Climate Profiles of Countries in Southern Africa: Eswatini

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The following climate factsheet[3] provides an overview of the climate of Eswatini, one of ten countries of interest for the Finnish Red Cross Food Security Study, 'Interventions to improve food security in a changing climate in Southern Africa'. Each of the factsheets were written as a compilation of information from peer-reviewed academic papers, government publications, and INGO documentation, and are also available in one compiled document.

1. *What is the general climate of Eswatini, and what are its climate zones?*

The climate of Eswatini (formerly Swaziland) is generally classified as subtropical with two main seasons. The country's summer (spanning approximately from October-April) is its rainy season, with over 80% of the country's annual precipitation occurring in the form of severe thunderstorms and frontal rains (Mason 2020). The winter is the country's dry period (Mason 2020). Due to the combined forces of geography and seasonality, Eswatini experiences a wide range of temperatures, between average monthly maximums of 29°C in the country's hottest region to minimums of 11°C in the country's coolest (Mlenga et al. 2019, Mason 2020). The existence of distinct climatic zones within the country is due to variations in altitude and proximity to the Indian Ocean. The latter is described by differences in influence from moist wind currents from the Indian Ocean and intense continental winter winds, which both play a key role in determining seasonality.

The literature often categorizes the country's climate through four distinct climate and agro-ecological zones: the Highveld, Middleveld, Lowveld, and Lubombo plateau. The Highveld, in the west, comprises 30% of the country's territory and is home to the high altitude steppes and extensive planted forests of eucalyptus and pine (Mason 2020). The Middleveld occupies 25% of the country's territory and is the most populated area with important crops of sugarcane and fruit such as pineapples. Finally, the Lubombo plateau is a narrow strip of land in the far east of the country. It covers 1500 square kilometers at an average altitude of 600 m.

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1.1. How does precipitation vary throughout the year?

The months of October to April are the country's rainy season, where most of the precipitation falls in the form of intense rainfall events. In April and May, precipitation declines rapidly, and is quasi null from May to August, particularly in the drier regions of the country. Rainfall events begin again in September as the rainy season moves throughout the country.

The further east, the drier the climate generally becomes. The Highveld sees the most precipitation, with annual totals between 700 and 1500 mm (Mlenga et al. 2019, Mason 2020). In the Middleveld, annual rainfall is between 550 and 850 mm (Mlenga et al. 2019, Mason 2020). Rainfall is most scarce in the Lowveld region, 200 mm annually (Mlenga et al. 2019, Mason 2020). In the Lumbodo Plateau, rainfall is similar to the Middleveld (between 550 and 850 mm/year) (Mlenga et al. 2019, Mason 2020, Sacolo and Mkhandi 2020).

1.2. How does temperature vary throughout the year?

Temperatures are highest in the austral summer, between October and April. With the onset of the rainy seasons, temperatures quickly drop for the winter months, and frost can even be seen in the higher elevation regions.

In the Highveld, temperatures are the most moderate with averages of 17°C (Mlenga et al. 2019, Mason 2020). In the Limbobo Plateau, average mean monthly temperatures are around 19°C (Mason 2020). Temperatures are highest in the Lowveld, where average mean daily temperatures near 22°C and maximums of 29°C (Mlenga et al. 2019, Mason 2020).

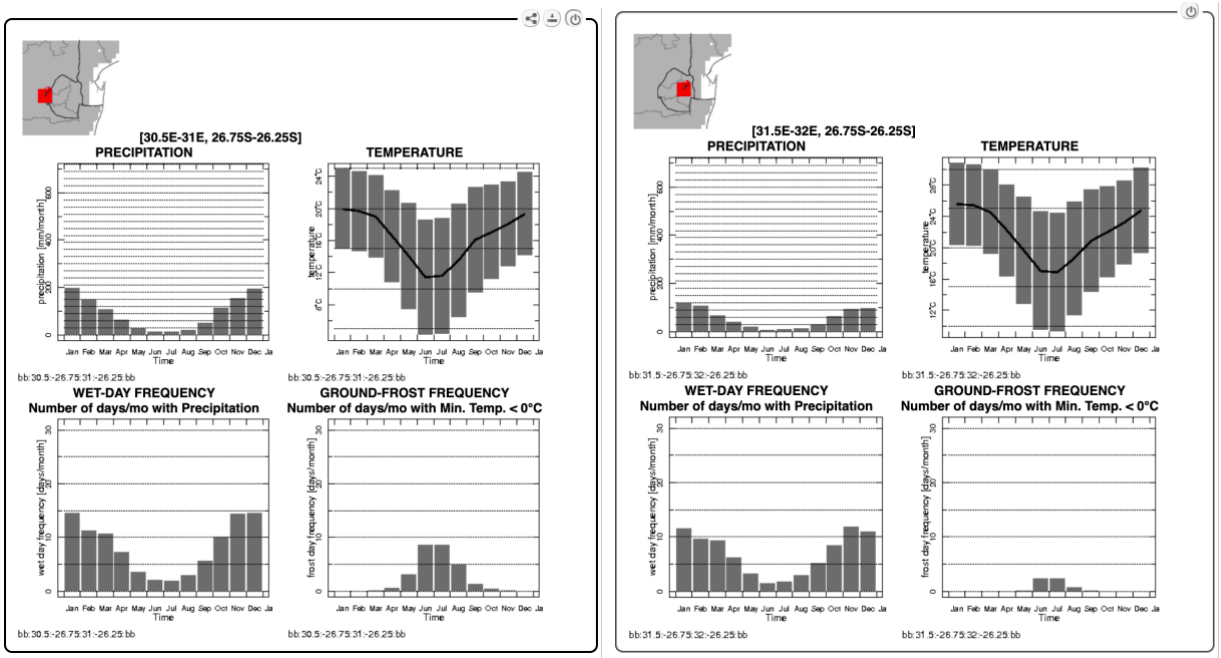

Figure 1. Climate Statistics for western (1a) and eastern (1b) Eswatini

2. *What types of extreme weather and climate does Eswatini experience?*

In Eswatini droughts, floods, and high-intensity storms are among the most common extreme weather events.

- Water scarcity leading to agricultural drought is a recurring phenomenon, with particular impact on the Middleveld and Lowveld regions, and often creating national disasters (SNVAC 2006). Even though Eswatini does not have a coastline, given the close proximity to a coastal area that experiences Tropical Cyclones (TCs), Eswatini can experience impact in the form of heavy rainfall (Sibusiso 2019). Droughts are also a major concern in Eswatini. Notably, Karama et al. (2020) assess that droughts were experienced in 1981-1984, 1990-1992, 2001-2003, 2006-2008, 2011-2013, 2015-2016, and, most recently in 2018-2019 (Karama et al. 2020). Mlenga et al. (2019) categorise droughts of 1990, 2001, 2004, 2006, and 2016 as particularly severe, and the worse agricultural droughts in 1985-1986, 2005-2006 and 2015-2016, based on their analysis of standard-precipitation indices. In the 2004-2005 drought, around a fourth of the country's population was in need of food aid (NCCP 2016). Additionally, both an earlier cessation of the rainy season and generally shorter rainy seasons are experienced in the central region of the country. The severity of the socioeconomic impact of drought is particularly high due to the 70% of the country's population depending on rain-fed agriculture (SNVAC, 2015). The Eswatini Vulnerability Assessment report of 2016 calculates that droughts can reduce crops yields by more than 50%, having a significantly devastating impact on food and economic security (Mlenga et al. 2019).

- Eswatini feels the impact of ENSO. El Nino years have also been linked to drought, most recently in 2015-2016 (Mohammed and Dlamini 2018). During La Nina years, Eswatini, and much of southern Africa, sees an increased risk for above average rainfall. Each individual El Nino and La Nina is different, however, and while historical data indicates increased risk of El Nino linked decreases and La Nina linked increases in rainfall, there are examples of seeing no shift, and/or even the opposite impact. Additionally, the Indian Ocean Dipole (IOD) is a shift of ocean temperatures in the Indian Ocean that may impact rainfall in Eswatini, with the positive phase (warmer than average temperatures in the western Indian Ocean) correlated with an increased chance of above average rainfall across southern and eastern Africa (Nash 2017). It is important to connect with local and regional institutions to better understand the context of potential and current climate and weather events.

- Flash floods occur in the summer months when severe thunderstorms can produce a large portion of the country's annual rainfall over a short amount of time. Current forecasts do not provide sufficient lead time for communities or the DRR sector to prepare. Although

rare, when they occur, riverine floods are also a significant threat Eswatini; in November 2009, for example, the country's 13 major rivers overflowed at a key moment in the agricultural calendar, water-clogging the newly planted crops and causing fears of widespread food insecurity (TNH, 2009). In 1984, cyclone Domonia caused severe floods which impacted over 4,000 people (NCCP, 2016). Additionally, bank erosion around rivers, such as the Mbuluzi River, has led to significant socioeconomic impacts as well as changes in the land surface (Sidorchuk et al. 2003).

3. *What are certain current and projected impacts of climate change in Eswatini?*

Climate change poses a threat to Eswatini's infrastructure, food and economic security and livelihoods more broadly.

3.1. Observed changes

- In their National Climate Change Plan (NCCP, 2016), the government of Eswatini describes some climate change related shifts in the form of variations in seasonality and precipitation events, higher temperatures, and increased occurrence of extreme weather events such as floods and droughts.

- Notably, droughts have become more frequent, more severe, and impacting a wider geographic area since 1986 (Mlenga et al. 2019). Most recently, a severe drought in 2015 and 2016 (which was linked to El Nino) caused significant declines in crop-productivity and increased food insecurity (Swaziland Economic Policy Analysis and Research Center 2017).

- Other types of severe weather have been experienced over the last few decades such as extreme precipitation events (NCCP 2016), notably experienced in 2009 (TNH 2009). Although changes in *patterns* are more difficult to establish, research has been able to show statistically significant increases in rainfall intensity in the last 40 years (UNFCCC 2012).

- Finally, annual mean temperatures in Eswatini have increased by over 3°C throughout the country between 1961 and 2000. Increased duration of heatwaves have also been recorded, in particular in the Lowveld region of the country (UNFCCC 2012).

3.2. Projected changes

While climate science is useful to understand future changes in climate, including probability of extreme events, it is important to note the inherent uncertainty in these projections. Uncertainty

does not mean we should not trust the science, however it does mean we should be aware of the intention of these projections, which is not to provide a perfect vision of the future.

- Overall, projections for Eswatini suggest an increase in drought for the early period of 2046 to 2065. Projections of rainfall itself are a generally increasing trend for both seasons and both periods. The highest increases in precipitation are projected in the winter period and especially in the Lowveld region and Lubombo Plateau but there is disagreement whether this would be for both periods or only the latter (UNFCCC 2012)

- Streamflow is projected to decrease by 40% by 2050 (NCCP 2016), with an increase in flood risk noted for the period 2081 to 2100 (UNFCCC 2012).

- There is general agreement that temperatures, both maximum and minimum, will increase throughout the century, notably between 1.5 and 2°C between 2046 and 2065. In particular, the Highveld and the northern part of the Lowveld region may experience the highest increases. With changes in global temperatures between 1-2°C, it is projected that the yields for staple cereals such as maize will decrease significantly; for instance, projections show that it may be increasingly difficult to grow maize in the Highveld region by 2050 (NCCP 2016).

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