

The effects of a RSA's
100 YEAR DROUGHT
and the way out of it.....

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Abstract

The effects of a “100 YEAR DROUGHT” and the way out of it.....

An exploration of local socio-ecological changes and agency development as a result of the national drought. South Africa is experiencing the worst drought in decades and the hottest temperatures since records started in 1904. The drought is magnifying existing issues within the South African landscape. The 60% of South African citizens living in poverty will struggle to afford food when prices increase as a result of a poor harvest during the drought. Poor municipal management allows valuable water to be wasted through leaking infrastructure, or polluted by badly managed sewage, further developing tensions which already exist between the public and government departments over limited resources. Differences in attitudes toward natural resources create frustration and friction among the "everyday" South Africans who use and might lose the benefits they bring.

What are the socio-ecological changes in the life of an average South African as a result of water scarcity, are they aware of it, and what can they, or we, do about it?

Keywords:

Drought, economical, South Africa, recommendation, maize

1. The purpose of the investigation

During our exploration of the theme “local water” for this year’s Water is Life 2016 conference, it became apparent that “local” water issues observed had to be investigated and understood on at least the national level to incorporate complexities (such as political, economic and social) necessary to make meaningful comments.

We are currently experiencing a national drought and we find ourselves in a year of municipal elections, this creates a perfect canvass to explore water related issues as they currently are or perceived. Look at promises that were and are made through National Development Plan (NDP) and Sustainable Development Goals (SDG), investigate the effects of water related issues on local citizens and make some recommendations of our own through the possibilities that have been uncovered.

The report therefore takes the format of a story of South Africa, from the perspective of an average poor family (which will be most affected). A country which had some exciting challenges before the onset of the drought and which will now have additional challenges which we will describe. We explore some possibilities to mitigate the effects of water scarcity and then we conclude with our “Mandela magic” pathway forward.

2. Method of the investigation

We decided to do a meta-analysis of all available sources to us, in order to get the most accurate depiction of the South African context. This included:

Document analysis,

- Mostly internet reports (NDP, SDG etc.)
- Local municipal meeting minutes.
- News24 online articles.
- Rhodes environmental interest group articles.
- PACSA reports

Conference presentation,

- TED presentations (online)
- SciFest Africa (attended)

Interviews,

- Young Water Professionals (Grahamstown)
- Sandy Elsworth (UK hydrogeologist)
- Nikki Kohly (Environmental officer, Rhodes)

and a Survey.

- Water survey presented to Grahamstown community (online).

As mentioned before we decided that an overview of the national water landscape was required in order to make meaningful comments. We also hope that this report will merely be the “springboard” for further involvement in more specific sections of our research.

3. Results of the investigation

3.1 The Survey

South Africa is known as the “rainbow nation” for its cultural diversity. Using results from a survey circulated in the Grahamstown region (home to many Xhosa, White, Zulu, Indian and mixed race people including lots of students due to the city’s abundance in educational institutions, of which our schools are one, patterns were drawn on how some South Africans perceive and are affected by the drought.

The survey was distributed on the 6th of March 2016 by email (which limited the variety of recipients to only those who have access to internet, higher income groups: 48,7% of South Africans) to people in the Makana area. It was released to explore how the South Africans, in a small city, perceive and are affected by the current drought situation. Due to the parameters of the website used, only 100 responses were accessible to analyse for results. The multiple-choice questionnaire consisted of 10 questions:

- Are you aware of a drought in South Africa? (Yes/No)
- On a scale on 1-5 (1 being not so bad and 5 being bad) how severe do you think that drought is? (1; 2; 3; 4; 5)
- Has the drought affected you in any of the following ways? (No water at home to drink/No water to use for recreational purposes (watering garden, filling pool)/Increased food prices/The drought hasn’t affected me)
- Have you changed any of your water related habits because of the drought? (Yes/No)
- Do you use water for recreational purposes? (Yes/No/Sometimes)
- How much water do you think you use each day? (50-100 litres/200-250 litres/300-400 litres)
- Do you notice water wastage? (Yes/No/Sometimes)
- On a scale of 1-5 rate your perception of Grahamstown’s water quality (1 being good, 5 being bad)? (1; 2; 3; 4; 5)
- Do you think the drought could cause political tension in South Africa? (Yes/No/Maybe)
- Do you think any of the following could be a result of the drought? (Increase in disease/Shortage of food or increased food prices/Tension between people in South Africa/Inflation/None of the above)

Noticeable results were as follows:

1. Although 100% of all respondents were aware of drought in South Africa, only 43.43% rated its severity as 5/5. This shows that the population is unaware of the severity of the drought. (2015 was the driest year since 1904, in terms of rainfall, clearly making it most severe 5/5.)

- 78% of people asked said that the drought has affected them by causing increased food prices. 15% said the drought hasn't affected them at all. Showing that most South Africans and most definitely the average poor South African household will be affected by the drought.
- When asked about the effects of the drought, 97% of people predicted a shortage in food, 59% predicted an increase in disease, 72% predicted tensions between people in South Africa, 82% predicted further inflation and 1% predicted that none of the above would occur.

It's clear that the people of South Africa, specifically in Grahamstown, know that a drought is occurring; yet many don't know the severity of the situation. Thus meaning that they haven't grasped the concept of possible effects and potential outcomes of the drought.

For this reason we realised that we need to explore these effects on average households ourselves, in order to allow others to do more specific research later.

3.2 South Africa

South Africa located in the southern hemisphere in the south of Africa has a population of 52.98 million people (2011 census). With 471 400 m2 of space and 9 provinces (see below)



Figure 1: Provinces of South Africa

South Africa is the 25 largest country in the world.

With 11 official languages including English, Afrikaans, Zulu, and isiXhosa etc. population diversity is a significant factor when considering South Africa as a whole. The 2011 census divided South Africa into 5 racial groups. These groups were Black African at 79.2%, White at 8.9%, Coloured at 8.9%, Indian or Asian at 2.5%, and

Other/Unspecified at 0.5%. The first census in South Africa in 1911 showed that whites made up 22% of the population; it declined to 16% in 1980, and 8.9% in 2011 and in 2011, Statistics South Africa counted 3,2 million foreign nationals in total.

Racial tensions are still high in South Africa even 22 years after apartheid and situations such as a corrupt government and the recent drought has resulted in heightened tension.

Average levels of education can best be measured through literacy. According to the 2012 General Household Survey conducted by Statistics South Africa, the adult literacy rate is qualified as the self-reported ability to read and write short sentences. Of the population 94.3% of people are said to be able to read and write.

South Africa receives little (avg. 495mm, global avg. 1033mm) and sporadic rain unevenly distributed over the country. It also experiences high levels of evaporation due to areas desertifying. This makes South Africa the 30th driest country in the world.

With a major water source of South Africa based at Katse dam, Lesotho (a landlocked kingdom, located in South Africa) and thus dependent on good relations our water is always a constant worry. With the constant mismanagement of water resources, with 1.58 billion cubic meters going unaccounted for each year according to MoneyWeb and now the most severe drought in 30 years, the population waits for change and encouragement that the country will be fine.

The recent release of the 2015 GINI coefficient rated South Africa as the fourth most unequal society in the world. With two sides to the South African population the recent drought has drastically different effects on these different "societies"

The following section will attempt to describe the average poor South African family, which will be facing the brunt of the crises.

3.3 The average household

According to the Pietermaritzburg Agency for Community and Social Action (PACSA) the average poor working class South African family is a black family of 7 people. The household will consist of 3 adults (2 active adults and one elderly adult, usually female) and 4 children (two of them teenagers and two below 10).

The monthly amount spent on food to feed this family in reality is R1869.39 but according to a dietician the bare minimum amount required to meet nutritional demands is R4228.38 The biggest monthly category spent is on starchy food (R562.06) and the five most expensive monthly items are:

- Maize (R209.66)
- Chicken Pieces (R136.47)
- Sugar (R117.98)
- Chicken Necks (R95.95)
- Cooking oil (R89.98)

According to Statistics South Africa, R4 660 is the average monthly consumption expenditure for Black South African Households (STATSSA, 2012), but many earn even less with minimum wage being set at R2362 and one old age pension being R1420.

Considering our average family however, if they attempted to meet basic nutritional requirements for their family they will have around R400 to meet all other household requirements. In reality the family would need an additional amount of at least R3420 to meet basic household requirements such as: transport, electricity, insurance and education costs.

As we have shown there is a little to no economical margin to play with here and many families are already in perennial debt.

As indicated, maize is the staple diet of an average family of 7 living in South Africa. The price of maize in March 2015 was R2658 per ton and is now R4917 per ton in March 2016. This shows that the price has gone up by R2256 in just a year. This is a huge increase in price, which the average South African family won't be able to afford, as their salary inflation would only have gone up by 7% compared to the inflation of maize 85%. Therefore not being able to afford the same quantity of maize

In summary, the cost of the PACSA food basket increased by 14.5% (R237) year-on-year, from R1 632.85 in March 2015 to R1 869.39 in March 2016. The impact of the drought on the food baskets of low-income households emerged strongly from November 2015: over the last five months food price inflation increased by 13.4% or R221 (see below).

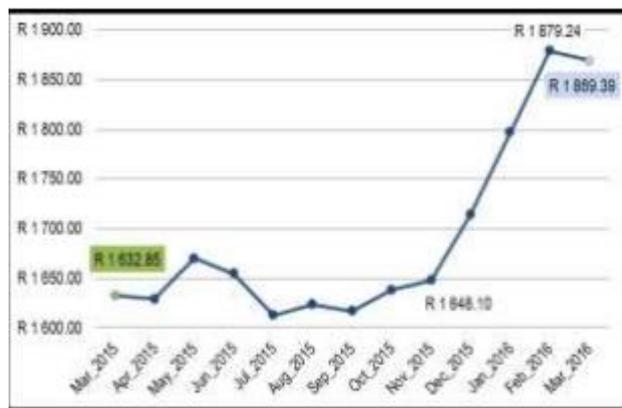


Figure 2: Fluctuation of Food basket price per month

3.4 Economic Landscape

Ranked by the World Bank as an “upper middle-income country”, South Africa is the second largest economy in Africa after Nigeria. South Africa's economy grew by a marginal 0.7% in the third quarter of 2015, according to preliminary estimates of real gross domestic product (GDP) released by Statistics SA in November of the year, following a 1,3% contraction in the second quarter.

Unemployment, at a rate of 25%-30% (compared to an average of 11% for upper middle income countries, according to the World Bank), remains the most

challenging of South Africa's hurdles: it is at the top of government priorities and at the heart of its economic policies.

This drought will increase unemployment and inequality within South Africa (which is already poverty stricken, with large amounts of inequality. As mentioned before, SA is the 4th most unequal country in the world, according to the Gini Index from the World Bank.)

The maize crop is down from 14.25 million tons [worth R25.4 billion] last season (2014/15) to an estimated 9.84 million tons this season (2105/16). This alone translates to a loss in income of close to R10 billion. The total loss due to drought is no doubt to several billions more. City press also confirms that this drought will cause farmers to lose around R10 billion this season and it will cost an additional R2 billion for farmers to import maize to feed their livestock, which in turn causes an increase in the price of meat.

The price of yellow maize, which is used mainly as animal feed, has risen by 93 percent from R1 946 a ton in January 2015 to a high of R3 757, so far this year. The price of white maize, which is a key low-staple food, has climbed by 160 percent from R1 907 a ton in January last year to a high of R4 952 a ton, so far this year.

According to AgriSA, 37 000 labourers have already been dismissed this year (March 2016) in the agricultural sector alone. This leaves another 37 000 people jobless which affects at least 200 000 people which depend on them as the “breadwinners” of the family. Households now have no source of income and the GDP plummets.

Farming remains vitally important to the economy of South Africa with 638 000 people formally employed by the sector according to Statistics South Africa, it's further estimated that around 8,5-million people are directly or indirectly dependent on the agriculture sector for their employment and income, most of those in post-production and industries that support agriculture.

It is estimated that there will be an increase by at least 6.4% in all foods in 2016. Maize meal prices are expected to increase by at least 40% in 2016, which will hit the average poor working class household, the hardest.

Farmers will have to spend more money to irrigate the crops and provide water for livestock. They have to spend money to drill new boreholes or even go as far as “importing” water from different locations, all at additional cost.

Low crop yield means farmers lose a lot of money, farm workers have to take pay cuts and some may even have to be laid off.

Businesses and industries that manufacture farm equipment and resources lose money because farmers do not have the money to buy from them.

Less or no rains mean dryer conditions and more veld fires. Farms are destroyed, properties are razed down, forests and trees are burned and people lose money this way. Governments also need to spend more resources to fight

fires and send emergency supplies to the most needed places.

Businesses spend more on electric generators or close production if hydro-energy companies operate below capacity. Energy industries also lose money because they cannot meet the energy demand of the region. The government again gets less tax money because people spend less. Businesses connected to water recreation, such as beaches and lakeside activities may close down because of low water levels or dried out water bodies. The livelihoods of people connected to such businesses are all affected.

The most recent gross domestic product (GDP) figures revealed that the agricultural sector had contracted by more than 17% quarter on quarter, largely because of the drought's effects.

Tabling a recent Industrial Action Report, which dealt with strike action due to labour unhappiness of wages in the citrus industry in the Western Cape, labour director general Nkosinathi Nhleko told journalists in Cape Town that strikes over the period involved 241 391 workers, cost the economy 3.3 million working days, and resulted in workers losing R6.6 billion in wages.

This gives us insight into what "brews" on the brink if the drought continues to cause loss of income, pressure on household income and living conditions.

There is little that can be done about South Africa's low and sporadic rainfall, but there are several ways in which South African's, especially the government, can respond and mitigate water loss or the effect thereof. They include:

- Allocate funds to farmers experiencing the current drought.
- Declare the drought a national disaster to access funds, which are made available at times of national disaster.
- Increase minimum wage.
- Increase pension and grant amounts.
- Increase allocation of funds (or divert it from surface water projects) to maintenance of existing and developments of new water infrastructure (especially groundwater infrastructure)
- Introduce tax breaks and fines for efficient and wasteful water management, respectively.
- Subsidize foodstuffs e.g. maize and sugar.
- Increase the research grants in the sector as well as subsidize the studies of needed skills e.g. civil engineers.

3.5 Social Landscape

Social effects include problems with public safety, public health and conflict between the people of South Africa. It is therefore the problems involving the overall welfare of the ordinary citizens and their households.

Before South Africa began to feel the effects of the drought we were already facing social challenges. We have a very high crime rate and we are still trying to deal with the unequal distribution of wealth and services that happened as a result of the Apartheid period. This has caused significant racial tensions.

We were experiencing a high level of unemployment, (between 25-30% of population in 2015; a lack of jobs and inadequate service delivery to the people.)

According to ISS, South African uses more water per capita (235 liters) than the global average (173 liters), which is unacceptable. We use 27% more water for household use than what is expected considering the size of our population. Municipalities also lose around 40% of potable water due to leaks, this, unbelievably, is in line with the global average, but compared to other water scarce countries (less than 10% in Australia) we could do a lot better.

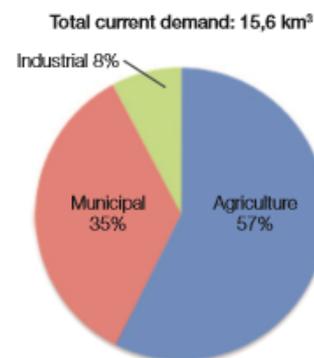


Figure 3: Split of water demand areas

The drought occurring in our country at the moment could cause as many as 200 000 people, which is 2.5% of our working population, to lose their jobs, mostly through farm labor lay-offs as mentioned before. This will result in urbanization as most of the people who are made jobless will move to the cities to find work. South African cities are not suited to such a high influx of population. Already 64% of the population lives in the urban areas. This is not a situation unique to South Africa as globally for the first time more than 50% of the population has become urbanized.

Serious problems like crime and over-population will increase as the drought gets worse as more people will be moving into the cities to find employment, food and water. This will cause over population in and around major cities, placing a huge demand on services, especially water provision, sewage and waste removal.

In this dire situation of unemployment and lack of basic services, one could almost have empathy for those that then resort to petty crimes to provide an income and those that turn to alcohol and other illegal substances to avoid the reality of the situation. Crime and other illegal activities thus soar under these conditions.

The lack of basic water provision and sewage services then creates conditions under which viruses and bacteria like *Legionella* and *polioviruses* can pollute ground and surface water. When rainfall decreases during a drought there will be less fresh water to dilute the polluted water. According to the Institute for Security Studies (ISS), almost all municipalities and industry in South Africa do not recycle or treat water before it is released back into rivers, therefore solely relying on dilution to “treat” water. Smaller concentration of water will therefore create a massive increase in water pollution. Urbanized populations are now at a high risk of drought related diseases. Cholera and diarrhea are easily spread when cities are overpopulated and hygiene is compromised due to a lack of available water. E-coli and salmonella are examples of bacteria that readily contaminate food during a drought. As the drought worsens, disease will begin to spread quicker and will affect more people.

In the years 2011 and 2012 the countries that make up the horn of Africa being Ethiopia, Somalia and Kenya experienced their worst drought in over 50 years. People from all of these countries were becoming terribly malnourished and therefore picking up many diseases like measles and polio according to The World Health Organization (WHO). They consequently launched a vaccination campaign in the Horn of Africa to prevent these diseases. Since so many of the people living in these countries were becoming malnourished they all began to join up together in different camps all over the surrounding region in order to find food and water. These large groupings of people increased the spread of infectious diseases. As the countries making up the Horn of Africa were not financially equipped for a crisis like this they did not end up spending huge amounts of money to contain these health issues, however close to US \$1.71 billion was committed by other countries.

There are many different measures that could be put in place in order to deal with the problems caused by the drought on a social level.

- Increase ability to police and implement by-laws.
- Rainwater harvesting by individual households.
- Fog harvesting in relevant areas.
- Increase basic hygiene and health training to store, test and treat water before consumption.
- Train civil engineers to maintain boreholes.
- Implement innovative measures (see recommendations, Kate Robey) such as ozone infusion into groundwater.
- Implement smart meters to detect leaks and reduce loss of potable water to 17% as per our commitment in the National Development Plan (NDP).
- Increase storm water capture.
- Increase waste water treatment.
- Desalination plants could be used to supplement water supply.

- Invest in “wetland” reticulation.
- Increase capacity of subsistence farming.

3.6 Agricultural Landscape

According to Statistics South Africa (2011) 79.5% of the country’s land is considered agricultural land. Two thirds of South Africa’s agricultural households are in Kwa-Zulu Natal (24.4%), the Eastern Cape (20.7%) and Limpopo (16.3%) combined.

South Africa’s agricultural activities range from producing crops (maize, wheat, sugar cane and sunflowers), livestock (cattle and sheep) and fruit (citrus and grapes to produce wine). South Africa is self-sufficient in all major agricultural products and is also a net food exporter.

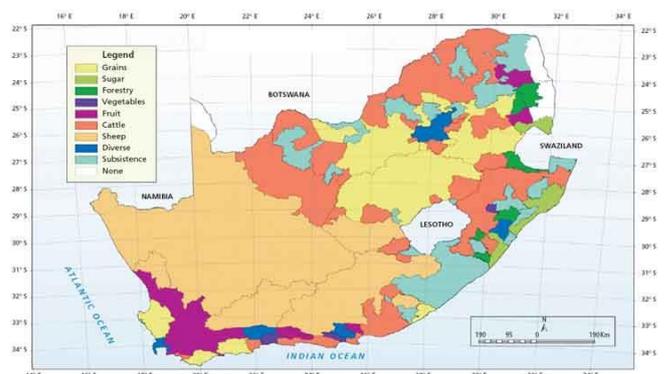


Figure 4: Map of main crop production areas in South Africa

It’s said that, 12% of the South Africa’s land can be used for crop production; only 22% of this land is arable. This is mainly due to the limitation of water availability with country’s unpredictable rainfall patterns. 50% of South Africa’s water that is used as irrigation for 1.6 million hectares of farming land. The country has a dual agricultural economy: well-developed commercial farming sectors and more subsistence-based production in the less developed areas. The country’s gross farming income is R131.5 billion. Agriculture’s percentage of GDP is 3% having decreased over the last 40 years. This statistic implies that South Africa’s economy is maturing, developing more significantly in secondary and tertiary sectors. That being said 7% are formally employed by the sector and 8.5 million people depend on it for their income. It is also estimated that up to 18% of GDP is generated in “secondary processing” of agricultural products, so the sector is of huge economic importance.

According to Africa Check, land ownership especially that of agriculture, in South Africa has continued to be racially skewed since the days of apartheid. “40 000 white families own 80% of South Africa’s agricultural land,” claims Member of Parliament, Andile Mngxitama. This figure causes tensions between races, generating labels such as “stolen land” as the ownership of land has great ties to wealth.

South Africa's current rainfall is more than 25% below normal of 450mm/year. (Global average is 1033mm/annum) and this has caused a poor crop yield, producing only 7.26 million tons of maize. This is 29% less than the 9.96 tons produced in 2015. Maize is the largest locally produced field crop according to SouthAfrica.info and one on which many South African households depend.

The drought has already resulted in five out of seven of South Africa's provinces (KwaZulu-Natal, Mpumalanga, North West, Limpopo and Free State; totaling 43.4% of South Africa's area) being declared a "drought disaster" for agriculture by Senzeni Zokwana, the Minister of Agriculture, Forestry and Fisheries. The head of the Agricultural Business Chamber, John Purchase, stated that "summer crops, especially maize, could not be planted in many areas, or plantings were severely damaged by the drought and heat".

The lack of water especially under drought conditions increases the rate at which desertification occurs, as well as eliminating any chances of the land recovering. Desertification is when fertile land (vegetation) becomes bare and infertile, often as a result of overgrazing, deforestation and other activity. Evaporation of water from exposed land and open water systems such as dams, rivers and canals also exacerbates the situation.

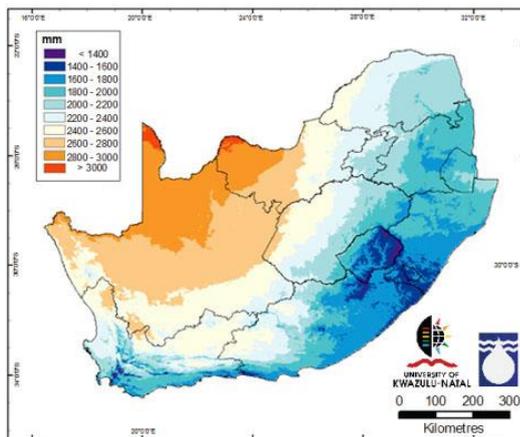


Figure 5: Open water evaporation/year

There are many measures that could be applied to improve water supply and reduce demand in the agriculture sector, they are:

Although it may not be a cheap alternative, farmers could look into a new technology, which is being developed in Colorado, USA. It is a subsurface drip irrigation system called "Smart Irrigation" which is especially suitable for arid, hot and windy areas as it eliminates evaporation, which is a major concern in South Africa. This complex system has been proven to significantly reduce the amount of water required, which can ultimately be useful when using rain water harvesting as the initial water conserving step.

- Maintain canals and improve current reticulation systems.

- Focus on groundwater exploitation. According to ISS we are only using half of the amount deemed to be available for sustainable use.
- Maintain existing groundwater infrastructure
- Implement innovative groundwater harvesting technology (see recommendations: Kate Robey)
- Revise the "use-it-or-lose-it" application of water rights
- Train farmers alternative farming methods (see recommendations: Allan Savory.
- Support GMO technology and exploit resurrection plants (see recommendations: Jill Farrant)
- Increase capacity of subsistence farming
- Aquifer recharge via storm water harvesting.

3.7 Ecological Effects

In South Africa we are the custodians of three biodiversity hotspots unique to South Africa; namely the Cape Floral Kingdom, the Succulent Karoo and the Maputaland Pondoland Albany. Together these three hotspots contain more than 20 000 plant species, half of which are found nowhere else on Earth.

Most of South African Tourism is generated by our beautiful weather and our unique landscapes including our fauna and flora.

Dry land combined with South Africa's unpredictable wind and lack of water will result in veld fires and destroyed habitats, which results in a loss of biodiversity. IOL reported that in July 2002 in Mpumalanga, one of the largest provinces in South Africa, (which was in a similar drought), devastating bushveld fires killed 4 people, destroyed 24 000 ha of land and accounted for damages of R32 million.

In certain biomes (grasslands, woodlands, fynbos, and sometimes indigenous forests), drought decreases forage production affecting herbivores and indirectly affects predators and scavengers. Droughts lead to increased mortality and reduced reproduction that is especially problematic with endangered species whose numbers are already low.

The increase in pollution due to the reduced effect of dilution as a result of less rainfall also sees more stress being placed on aquatic ecosystems and their ability to naturally recycle water. The ISS report describes South African wastewater treatment as "suspect", but still considers it a source of secondary surface water.

There are a number of measures that could be considered to improve the ecological sector:

- Develop and enforce by-laws that curb polluting.
- Implement better wastewater treatment technology.
- Investigate the effects of reduction in rainfall on aquatic ecosystems to inform damming projects.

3.8 Political Landscape

South Africa has been a democracy for 22 years. The current party in power the African National Congress (ANC) has been in power since apartheid ended and democratic election were held in 1994. Politics in South Africa is still finding stable ground as nearly a century of racial tension and divide has caused multiple complications – both emotional and technical. Drought, a so-called “catalyst”, does not make situations any simpler to handle and often, racial tensions are brought back to the surface when the population faces difficulties such as drought. This coupled with the additional tension and populist rhetoric of an election year makes for very tense times in South Africa.

According to our locally distributed survey, 71.72% of respondents said they thought the drought could cause political tension in South Africa. It has been seen that a shortage of water can cause major unrest between populations.

Syria’s Civil War of 2011 was mainly caused by the lack of water and drought in the country.

A main worry is that tension was already high without the severity of the drought, with arguments over university fees and applications sparking recent unrest. Now with a severe drought and more pressure put on majority of the population, tension only looks to increase.

The devastating war of Syria that began in March 2011 was the result of complex interrelated factors. Although the focus of the conflict was regime change, a number of sociopolitical triggers contributed to the conflict. Including challenges associated with climate variability and change and the availability and use of freshwater. Starting in 2006, and lasting into 2011, Syria experienced a multi-season, multiyear period of extreme drought that contributed to agricultural failures, economic dislocations, and population displacement. This dry period continued and is now being described as the “worst long-term drought and most severe set of crop failures since agricultural civilizations began in the Fertile Crescent many millennia ago” [Gary Nabhan, as cited by Femia and Werrell (2012)] (similar to the drought that south Africa now faces “the worst drought in 100 years”)

In particular, the combination of very severe drought, persistent multiyear crop failures, and the related economic deterioration led to very significant dislocation and migration of rural communities to the cities. These factors further contributed to urban unemployment and economic dislocations and social unrest. By late 2011, the UN estimated that between two million and three million people were affected, with a million driven into food insecurity. This number is scarily similar to the 2.7 million households affected by the current South African drought. Bad management and poor planning further worsened conditions. The first unrest started in a town called Dara where a particularly large group of unemployed men forced off their land by crop failures started demonstrating. Not soon after the first unrest civil war commenced.

Recently 3000 farm workers were retrenched in Mpumalanga (province in SA) as reported by the Congress of South African Trade Unions (COSATU) and violent protests ensued. Police managed to quell protests but more and more workers are being retrenched because of the drought and unrest is growing.

Syria is not the first time that water and other environmental and resource factors have influenced or played a role in contributing to violent. The earliest recorded conflict over water there occurred over 4500 years ago.

This evidence along with the similarities to Syria suggests that South Africa may be heading the same way.

Political tension in South Africa is already high due to a number of reasons such as economic pressure of the depreciating Rand and as well as political highlighting of racial differences and power to gain political support. Politicians are using the drought as a way to gain votes in upcoming elections by introducing plans that will decrease negative effects on agriculture. Although this is a good thing, plans are simply used as advertising and are not put into place because the party may or may not be voted into power. Based on performance of our millennium goals which matured in 2015, there is little confidence of rigorous application of these goals. The ISS report even identifies that even if the implementations are mobilized it will not be enough to quench demand.

Free State Agriculture CEO Henk Vermeulen said “All the focus is on the election and I think the focus needs to shift in terms of food security because if the people don’t have food to eat, you will see an uprising and the situation will be difficult for everyone to handle.”

The government has promised R32 million in order to assist farmers affected severely by the drought. This follows the R200 million previously made available as a relief measure, but this is less than the R500 million made available in 2004 in what was considered a less severe drought. Therefore opposing political parties are questioning the lack of relevant support.

Opposing parties further question the capability of the current government, since large projects such as coal burning power station Medupi and Kusile are billions over budget years past deadline and twice as expensive as predicted. Nuclear power seems to be considered despite there being no global strategy to deal with radioactive waste. This coupled with recent Constitutional court rulings against the ruling government on charges of misspent public funds does not bode well for political promises made to public for future implementation.

That being said South Africa has managed to increase water supply to households by 10%, leaving it at 71% of supplied households currently. It managed to reduce those that experience regular hunger by 15% (were the target was 50%). The task gets increasingly difficult, as the real per capita GDP growth has dropped 4% in the last decade. It's a far cry from no hunger, clean water and sanitation and jobs for all.

Water saving measures include introducing water restrictions, monitoring adherence to water restrictions, applying penalties where necessary, prioritizing the repair of water leaks, promoting water-efficient technologies such as low-flush toilet cisterns, rainwater harvesting and the use of grey water for irrigation. Of all these proposed measures only water restrictions have been put into place.

No development on rainwater neither harvesting nor using grey water for irrigation has been made. Rainwater harvesting could be a particularly successful relief measure because harvested rain can supplement up to 86% of a household's domestic water use and coupled with a grey water harvesting system, the savings could even be greater.

At the moment only 15% of all storm water is re-entering the ground to replenish aquifers and boreholes. Rainwater harvesting is a cheap alternative that the average South African would be able to afford and get great use from. (A 200m² roof can harvest 6000l of water from an inch of rainfall; enough to supply a four person household for four days).

Worldwide, 87% of the population gets its drinking water from improved sources, and the corresponding figure for developing regions is also high at 84%. Access is far greater, however, in urban areas (at 96%), while only 81% of rural populations have access to improved sources. However, these estimates do not take into consideration service quality (e.g. intermittent supply, disinfection) or affordability. Obviously the rural areas struggle to get water on a daily basis and when a severe drought hits without the correct infrastructure or services, people in those areas do suffer.

It is when the situation in the rural areas does not improve that unhappiness with government services and unrest with conditions spark political unrest.

When the average South African household who already has to deal with overcrowding, unemployment, rising food costs, crime rates and lowering levels of service have all

these challenges magnified by a severe drought making unrest and violence expected.

4. Recommendations:

We would like to conclude that South Africa needs to act immediately to mitigate the effects that the drought could have on our beautiful land and its people. We believe that we have demonstrated that there are multiple and all encompassing effects that this drought has already had on our society, environment and economy, as well as politically. We have also proposed some theoretical solutions.

Tensions and dissatisfaction with the government and status quo are creating feelings of discomfort amongst the middle-income classes and sheer desperation amongst the working class as a result of the drought. The worst-case scenario, as with Syria, is severe civil unrest and potentially civil war, as racial tensions are bound to flare up. This however is not the future we see or want and we would like to describe a "path" out of this scenario to create a more water-conserving South Africa and prevent the effects on our country of this "100 year drought".

We would like to do this by discussing five recommendations in order of "do-ability", with motivations. Most of our recommendations have researchers from South Africa involved in their development.

4.1 Rainwater harvesting



Figure 6: Very basic rainwater harvesting setup

Rainwater harvesting is a practical solution. It is low tech, affordable and would generate a large amount of low skilled work for the unemployed (a South African National Developmental Goal) if it was subsidized and rolled out by the government for poor households to implement. A house with a 200 square meter roof can harvest 6000 liters of water from as little as 2,5cm of rainfall; which is enough to supply or at least supplement water towards subsistence farming irrigation as well as for drinking, cooking and flushing.

This is particularly relevant in the South African context with a large proportion of rural settlements where the municipal water use is 35% of national use compared to 8% on average. With individual households harvesting water a reduction of 9% can be achieved, even if municipal leakage

remains at around 50% of potable water. This can make an additional 9% available to the agricultural and industrial sections, which can ensure food security and generate economic growth.

4.2 Groundwater exploitation (Kate Robey)

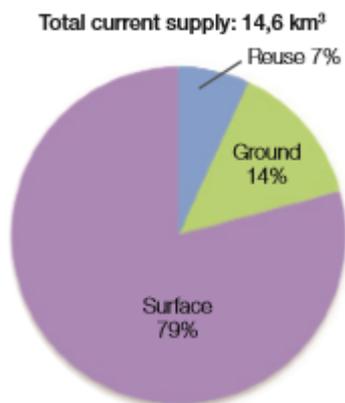


Figure 7: Water supply sources

Only 13% of total supplied water originates from groundwater. Currently South Africa only withdraws about half of the groundwater which is estimated can be sustainably extracted. Due to the lack of surface water in the country’s semi-desert and desert areas, ground water is said to be “more valuable than gold.” Recent development, aided by hydrogeologist Kate Robey (credited on the “200 influential South Africans” list for her work focusing on improving the utilization of groundwater across South Africa) has enable the 60% of South African towns who depend on groundwater to access it more sustainably. The maintenance of these systems are often poor and leads to corrosion as a result of the high salt, iron and mineral content of the water.

Ms. Robey’s work proposes the use of ozone, which is then pumped into aquifers through existing boreholes, which then causes the precipitation of iron in the aquifers, sparing the metal pumps and piping their corrosive fate. Assured access to these aquifers and their water could increase reliability of irrigation for agriculture and the households in arid areas that depend on it, while driving down the cost for maintenance.

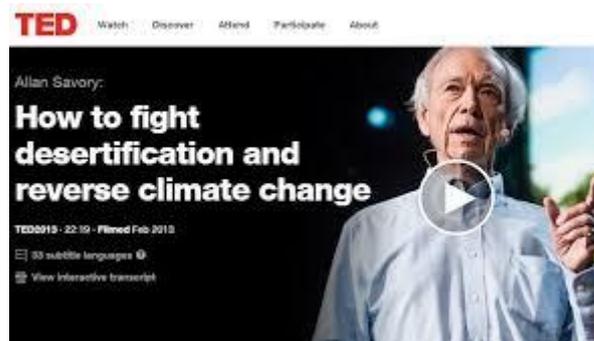
4.3 Fog Collection

Fog catching is an effective method of harvesting water and has been explored by Drop Net “Fog Collector” Executive, Josephin-Victoria Linke. Massive nets that mimic the behavior of the Namib Desert beetle condense water droplets in mist/fog. Each panel can produce 150-750 liters of fresh water per day. The World Health Organization has approved this water quality and the method has been used successfully in San Francisco, as well as in the Andes and Atacama-desert in Chile (the driest place in the world).

This is also a cheap and easily manufactured system and can also benefit South Africa’s high unemployment rate by creating jobs that require minimum skills in areas such as

the West Coast of South Africa where cold sea currents meet warm terrestrial areas to generate fog.

4.4 High intensity farming (Allan Savory)



Allan Savory, educated in South Africa, proposes that in order to reduce high evaporation rates, (quoted by the ISS report as often being more than the rainfall in certain areas of South Africa for a specific year, and at the same time increase stock yield), we should increase our stock on land to mimic migration patterns.

He suggests that historical migration through grasslands allowed for the grass to be flattened (which covers the soil, preventing water loss through evaporation) as well as creating “injuries” to grass which allows for speedy decomposition and return of nutrients for the following growing season. The “migrating” animals also fertilize the area they move through and are forced to move on, as to not overgraze the area. He has had several successes in rehabilitating land in the South African Karoo.



Figure 8: Comparison of Karoo landscape after intensive farming practices proposed by Allan Savory.

4.5 Resurrection plants (Jill Farrant)



Professor of cell and microbiology at the University of Cape Town, Jill Farrant, proposes possibly the most radical and exciting answer to our water supply challenges in South Africa: the Resurrection plant. She proposes that we study

these plants, which stop growing during interruptions in rainfall, without dying. Their “seed” stage is presented as a “hibernation” stage of life and once it rains again they simply continue to grow. This is a lot more practical than the annual crops, such as maize and wheat, which we cultivate and grow and who are very vulnerable to rain variability.

The suggestion therefore would be to explore the nutritional value of resurrection plants themselves and failing a decent alternative, to look at genetically engineering current crops to “switch on” their hibernation gene during times of drought.

Very

exciting

indeed!

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