Scarcity Now Threatening Africa - Why isn't it Being Addressed?" *Ambio*, 18 (2): 112-118.
- Gleick, P.H. (ed.). 1993. *Water in Crisis: A Guide to the World's Water Resources*. New York: Oxford University Press.
- Hickman, P. 1997. Comments during the presentation of a paper entitled *Construction of Dams in Small Rural Areas Using Tractors*. 2nd Africa Water and Wastewater Conference, Water Africa '97. 15-18 September 1997. Harare, Zimbabwe.
- Homer-Dixon, T. and V. Percival. 1996. *Environmental Scarcity and Violent Conflict: Briefing Book*. Population and Sustainable Development Project, American Association for the Advancement of Science and University of Toronto.
- King, J. and D. Louw. 1996. "Assessment of Instream Flow Requirements for Regulated Rivers in South Africa Using the Building Block Methodology." paper presented at the Vic Falls Conference on Aquatic Systems and International Symposium on Exploring the Great Lakes of the World (GLOW) Food-web Dynamics, Health and Integrity. July 15-19, 1996. Victoria Falls, Zimbabwe.
- Mac Donald, M. and Partners. 1990. *Sub Saharan Africa Hydrological Assessment: SADCC Countries: Regional Report*.
- Percival, V. and T. Homer-Dixon. 1995. *Environmental Scarcity and Violent Conflict: The Case of South Africa*. Population and Sustainable Development Project, American Association for the Advancement of Science and University of Toronto.
- Storm, B. 1998. "River Basin Management Modeling," paper presented at the Water Africa '98 Conference, 30 June - 2 July, 1998. Nairobi, Kenya.
- Turton, A.R. 1998. *The Hydropolitics of Southern Africa: The Case of the Zambezi River Basin as an Area of Potential Co-operation based on Allan's Concept of 'Virtual Water'*. Unpublished M.A. dissertation submitted to the Department of International Politics at the University of South Africa. Pretoria: UNISA.
- Turton, A.R. and W. Bernhardt. 1998. "Policy-making within an Oligarchy: The Case of South Africa under Apartheid Rule," paper presented at the 14th International Congress of Anthropological and Ethnological Sciences, Symposium on Anthropology in Policy and Practice: The Global Practice of Anthropology. July 26 - August 1, 1998. Williamsburg, VA. USA.
- World Rivers Review. Namibian pipeline project heats up. February 1997.