

The Mitigation Mechanisms of Climate Change in The South African Context

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Abstract: South African climate change is unique and takes three forms: excessive heat, floods and sporadic wildfires. Climate change is not only affecting human beings; it is a challenge across the board. The challenges apply to nature, the environment and any creature in the universe. However, the main role player in managing this appropriately remains human beings. Therefore, the purpose of this paper is to discuss the mitigating mechanisms of climate change in South Africa.

From the non-empirical research design, i.e. a systematic review standpoint, the researchers analysed historical overview patterns of rainfall, droughts, floods and heatwaves in the South African context. For data collection, documentary sources were used qualitatively. Non-probability purposive sampling was adopted to outline keywords/phrases to filter information relevant to the study purposes and the research problem, restricted to 10 years in the literature. Textual analysis was adopted for data analysis.

It was established that the climate condition challenges manifest differently in the nine South African provinces. Each of these provinces experiences different types of climate change challenges. South Africa has two main economic challenges related to climate based on water shortages and the electricity crisis. The results also show that South Africa sources electricity from Mozambique and water from Lesotho and human beings are liable for the proper control and sustainable mitigation mechanisms of these scarce basic needs. They do not conserve the environment properly, further affecting other creatures negatively. Their actions are very toxic to this environment, creating other severe challenges to climate change.

This paper recommends mitigation processes to overcome climate change challenges in South Africa by harvesting energy and water. This will turn South African climate change challenges into viable economic growth opportunities by using the two main challenges of floods and excessive heat in a beneficial way.

Keywords: Climate change [drought and heatwave], Environment, Electricity, Mitigation mechanisms, Solar energy, South African context

Introduction

Four mitigation aspects of climate change, namely drought, energy, floods and heatwaves, are discussed in this article. In 1994, the South African population amounted to 4 100 000 and 54% of households had access to electricity from the grid. Almost 100% of the White population had electricity in South Africa prior to 1994. About 37% of the Black population were connected to the Eskom grid and mostly were from townships, whereas rural communities were in the dark.

It was a challenge for Black communities in rural areas to have access to clean water prior to 1994. Even today this is a major challenge for most villages. The shortage of water is still a burning issue among the Black community in South Africa.

Poverty cannot be blamed as that is the result of the previous discriminatory regime. Most Black people are not poor by choice; the system of the past played a major role and had a significant influence on their current situation and condition. Oppression and discrimination deprived South African Black people's access to basic human needs such

as water and electricity, including opportunities to take part in the country's economy. Prior to 1994 there were no service delivery protests across South Africa.

The democratic government faces multiple service delivery protests mainly regarding water and electricity. After 1994 supply capacity was provided by Eskom. Grid supply planning was not a priority as the playing field was now level and everyone had access to the two basic human needs resources. All resources were distributed equally to all citizens.

Although apartheid was declared a crime against humanity in 1998, South Africa did not prosecute all who participated in this crime. Even the international courts did not prosecute anyone for the crime after 1994.

Research Methodology

From a non-empirical research design, i.e. a systematic review standpoint, the researcher analysed historical overview patterns of rainfall, droughts, floods, electricity supply and heatwaves in the South African context. For data collection, documentary sources were used qualitatively. Non-probability purposive sampling was adopted to outline keywords/phrases to filter information relevant to the study purposes and the research problem, restricted to 34 years in the literature. Textual analysis was adopted for data analysis.

The purpose of this article

Mitigation processes are recommended to overcome climate change challenges in South Africa by harvesting energy and water availability. This will turn the South African climate change challenges into viable economic growth opportunities by using the main two challenges of floods (water harvesting) and excessive heat (energy harvesting) to increased energy and water harvest and in a beneficial way. Mechanisms are identified which will enhance water/natural energy generation in order to reduce the huge shortage of water/energy in South Africa which has resulted in load shedding and water shortage.

Discussion

Nature and extent of climate change in South Africa

Climate change is currently one of the biggest challenges not only in South Africa, but also globally. This global phenomenon is negatively and adversely affecting the entire world differently. "It is defined as significant changes in the average values of meteorological elements, such as precipitation and temperature, for which averages have been computed over a long period" (Malhi, Kaur and Kaushik, 2021). Maluleke and Mokwena (2017) mention that some parts of South Africa are predicted to have less rainfall and more wind, and other parts may have more rainfall, be hotter and have more humid conditions.

As asserted by Kreft, Eckstein and Melchior (2017), climate change is already a measurable reality posing significant social, economic and environmental risk. South Africa, like many other developing countries, is not safe from the effects of climate change (Western Cape Government, 2022).

Climate change is a key concern within South Africa. Annual temperatures have increased at least 1.5 times the observed global average of 65 °C over the past five decades and extreme rainfall events have increased in frequency. Some of the provinces in South Africa that are affected are discussed below.

KwaZulu-Natal

KwaZulu-Natal is envisioned to experience increased temperatures, increased periods of drought, more intense storms and flooding and sea level rise due to climate change (eThekweni Municipality, 2022).

According to the University of the Witwatersrand (2023), "the disastrous flood that hit Durban in April 2022 was the most catastrophic natural disaster yet to be recorded in the KwaZulu-Natal in collective terms of lives lost, homes and infrastructure damaged or destroyed". eThekweni Municipality has already started looking for solutions to oversee climate change effects in KwaZulu-Natal. The challenge of floods is that, its water cannot be harvested successfully due to its destructiveness to human and infrastructure.

In 2015, the eThekweni Municipal board adopted the Durban Climate Change Strategy (DCCS). This was the first multi-sector climate change strategy developed for Durban. Since the strategy's adoption, there has been progress in some of the key goals outlined in the DCCS, including the development of climate change structures within eThekweni Municipality and the implementation of key climate change response programmes. The DCCS also made provision for a five-year review process to ensure that the strategy is updated regularly (eThekweni Municipality, 2022).

According to eThekweni Municipality (2022), the DCCS was revised in 2019 and the themes used to achieve the strategy were upgraded. The themes are:

- a) Enabling theme: This includes legislation, policy and planning, governance, research, communication and capacity building, and climate finance.
- b) Cross-cutting theme: This includes economic development and risk management.
- c) Adaptation theme: This includes biodiversity, food security, health, sea level rise and coastal protection and water and sanitation.
- d) Mitigation theme: This includes energy, transport and waste.

Cape Town

In 2015, South Africa documented its lowest annual rainfall since 1904. In the same year, Cape Town also documented its highest temperature in the last 100 years at 42 °C. The lack of rain and abnormally elevated temperatures contributed to some of the worst fires the city had seen. During the budget year 2017/2018, the Western Cape experienced its worst drought in decades, which threatened our water security (Western Cape Government, 2022).

The Western Cape Government (2022) formulated an action plan to tackle climate changes and their impact. They identified the following objectives for their action list:

- Objective 1: Responding to the climate emergency.
- Objective 2: Transitioning in an equitable and inclusive manner to net zero emissions by 2050.
- Objective 3: Reducing climate risks and increasing resilience.
- Objective 4: Enabling a just transition through public sector, private sector and civil society collaboration.

Climate Change Impacts

It is widely recognised that climate change will have harmful effects on many human beings, particularly on the most disadvantaged (Caney, 2015). Climate change impacts different segments of society in different ways. Flooding can lead to the spread of disease and damage to ecosystems and infrastructure. Human health issues can increase mortality, impact food availability and limit worker productivity. Climate change impacts are seen throughout every aspect of the world we live in. However, these impacts are uneven across the country and the world, even within a single community (United States Department of Commerce, 2021).

Agriculture

Climate change significantly impacts agriculture and commercial forestry, which have significant potential for adaptation. Worldwide, agriculture is a key contributor to climate change, being responsible for about 14% of all GHG emissions. Agriculture is the major consumer of water (through irrigation) and is vulnerable to changes in water availability, increased water pollution (particularly from toxic algal or bacterial blooms) and soil erosion from more intense rainfall events and increased evapotranspiration (Department of Environmental Affairs, 2012:18).

As further explained by Masiwa (2020), the following are the main effects that climate change is expected to have on agriculture:

- Unpredictable weather patterns
- Changes in the agricultural economy
- Forced technological adaptation
- Infrastructure changes on the farm
- Imports of agricultural equipment, technology and machinery
- Groundwater and surface water availability
- Soil fertility

Maluleke and Mokwena (2017) explain that from October 2012 to February 2013, the El Niño-Southern Oscillation (ENSO) was in a strong El Niño phase for the period, resulting in drought circumstances in some parts of the Limpopo province, which negatively affected livestock farmers in the Makosha and Xilukwana villages. Consequently, between 134 and 171 livestock were reported to have died in the Makosha and Xilukwana villages.

Water

South Africa is most likely to experience impacts of climate change primarily affecting water resources (Department of Water Affairs, 2013). Water is the primary medium through which the impacts of climate change are being felt in

South Africa, according to the National Water Resource Strategy. Increases in climate variability and climatic extremes are impacting both water quality and availability through changes in rainfall patterns, with more intense storms, floods and droughts; changes in soil moisture and runoff; and the effects of increasing evaporation and changing temperatures on aquatic systems. South Africa has been experiencing a serious drought since 2015, with associated crop losses, water restrictions and impacts on food and water security (Department of Water Affairs, 2013).

Health

Climate change affects the social and environmental determinants of health, such as:

- Clean air
- Safe drinking water
- Sufficient food
- Secure shelter

Between 2030 and 2050, climate change is expected to cause nearly 250 000 additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress (World Health Organisation, 2021). Furthermore, climate change is undermining many of the social determinants for good health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are felt the most by the most disadvantaged, such as women, children, poor communities, the elderly and those with underlying health conditions.

According to the United States Environmental Protection Agency (2023), climate change affects people's health in two ways:

- “By changing the seriousness or frequency of health problems that people already face.
- By creating new or unanticipated health problems in people or places where they have not been before.”

The health effects of climate change include respiratory and heart diseases, pest-related diseases, water- and food-related illnesses, and injuries and deaths. Climate change has been linked to increases in violent crime and overall poor mental health (United States Environmental Protection Agency, 2023).

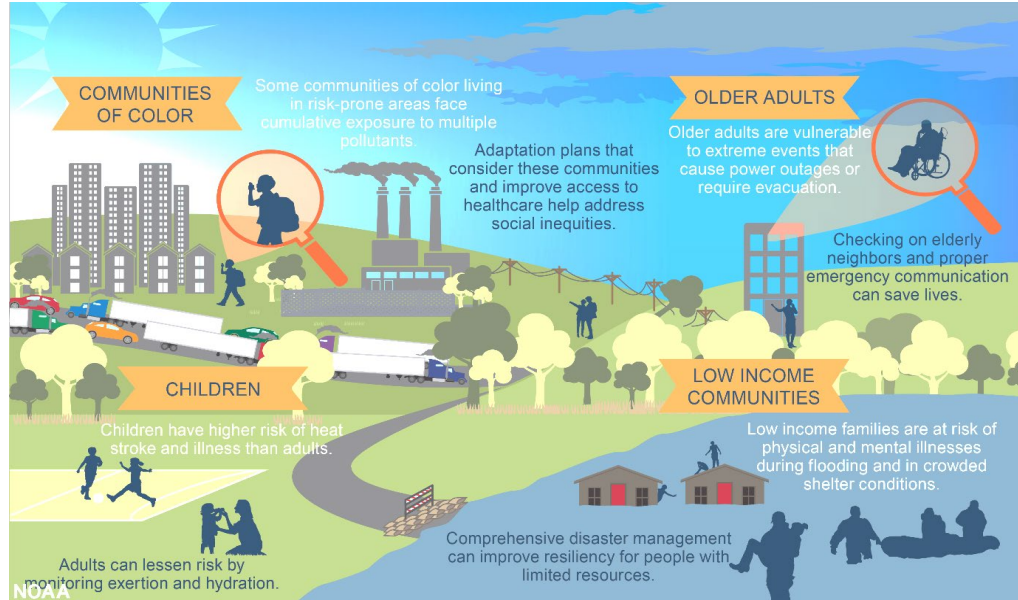


Figure 1: Most vulnerable individuals to climate change

Source: United States Department of Commerce (2021)

Figure 1 above provides examples of how all individuals are affected by climate-related health threats, despite area or age of the individual.

Results and recommendations

Mitigation processes are recommended to overcome climate change challenges in South Africa by harvesting energy and water availability. This will turn South African climate change challenges into viable economic growth opportunities by using the two main challenges of floods and excessive heat in a beneficial way. Harvesting solar energy will benefit most poor and rural communities in South Africa. The heatwave is mostly affecting inland Province in South Africa while the flooding is torturing the coastal Province and more to Western Cape and Kwazulu-Natal Provinces. The inland Provinces were sporadically less severely affected but the coastal Provinces were hardly affected.

Harvesting energy through the solar panel in the inland Province will be more successful, especially in the rural villages. This will reduce the Eskom supply load to the industrial and economic production sectors. The government should priorities subsidising the rural villages with solar panels and encourage discontinue the use of Eskom. This will significantly reduce energy shortages in South Africa. While erecting more medium size water dams and water treatments plants in the rural villages might be solution of water shortages. This will allow more water harvesting processes into these small dams while majors' infrastructure will be directed to big economic production sites.

Conclusion

Climate change is not only a South African problem, but an international challenge. It is already a measurable reality and, along with other developing countries, South Africa is especially vulnerable to its impacts. Although no region of the world will be entirely spared, the negative impacts are likely to fall most heavily on poor nations in the tropical region. Since the researcher employed theoretical systematic literature, the findings are more based on the literature of the past experience. As such non empirical application is non-existence. This research aim to improve the lives of rural communities on two resources namely: water and electricity, which form basic human rights as per South African constitution bill of rights.

References

1. Bega, S. 2023. *Scientists say the April 2022 floods in KZN are the most catastrophic natural disaster recorded in province*. Available at <https://mg.co.za/environment/2023-04-13-scientists-say-the-april-2022-floods-in-kzn-are-the-most-catastrophic-natural-disaster-recorded-in-province/> (Accessed: 19 April 2023).
2. Caney, S., 2015. Climate change. In *The Routledge handbook of global ethics* (pp. 384-398). Routledge.
3. Department of Environmental Affairs. 2012. *National Climate change response*
4. https://www.gov.za/sites/default/files/gcis_document/201409/nationalclimatechangeresponsewhitepaper0.pdf (Assessed 03 November 2023)
5. Department of Environmental Affairs. 2017. *South Africa's 2nd Climate change report 2016*. Available at: https://www.dffe.gov.za/sites/default/files/reports/southafrica_secondnational_climatechnage_report2017.pdf (Assessed: 20 April 2023).
6. Department of Environmental Affairs. 2018. *South Africa's Third National Communication under the United Nations Framework Convention on Climate Change*. URL: https://unfccc.int/sites/default/files/resource/South%20African%20TNC%20Report%20%20to%20the%20UNFCCC_31%20Aug.pdf. (Assessed:25 April 2023)
7. Department of Water Affairs. 2013. *National Water Resource Strategy*. Available at: <https://www.dws.gov.za/documents/Other/Strategic%20Plan/NWRS2-Final-email-version.pdf> (Assessed: 21 April 2023).
8. Department of Water Affairs. 2013. *National Water Resource Strategy: Water for an Equitable and Sustainable Future*. June 2013.
9. eThekweni Municipality. 2022. *Durban Climate Change Strategy 2022* Available at: <https://www.durban.gov.za/pages/residents/climate-change-strategy> (Accessed: 20 April 2023).
10. Kreft, S., Eckstein, D. and Melchior, I. 2017, *Global Climate Risk Index 2017*. Available at: <https://germanwatch.org/de/download/16411.pdf> (Assessed: 25 April 2023).
11. López-Feldman, A. and Rivera, J.J.M., 2019. The Effects of Climate Change on Poverty and Income Distribution. *Economic Tools and Methods for the Analysis of Global Change Impacts on Agriculture and Food Security*, p.25.
12. Malhi, G.S., Kaur, M. and Kaushik, P., 2021. Impact of climate change on agriculture and its mitigation strategies: A review. *Sustainability*, 13(3), p.1318.

13. Maluleke, W. and Mokwena, R.J., 2017. The effect of climate change on rural livestock farming: case study of Giyani Policing Area, Republic of South Africa. *South African Journal of Agricultural Extension*, 45(1), pp.26-40.
14. Masiwa, D. 2020. 7 impacts of climate change on South African agriculture. Available at: <https://www.foodformzansi.co.za/7-impacts-of-climate-change-on-south-african-agriculture/?fbclid=IwAR1e9AHO0ffwvPaQIQv7Ucu2voGCsPt0YnikcCofjuscwilkznzgIkiw0zeE> (Assessed :19 April 2023).
15. United States Department of Commerce. 2021. *Climate change impacts*. Available at: <https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts> (Accessed: 22 April 2023)
16. United States Environmental Protection Agency. 2023. *Climate Change and Human Health*. Available at: <https://www.epa.gov/climateimpacts/climate-change-and-human-health#:~:text=The%20health%20effects%20of%20climate.and%20overall%20poor%20mental%20health>. (Accessed: 18 April 2023).
17. University of the Witwatersrand. 2023. *The 2022 Durban floods were the most catastrophic yet recorded in KwaZulu-Natal*. Available at: <https://www.wits.ac.za/news/latest-news/general-news/2023-04/the-2022-durban-floods-were-the-most-catastrophic-yet-recorded-in-kwazulu-natal.html> (Accessed: 18 April 2023).
18. Western Cape Government. 2022. *Climate Change*. Available at: <https://www.westerncape.gov.za/general-publication/climate-change#:~:text=According%20to%20the%20Western%20Cape,days%20and%20more%20heat%20waves>. (Accessed: 22 April 2023).
19. World Health Organisation. 2021. *Climate change and health*. Available at: <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health#:~:text=Climate%20change%20affects%20the%20social,malaria%2C%20diarrhoea%20and%20heat%20stress>. (Assessed: 22 April 2023).
20. Ziervogel, G., New, M., Archer van Garderen, E., Midgley, G., Taylor, A., Hamann, R., Stuart-Hill, S., Myers, J. and Warburton, M., 2014. Climate change impacts and adaptation in South Africa. *Wiley Interdisciplinary Reviews: Climate Change*, 5(5), pp.605-620.