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Economic Impacts of Drought on Water Users of uMhlathuze Municipality of South Africa

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ABSTRACT The 2015-2016 drought severely affected KwaZulu Natal, one of the Provinces in South Africa, and undercut its economy. Although the drought's economic impacts on the Province are to some degree covered in literature, however, there is lacking any research inquiry into the impacts of the drought on uMhlathuze Municipality, which is an important economic hub in the Province. This paper, therefore, investigates the economic impacts of the 2015-2016 droughts on commercial agriculture and industrial activities in uMhlathuze Local Municipality. Relying on field observation and the use of secondary data, the findings showed that the 2015-2016 drought impacted flows in rivers, lakes' water level, agricultural sector, industrial sector and other sectors, which operations depend on water availability, and reduced the share of the gross domestic product contributed by the Municipality. The study recommends improved water conservation and redistribution strategy that ensures judicious water use and efficient drought preparedness.

INTRODUCTION

Water plays an important role in the socio-economic life of any society given its centrality to rain-fed agriculture and water-dependent industrial activities (Freund et al. 2018; Mniki 2009). Therefore, water stress, in form of drought, constitutes a serious climate change issue today. Drought is defined as an extended period of abnormally dry weather with less precipitation causing resource imbalances. It is a natural hazard that results from a deficiency of precipitation from expected or normal, which results in shortage of water supply for socioeconomic activities (Wilhite et al. 2007; Estrela and Vargas 2012). Drought negatively impacts various sectors of the economy due to their dependence on water for production of goods and services (Wilhite et al. 2007; Maia et al. 2015; Tànago et al. 2016; Kilimani et al. 2018). Drought threatens the supply of natural resources such as food, water for domestic use, farming and herding, agro-based raw materials, forest resources and seafood, to mention but a few (Maia et al. 2015; Abrams 2003; Bradford and Bell 2017). It has been described as a *threat multiplier* capable of producing knock-on hazards and conditions that threaten human lives with such problems as loss of land, persistent poverty, displacement and migration, and may trigger competition over increasingly scarce natural resources, which can result in societal tensions (Assembly 2010). Socio-economically, drought is regarded as the most severe natural disaster in terms of its impact on livelihoods and gross domestic product (GDP) of people and countries across the world (Buckland and Eele 2000). Drought results in low crop yield, famine and other conditions, which lead to loss of crop, death of animals, and stagnant economic growth (Mniki 2009). In some cases, it

leads to increase in farmers' suicide rate. For example, Katalakute et al. (2016) reported a thirty-five percent increase in farmers' suicide in the State of Maharashtra, India between 2011 and 2015 as a result low crop yield cause by drought. It has been argued that drought is one of the consequences of un-circumspect exploitation of nature's resources and the concentration of greenhouse gases in the atmosphere (Ibrahim 2010; IPCC 2007). A contrary argument suggests that drought is simply a natural phenomenon, which is not caused by anthropogenic factors (Ashraf and Routray 2013). Regardless of these opposing views, drought remains an existential threat across the world today.

The world over, African countries and other developing have experienced the highest level drought-related casualties (Masinde et al. 2018). In these countries, drought has a great impact on economic performance due to the fact that these economies depend on rain-fed agriculture, which accounts for over seventy percent of food production, employment and income generation (Masinde et al. 2018). In this respect, evaluating the impact of drought is important in formulating drought mitigation and adaptation policies (Logar and van den Bergh 2013).

Several studies have been conducted on the intensity of drought, the impacts of drought introducing new strategies and policies to mitigate it. For example, Howitt et al. (2015) examined the economic impact of the 2014 drought on agriculture in California. Findings of the study revealed that the drought was responsible for great reductions in water availability, groundwater availability, low crop yield and ultimately loss of revenue and jobs. It is estimated that in 2015, a total of USD 2.74 billion losses were recorded as well as 21,000 jobs losses as a result of drought during the period (Howitt et al. 2015). In addition to that, California lost a total of USD 1.3 billion in gross domestic product due to drought. Similarly, Ngaka (2012) assessed the economic impact of the 2007-2008 drought in South Africa. The findings revealed that the frequency and impact of natural disasters in farming communities in South Africa have increased significantly. The severity of drought becomes prominent not only from the degree of rainfall deficiency, but human activities that increase the water demand and deplete the resources available. The results further revealed that major losses were experienced, which included the number of livestock mortalities owing their occurrence to the drought. Mniki (2009) examined the economic impacts of the 2004 drought-induced disasters on farmowners of Nkonkobe Local Municipality, Eastern Cape Province of South Africa. The findings revealed that the crop production and size was reduced during the drought period. Drought-related impacts are more severe in areas with the overall yearly food deficit, and these effects include losses in crop production and livestock, loss of national economic growth and development, income loss for farmers, the decline in food production and increase food prices, and unemployment from drought-related production losses. On the social aspects, there is food shortages as a result of drought occurrence (malnutrition, famine), loss of life from food shortage and drought-related conditions, the conflict between water users and water authorities, increased poverty, the decline in living conditions in rural areas (Wilhite 2005).

In South Africa, water shortfall occasioned by regular exposure to unfavourably low rainfall and unfavourably high temperature coupled with increased water demands that far exceed its supply is a huge challenge. Drought has been cutting jobs in South Africa (Johnston 2009), and it is partly responsible for worsening living conditions of rural and agrarian communities in South Africa. In KwaZulu Natal, drought remains a major challenge to agro-allied activities (Pieterse 2019) and responsible for why scarce freshwater resources are under extreme pressure to sustain the fast-growing agricultural and industrial activities in the Province. The Province's experience during 2015-2016 drought was extensive and it touched crop production, herding, and it strained domestic and industrial water use. Although, theoretical and empirical literature exists on the impacts of 2015-2016 drought on the Province, there is dearth of scholarly investigation on the impacts of the last drought experience in 2015-2016, on uMhlathuze Local Municipality, which is (a) an important economic and political hub in KwaZulu Natal Province, and (b) more importantly, which has Lake Mzingazi, that has been supporting agricultural and industrial activities in the district.

Objective

This paper, therefore, investigates the socioeconomic impacts of the 2015-2016 droughts on commercial agriculture and industrial activities in uMhlathuze Local Municipality.

Questions

The questions that the paper sought to provide answers to are:

1. What is the impact of rainfall deficiencies and increased temperature on Lake Mzingazi's water level?
2. How does that situation affect water demands and the Municipality's economy?

METHODOLOGY

The study combined the use of primary and secondary data in collecting the relevant data for the study. Apart from accessing official documents from relevant government agencies, visits to the lake were done to gain a firsthand observation of its state. From the data obtained, the analysis was done using Microsoft Excel and plotting graphs from the averages calculated. Rainfall analysis was generated in a spreadsheet for each station and monthly averages were formulated. Using water level data, the analysis was done in a graphic format and these graphs relate to climatic factors and water level. From the record of GDP contribution of the Municipality between the period (1990- 2018), two graphs were drawn. Results for monthly rainfall averages, monthly temperatures and water level graphical representations were correlated with respect to their effects on the water level of Lake Mzingazi and how that, in turn, affects economic activities welded to the lake.

Selection and Geography of the Study Site

uMhlathuze Local Municipality is located on the northeast coast of the Province in the coastal belt of the uMhlathuze Catchment, lying between 28° 58´ 00½ and 28° 39´ 30½ south latitude and between 32° 45´ 45½ and 32° 15´ 00½ east longitude (uMhlathuze Municipality 2015; Xulu 2014). With it being the third largest municipality in KwaZulu Natal, it covers a land area of 795 km^2 (see Fig. 1) and within it are situated a number of towns namely Richards Bay, Empangeni, Esikhaleni, Ngwelezane, Enseleni, Felixton and Vulindlela. Richards Bay and Empangeni are the economic hubs of the Municipality because of the appreciable presence of industrial activities and service businesses there. Their contribution to the overall economy of the Municipality is quite significant.

Climate and Hydrology of the Study Site

uMhlathuze has a combination of warm, hot and humid subtropical climate and moist summers with average daily temperatures ranging from 29°C in January to 23°C in July and extreme weather conditions reaching >40°C in summer, and annual average precipitation of 1228mm that normally occurs in summer. Although uMhlathuze Municipality's water sources are uMhlathuze River, Nseleni River (Nsezi Lake) and Lake Cubhu, much of the water that feeds industrial activities and service centres in Richards Bay, Empangeni, Ngwelezane comes from Lake Mzingazi. The Municipality has a climate conducive for commercial agriculture with sugarcane production in low lying areas, vegetables, and subtropical fruits in irrigated areas.

Lake Mzingazi

This is situated in Richards Bay area, one of the small towns in the Municipality, it is a coastal lake of freshwater with a total catchment area of 171 km^2 and when at full supply level, the volume is 47.6 million m^2 (Moloi 2012). The lake is a shallow system getting its input from a number of streams, but most importantly the contributions from Mdibi and Mzingazi Rivers.

RESULTS

This study aimed at investigating the severity of the drought impact on water users, especially with regards to their economic activities. Results presented below include, monthly rainfall averages, monthly temperatures, and water level. These sets of data were correlated to present the relationship or effects of each of the variables on the other.

The result presented in Table 1 shows that changes in rainfall have a substantial influence on

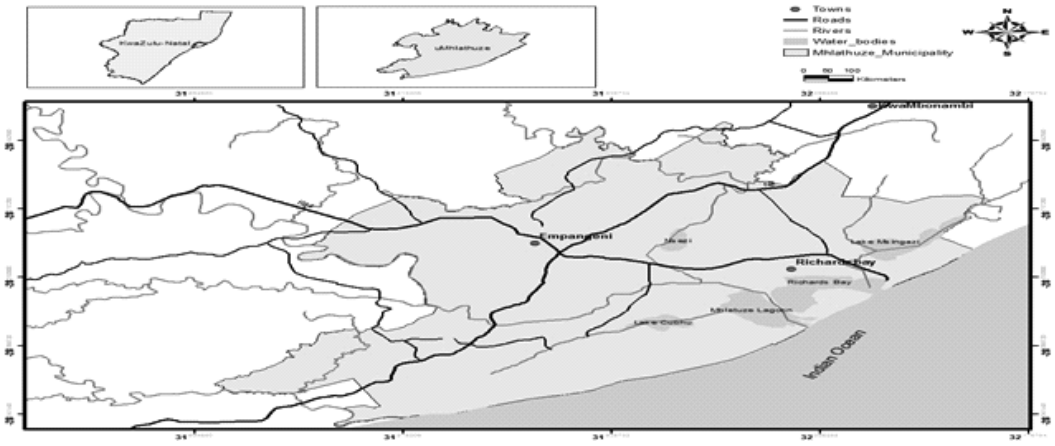

Fig. 1. Study area map: uMhlathuze Local Municipality in Northern KZN

Table 1: The rainfall and variations in the water level of the Mzingazi Lake in relation to summer month's temperatures

Year	*Annual rainfall Mtunzini (mm)*	*Annual Cor. Flow Aqua.*	*Lake Spillway*	*Summer months temperatures*
1993	313.2	1.06	3.05	28.9
1994	567.6	1.22	3.05	29.6
1995	1226.2	2.37	3.05	29.5
1996	1260.6	3.50	3.05	29.8
1997	1383.8	3.78	3.05	28.4
1998	886.8	3.59	3.05	29.1
1999	1365.2	3.30	3.05	29.5
2000	1702.8	3.77	3.05	28.5
2001	1011.8	3.66	3.05	29.0
2002	899.2	3.37	3.05	29.4
2003	620.8	2.99	3.05	30.1
2004	1447.4	3.44	3.05	30.0
2005	1004.2	3.40	3.05	28.5
2006	1818.6	3.09	3.05	28.4
2007	1709	3.11	3.05	28.9
2008	1231.6	2.98	3.05	28.7
2009	908.6	2.41	3.05	27.9
2010	818.6	1.63	3.05	29.4
2011	1354.6	1.46	3.05	29.0
2012	1186.6	1.82	3.05	29.1
2013	1171.6	2.33	3.05	29.7
2014	595.2	1.31	3.05	29.5

Source: Department of Water and Sanitation 2015

the lake's water level and by extension affects water supply and use in uMhlathuze Municipality. Huge disparities can be seen in the rainfall level in the Mtunzini station (1993-2014). There were periods in which the rainfall level exceeded 1500mm. These periods are associated with flood occurrences. On the other hand, there were periods in which rainfall level was below 600mm. These periods are associated with drought occurrences. For example, in 1993, 1994 and 2014, the area witnessed a heavy drop in the amount of rainfall in the region. The lake apparently is a deep reservoir from which water needs of industrial and agricultural activities around it are met. The decrease in the water level of the lake will in turn adversely impact water use in uMhlathuze Municipality. The occurrence of rainfall contributes significantly to the amount of water available in the lake, though the lake is not only sustained only by the water it receives from rainfall. According to the South African Weather Service (SAWS), a rainfall deficit of twenty-five percent is normally regarded as a severe drought, but it can be estimated that a shortfall of twenty percent from normal rainfall is likely to cause crop and water shortfalls in a region and this is usually accompanied by social, and economic hardship. The contribution of groundwater seepage also adds to the storage. This however still depends on rainfall ultimately since extended rainfall deficiencies will diminish aquifers.

The period preceding the 2015-2016 drought experience in the Municipality (2013-2014) as can be seen in Table 1, witnessed a sharp drop in the water level. Whereas, the atmospheric temperature within the same period seemed to be significantly high. This supports the possibility of a correlation between the impact of temperature and the

water level of the lake. The import is that the atmospheric temperature increases the evaporation rate, which resultantly decreases the water level in the lake. Higher temperatures and strong winds increase the amount of water evaporated. Evaporation from the lake surface may not matter only if there is sufficient water supply for underground seepage, rainfalls, and there is no excess runoff to diminish the lake reservoir.

Table 2: The GDP share of uMhlathuze from 1990-2018

Year	*GVA Primary sector – agriculture and forestry (% growth)*
1990	-3.12075
1991	0.145539
1992	-9.78243
1993	9.68428
1994	3.309046
1995	-9.86312
1996	8.024285
1997	1.335252
1998	-1.6156
1999	0.704481
2000	0.567901
2001	-1.05569
2002	2.598918
2003	2.680016
2004	1.341059
2005	1.485778
2006	-1.8631
2007	0.020683
2008	-0.69873
2009	-4.40089
2010	3.978119
2011	-0.1338
2012	-1.85276
2013	4.078833
2014	0.284186
2015	0.987208
2016	-5.37052
2017	7.962577
2018	-2.46751

Source: South African Reserve Bank (SARB, 2019)

The result, as presented in Table 2 shows a plunge in the productive capacities of uMHlathuze from 2013 to 2014. The downward slope in economic activities worsened during 2015-2016 droughts. Losses observed in this graph were experienced during the drought years when temperatures were high and water level low. The GDP was affected during the same years and this signifies that climate factors, water resources, and uMhlathuze's economy should be assessed in integration, not in isolation.

DISCUSSION

The study tested the variations in rainfall and temperature variation trend. The variations in these factors revealed the severity of the drought conditions that the uMhlathuze area is experiencing. It also indicated how their variability affects the water levels of the lakes that supply the uMhlathuze Local Municipality as well as how the declining water levels affect the water users. High temperatures affect the water level, while on the other hand, low rainfall also causes reduction in water level. The continuous decline in the water level as presented in Table 1 is inimical to the growth of the industrial and agricultural sectors that primarily depend on water for their economic activities. This is in line with the study of Pieterse (2019), Howitt et al. (2015) and Ngaka (2012) who affirmed that periods of drought is usually characterised by a decline in water availability, and low crop production, which in turn lead to loss in revenue and jobs. For the industrial sector, reduction in water level will lead to a reduction in or higher cost of raw agro-material. This, according to Maia et al. (2015) will negatively affect the agro-food and pulp and paper subsectors. Furthermore, the period of drought is characterised by high temperature. This is significantly responsible for the reduction in water level as a result of evaporation. This, according to Bradford and Bell (2017) threatens the supply of natural resources such as food and water. The impact of the drought was also felt in the economy, especially in the primary sector, which consists of the agriculture and forestry sector. Production declined sharply during the period under review as shown in Table 2. In the long run, the entire ecosystem would be affected. There would be an increase in food shortages, malnutrition and even death either because of hunger or suicide, which is as a result of high indebtedness, low crop yields because of the drought.

CONCLUSION

The study investigated the socioeconomic impacts of the 2015-2016 droughts on commercial agriculture and industrial activities in uM-

hlathuze Local Municipality using both primary and secondary data. The results of this study reveal the intricate relationship that exists between drought and man's livelihood sources. The 2015-2016 drought impacted flows in rivers, lakes' water level, agricultural sector, industrial sector and other sectors, which operations depend on water availability. Consequently, water redistribution strategy that restricts water use was put in place as the only coping mechanism.

RECOMMENDATIONS

In this post-drought season, an effective strategy to govern water resources needs to be implemented. The strategy should ensure that the available water is used judiciously, and the excess should be preserved for the future.

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