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Review

Influence of Climate on Conflicts and Migrations in Southern Africa in the 19th and Early 20th Centuries

Mphethe I. Tongwane [1,2,*], Teke S. Ramotubei [3] and Mokhele E. Moeletsi [4,5]

[1] Zutari, Riverwalk Office Park, 41 Matroosberg Road, Ashlea Gardens Extension 6, Private Bag X13, Pretoria 9866, South Africa
[2] Department of Geography, QwaQwa Campus, University of the Free State, Private Bag X13, Phuthadithjaba 9866, South Africa
[3] Climate Modelling Group, Council for Scientific and Industrial Research, P.O. Box 395, Pretoria 0001, South Africa
[4] Agricultural Research Council-Institute for Soil, Climate and Water, Private Bag X79, Pretoria 0001, South Africa
[5] Risk and Vulnerability Assessment Centre, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa
* Correspondence: mphethe.tongwane@zutari.com

Abstract: Climate and other environmental factors continue to play important contributions on the livelihoods of communities all over the world. Their influence during historical periods and the roles they played remain under-reported. The main objective of this review is to investigate the climatological conditions during the time of the invasion of early European settlers in Southern Africa in the 19th and early 20th centuries. It establishes the possible relationships between climate variability and historical conflicts and wars, famines, disease pandemics, and the migration of African people to towns in search of sustainable and predictable livelihoods away from unreliable agriculture. A qualitative analysis of published peer reviewed literature in the form of reports, papers, and books was used in this review. At least 60 literature items were reviewed in this paper. There is a relationship between climate variability and the historical events of the 19th and early 20th centuries. Tribal conflicts and most of the wars between the settlers and the African people for land coincided with periods of droughts. Drought were key causes of famines, instabilities, and land degradation in the region. This study highlights the influence of environmental conditions on socio-economic conditions as the world enters an era of climate change and urbanization in developing countries, particularly in Africa. It shows that the hardships caused by environmental conditions have the potential to destabilize societies.

Keywords: droughts; floods; famines; poverty; European settlers; wars

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1. Introduction

There are multiple typologies of migration that include invasion, conquest, colonialization, and immigration [1]. Various environmental factors for a location during a particular period can influence or become a catalyst for the movement of people, animals, and birds [2–4]. In ancient and modern societies, migration due to environmental impacts results in environmental refugees [5]. On the contrary, it is important to note that climate does not only facilitate migration, but can also be the primary source for conflicts and wars when the natives stage a resistance to conquest [6].

Human migration in Africa has occurred for many years as a result of several causal factors [7]. Climate has had either direct or indirect historical impacts on the livelihoods and behaviors of people over the continent. Diverse geography and ecosystems have resulted in various political ecology conditions in the continent [8]. Extreme climatic events such as droughts have caused famines, conflicts, and the movement of people in

search of food. Climate variability, particularly droughts, continues to cause pressures on natural resources for people and animals [9]. Environmental challenges, particularly drought, have caused famines, fights over arable lands, and socio-political tensions that have increased vulnerabilities and risks of African communities to the invasion of the European settlers [10].

Studies show that mixed farmers who combined pastoral and agricultural systems migrated from North Africa, settled to the east of Southern Africa, and found the San people, who were pastoralists that survived by hunting and gathering wild food [11]. Climatic conditions in east southern Africa suited their livelihood of crop production and animal husbandry. A hilly landscape provided a variety of rich grasslands for both animal husbandry and wildlife. An abundance of wetlands on the plateaus of mountains and valleys naturally harvested rainwater and regulated the flows of a network of perennial rivers. The plateau is a head stream region of the Orange, Tugela, and Vaal river systems that continues to be the mainstay of water circulation in the region [12].

Soil and climatic conditions were optimum for sorghum, a staple food item that became known as African corn by the European settlers who later invaded the region [13]. Mixed farmers had technologies that enabled them to produce this drought tolerant cultivar. Conflicts over the supremacy of natural resources, whose yields fluctuated according to variable environmental conditions, became rife [14]. Droughts and floods have been predominant environmental hazards that have always defined livelihoods and migrations in the region [8]. Although they often occurred intermittently, the nature of the droughts had longer lasting impacts than floods.

The permanent residence of European settlers in Southern Africa started in the 1650s [15]. On their business trips to Asia, European sailors regularly passed by the Cape of Good Hope in the southern tip of Africa [11,16]. The location marked the midway point of the lengthy trip traversing over the west coasts of Africa and the vast seas of the Indian Ocean. It therefore became a strategic station where the sailors could recuperate and restock food items, especially Mediterranean fruits and fresh water [17]. A mechanical problem on a ship in 1648 necessitated an unplanned lengthy stay by the sailors in the Cape, as they waited for assistance with their broken ship [11,18]. This stay provided an opportunity for the desperate sailors to explore the treasures of the land. They needed a sustained supply of food, and ventured into leasing pieces of land with the natives to produce grains. It did not take long for the sailors to finally decide to have a permanent and organized station in the Cape in 1652, by the time of the arrival of Dutch settlers, led by van Riebeck [16].

Changes in environmental conditions are projected to continue to influence human migration into the future [19]. It is anticipated that impacts of climate change will cause hardships to communities, particularly in low income and vulnerable countries, necessitating mass migrations of people in search of better livelihoods elsewhere. It therefore becomes important to investigate the historical relationships of people, their climate, and migration, which have come because of perturbed environmental conditions. An understanding of the role previously played by climate on human migration provides the basis for future impact studies resulting from the projected climate changes. The objective of this study is to provide a qualitative analysis of climate-related conflicts and the resulting migrations that have occurred in Southern Africa during the 19th and early 20th centuries. The study seeks to find relationships between climate hazards, poverty, conflicts, wars, and historical migrant labor in Southern Africa. The hypothesis of this review is that climatic and environmental conditions played a significant role in the history of Southern Africa. Understanding of the climate–conflicts–migration nexus can help with the design of effective resilience measures and strategic developments [20] for the adaptation and mitigation of future climate impacts on human migration in the present era of climate change.

2. Approach and Sources of Data

2.1. Study Area

Southern Africa (Figure 1) is arid to the west, and predominantly semi-arid in other parts, with rainfall variability being high, at 40% [21,22]. The eastern part of Southern Africa is humid subtropical, with the Drakensberg Mountain range playing a significant role in the climate of the region [23]. The plateau in the southeast of the region, which has highest elevation in Lesotho, is characterized by windy and snowy conditions in winter [24]. The Free State province, located in central South Africa, is one of the highest cereals (maize, wheat, and sorghum)-producing areas in the region [25]. Moreover, the mean annual rainfall in the western part of Southern Africa can be as low as 25 mm, but it can exceed 1000 mm in other parts of the region [15,26].

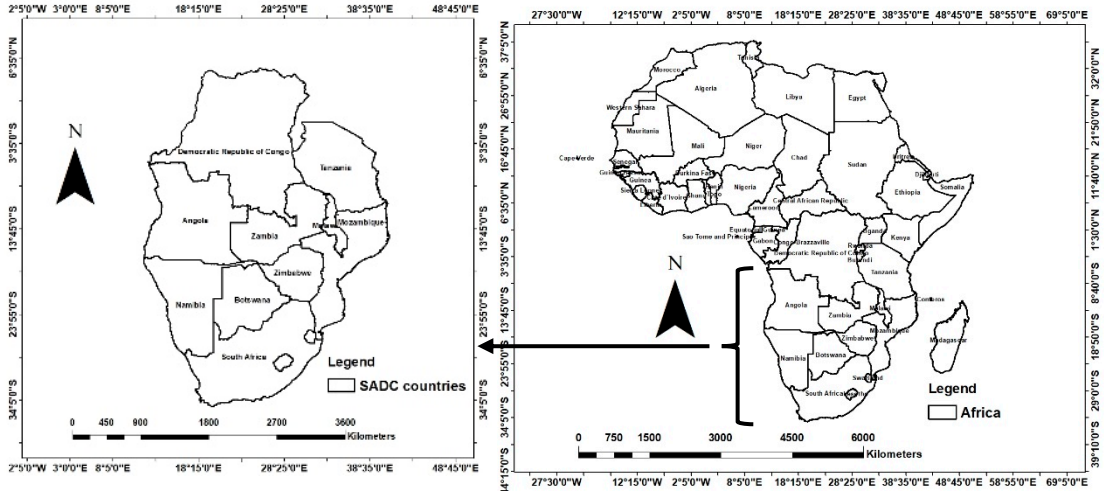

Figure 1. Map of the study area in Southern Africa.

2.2. Approach

This study focused on historical impacts and the influence of climate on the people, their livelihoods, and conflicts in Southern Africa in the 19th and early 20th centuries. It has mostly relied on published peer reviewed literature, including articles, reports, theses, and books. The search consisted of various combinations of the following keywords: impacts of, climate variability, droughts, floods, snow, famine, conflicts, wars, European settlers, migration, and Southern Africa. Strings used in the search included, but were not limited to (1) impacts of historical climate variability in Southern Africa; (2) famines, conflicts, wars, and European settlers in Southern Africa in the 19th and 20th centuries; and (3) historical droughts, floods, food insecurity, and conflicts between tribes and European settlers. The period of research was between 1800 and 1950. Although the settlers had arrived in Southern Africa around a century and a half earlier, expansion and widespread colonization of the region increased at the beginning of the 19th century. Little literature exists prior to this century. On the other hand, the climatic and historical events of the second half of the 20th century are widely reported.

A selection of literature paid more attention on the articles that reported on climate hazards and their impacts. However, climate variability and its impacts on society were also linked between several pieces of literature. Preference was given to old literature, particularly on the impacts of climate variability and migrations, but information was also obtained from not-so-old scientific articles that have used modern techniques to identify historical climate variability. Not less than 100 peer reviewed literature items were reviewed, and information was obtained in nearly 80 articles.

Historical data on grain production, and how it was influenced by climate variability in the 20th century, were also used in the study. Although meteorological data recordings started in the 1870s in some countries in Southern Africa [22], the 20th century brought in

the widening of systematic observations and recordings of events in the region. The data on grain production were obtained from the literature. Historical climate conditions were reviewed from the published literature, to establish a scientific basis for the impacts that may have resulted in the past. The historical climatic conditions were mainly based on El Niño Southern Oscillation (ENSO) data for periods after the commencement of climate observations and reconstructed records for periods prior to instrumental observations.

3. Climate and Wars in Southern Africa

This section contains two periods in the history of Southern Africa. These are Section 3.1, which discusses the climatology of Southern Africa during the two centuries; Section 3.2, which presents the early 19th century conflicts; and Section 3.3, which presents the invasion of Southern Africa by invaders from Europe, and the wars between them and the natives in the 20th and the 21st centuries. Section 3.4 investigates climate and food production during and after the discoveries of mines in South Africa, in the late 1800s. Table 1 provides a summary of the historic events and their linked climate conditions.

3.1. Climatology of Southern Africa during the 19th and 20th Centuries

In addition to a complex landscape that consists of steep slopes and latitudinal positioning, the climate of Southern Africa is influenced by combinations of oceanic and continental interactions that include the Mozambique channel trough, Mascarene high, southern annular mode, South Indian Ocean dipole, South Atlantic Ocean dipole, intertropical convergence zone, and ENSO [27–33]. Of these, ENSO plays a very critical role in influencing the climate variability in the region [34]. The two ENSO states (El Niño and La Niña) have typically been linked to some of the severe droughts and floodings in the years between 1875 and 1978 [35]. ENSO's influence on Southern African climate variability has been linked from way back in the 1700s through the use of proxy data [36]. Although El Niño is largely associated with dry conditions in Southern Africa, there are occasions where it did result in neutral or wet conditions [37].

Dry and wet conditions in Southern Africa are periodic and occur regularly. These conditions have been observed or reconstructed using several scientific techniques. Although paleoclimate records are complex and largely inconclusive due to high climate variability in Southern Africa, they show relatively drier conditions in the region in the early 1800s and the 1820s [38]. There were six major drought occasions (i.e., 1820–1827, 1831–1835, 1844–1851, 1857–1865, 1877–1886, and 1894–1899) that could be identified during the 19th century [39]. These authors [39] also identified seven main wet periods (1816–1817, 1829–1830, 1851–1852, 1863–1864, 1874–1875, 1889–1891, and 1899–181900) during that century. Similarly, using a standardized precipitation index, more than 20 (out of 93) of rainfall districts in South Africa experienced drought during the years 1926, 1927, 1933, 1945, 1947, 1949, and 1952. Some of these years (1926, 1933, 1945, 1949, and 1952) had more than half of the districts dry.

Climate systems that are prevalent in Southern Africa are responsible for climate variability in the region [40]. As a result, climate variability has been shown to be related with food insecurity, instability, and various hardships in Southern Africa [41]. Throughout the world, but more particularly in Southern Africa, occurrences of ENSO have been associated with the productivity of biophysical systems [42]. More than other climate drivers, ENSO is frequently associated with impacts of climate and weather on the livelihoods of people in the region.

3.2. The Influence of Climate during the Tribal and Invasion Wars in the 19th Century

The 19th and 20th centuries were tumultuous periods in Southern Africa. Turmoil in Europe threatened the superiority of British in trade routes to India through the Mediterranean Sea and the Atlantic–Indian ocean wing [43]. The British occupied and took over administration at the Cape in 1795 to prevent the peninsula from being controlled by the French [11,18]. The breathtaking pace at which the settlers invaded the land in Southern

Africa after the 1800s, and the aggression and sophisticated techniques they used, left the natives with little choice in resisting the political and economic consequences that followed. Since their arrival in the 17th century, the settlers had studied the environmental conditions of Southern Africa through various explorations, and have noticed that the climate was highly variable and prone to prolonged droughts that always threatened food security. The settlers realized a transhumance form of livelihood by the natives, involving the regular movement of both people and livestock during periods of hardships to search for water, pastures, and resources that would support their lives [44]. The attacks and invasions against the African people coincided and became effective during drought periods [16].

The 19th century in Southern Africa was politically and socially very turbulent. Famines and land invasions by settlers during the length of century caused perilous situations. Three decades of the century were generally dry and historically eventful. In the 19th century, a devastating drought occurred that caused a widespread famine. This famine (termed sekoboto in Sesotho and mahlatule in the Zulu oral traditions), though it started in 1800, had its peak and most devastating impact in 1803, when agriculture failed in the region and people across the whole social spectrum lost their sources of livelihoods, as livestock died and crop production failed completely [45]. As a result, there was strong competition over the little remaining productive land and durable water resources, and those who had already consolidated their power prevailed over weaker groups, in the open contests that emerged [10]. To avert the famine, the Cape colony rationed food and imported cereals from Asia and Australia [43]. This famine had serious impacts on the rituals, traditions, and cultures of the natives. Lepoqo, who later became Moshoeshoe I, the first king and founder of Basotho nation, could not be initiated until 1804, when conditions improved [45,46]. However, a younger Moletsane (who was 14 or 15) of Bataung proceeded and performed the ritual at a location near Steynsrus and Marquard in the now Free State province of South Africa [45]. This indicates how environmental hazards can affect communities differently, and how the responses to environmental hardships may vary between societies.

Water resources and pastures in 1803 dried up, and the resulting death of livestock in large quantities depleted a wealth of social benefits. In response to the water resources and pastures drying up, as well as large numbers of livestock deaths, farmers either prematurely weaned or deprived suckling animals their precious sources of nutrition, putting into action a Sesotho proverb that put literally, says "an animal (more especially a cow) would rather be compromised to save a human's life during difficult situations". During periods of droughts and bad harvests, communities of Southern Africa would use various coping strategies to make a living. They moved their settlements from dry lands to where they could dig remnant wells, and intensified the hunting of wild animals and food [47]. Communities competed with livestock, birds, and locusts in tirelessly hunting for any form of edible wild plants and water [45,47]. Pillars of livelihoods for communities were destroyed when the conditions of the famine improved, around 1805 [45]. Draught power and seeds were consumed and became hard to find. The ivory trade, shipped through the east coast of Southern Africa, became insignificant because the animals were depleted. During the years of good production, the communities of Southern Africa would produce harvests that were enough to sustain them over two to three years of bad harvests [26,47], because their vast lands allowed for extensive production. However, the drought experienced in the early years of the 19th century far outweighed this practice.

African communities did not only battle the impoverishing conditions of droughts during the infancy of the 19th century. The devastating famine of 1803 and other climate related disasters that followed coincided with purposed inland movements of the European settlers, who found these conditions opportune for them to ambush the impoverished communities in Southern Africa. The long conflict between the Khoisan and the Dutch settlers that started in 1659 ended in 1803 with a defeat to the former [48]. The droughts in 1801, 1811–1812, and 1818–1819 weakened African communities and fueled tribal conflicts, including the dispossession of the Xhosas of their livestock by the settlers from the Cape

colony [10,11,48]. The ivory trade at the eastern seaport of Delgoa decreased, and conflicts over productive land grew during the period between 1800 and 1818 [48]. These periods correspond chronologically with periods of demographic and political turmoil among the northern Nguni people [10].

Prolonged and frequent droughts between 1800 and 1820 were catalysts for poor food production that resulted in extreme famines and civil unrests. Ethnic conflicts over supremacy and limited natural resources amongst the Africans, beginning around 1815, grew and became a warfare termed difaqane, which affected most parts of Southern Africa in the early 1820s [11]. Difaqane caused widespread famines, depopulation, and the displacement of people and livestock, as well as the formations of the nations of modern Southern Africa. Anthrax outbreaks, which are common occurrences during dry environmental conditions, were reported in the autumn of 1825 in the interior of South Africa [10]. Communities did not have opportunities to till and cultivate for their own consumption. With no veterinary services and medications at the time, the disease killed a large number of livestock. This exacerbated food insecurity in the region, as both crops and livestock could not provide for the livelihoods of the people.

The Cape colony began assembling technologies to address the impacts of dry conditions. The construction of dams to support agriculture and to alleviate other drought-related impacts in the Cape Colony started at the close of the wars, in 1828 [18]. Agriculture remains a main consumer of water in South Africa, particularly for commercial production [49]. To cope with the adversities of erratic rains, the Africans depended on indigenous water conservation techniques such as terracing, to keep moisture for their subsistence agriculture [50].

3.3. Influence of Climate on the Invasion of Southern Africa by European Settlers after the Tribal Wars

The population of the settlers in the conquered fertile lands of the Eastern Cape grew during the unrests of the difaqane and limited agricultural production; recurrent droughts compelled the young settlers to move towards the less populated interior of the country from around 1836 [51]. A drought in 1834 exacerbated the urgency of the invasion of the settlers. The conditions were so severe that the confluence of the Orange and Vaal rivers became dry [18]. That situation indicated a widespread drought that persisted from October 1833 [52]. A notable famine was averted, as there was a carryover of grains from the previous harvest. Basotho practiced matsema production systems and traded surplus grains for livestock. Unlike the dry conditions that were uneventful nearly a decade earlier, the drought that occurred between 1841 and 1843 was accompanied by the first wars between Basotho and the European invaders who were moving northwards [52]. As a result, the native communities starved during this period and their exposure to conflicts increased. Basotho were around 80,000 at the time, and they reigned over the territory that included the area between the Orange, Vaal, and Caledon rivers [53]. Communities that had hidden for cover in the gorges of the mountains during the difaqane had descended into the fertile lowlands. It was difficult for Moshoeshoe to manage vast fertile lands of his territory amidst the expansion of settlements after the difaqane, and further necessitated by unfavorable environmental conditions. The settlers were in possession of limited lands in the Eastern Cape, and erratic climatic conditions threatened their food security so much that other potential production areas were urgently needed. Encroachment of the Orange Free State by the settlers in search of fertile grasslands to graze their livestock during the drought ignited conflicts between them and Basotho. The fertile lands that produced grains that were traded to lands far in the Eastern Cape became a contentious territory [11,16].

Aftermaths of a war between Basotho and the Afrikaners in 1858 were catalysts to a famine that lasted for a few more years. The settlers wanted Moshoeshoe to withdraw his chiefs, who had occupied areas in the Orange Free State beyond the Warden line, but the latter missed the deadline. Scores of Basotho fled aloft to the mountains, only to be trapped and held hostage by snow that fell for three days at the end of April in 1858 [54].

The invaders had burnt their fields and caused starvation in the process. The migration of black youths, particularly from the Eastern Cape to major urban towns, and the resulting erosion of manpower as a result of destroyed livelihoods, started around this time [55].

Wet conditions that brought a relief were experienced in the beginning of the summer growing season in 1858, and normal cultivation was conducted. However, prospects of good harvests were hampered by midsummer drought. The dry conditions continued until 1863, and agriculture failed for several agricultural seasons, causing severe food insecurity and prompting the chiefs in Lesotho to ask for priests to pray for rainfall, a culture that still exists currently. This drought, furthermore, triggered the migration of Batlhaping in Kuruman due to water scarcity [56]. The dusty dry conditions ceased flows of perennial rivers and typhoid—a disease common during droughts, broke up [26]. Basotho lost fortunes of livestock and agricultural production during this decade, leaving Moshoeshoe and his people crippled with famine.

3.4. Climate and Food Production during and after the Discoveries of Mines in South Africa

The discovery of diamonds in 1867 in Kimberly, South Africa, brought market opportunities for countries in Southern Africa. Lesotho was able to export over 8000 metric tonnes of grains to the emerging mining markets in South Africa during the 1870s [8]. Widespread drought between 1875 and 1878 caused a global famine crisis in the tropical and subtropical regions, which in Southern Africa, occurred between 1876 to 1878 [57]. This drought became the genesis of the existing inequalities of the "first" and "third" worlds, as the colonial markets took advantage of the situation in the distressed regions of the African people [57]. The agriculturally based economy was succeeding, and the Cape colony introduced a series of laws and taxes that were unwelcomed by the Basotho and the rest of the neighboring countries, causing a rebellion of Moorosi in 1879 and the Gun war in 1880 [58].

Basotho were still not content with the loss of their land and they were still contemplating plans to reclaim it back. However, the transfer of the authority of the disputed land was sealed in Berlin in March, 1885, when the continent of Africa was split in a conference by the ultimate colonial powers, Britain, France, Germany, and Portugal. The outcomes of this historic conference included a separation of the same communities and declining trade systems between societies and markets [15]. The conference was held amidst an economic recession that began in 1882 and ended in 1886 [59], and the impoverishing drought. However, wet and frosty winter conditions in 1887–1888 provided an opportunity for Basotho to produce their precious cash crop of wheat.

The 19th century closed with yet another calamity. The arrival of a noble rinderpest epidemic in Southern Africa in the exceptionally dry 1896 caught everybody by surprise. It was unknown in the region and responses to arrest its deadly effects were difficult to coordinate. Rinderpest, a deadly viral cattle disease, was first recorded in East Africa in 1889 [60]. The absence of early warning systems in the continent at the time made it possible for the disease to spread throughout the continent quietly but rapidly. Although the disease was caused by migrating animals, its rapid spread in Southern Africa was promoted by the dry conditions that prevailed at the time [61–63]. The disease went on to kill more than 90% of the cattle in Southern Africa [61,64]. The disease caused great starvation and limited the production of grains and their transportation to the market, as surviving livestock were quarantined [61,64]. Dry conditions and rinderpest caused widespread famine, and job opportunities in the mines provided Southern African inhabitants with an alternative source of income [41,48,57].

Table 1. A compilation of historical incidences potentially caused by climate variability in Southern Africa.

Period	Climate Condition	ENSO Status	Major Historical Events That Coincided with or Were Caused by the Droughts
		The 19th Century	
1800–1807	Drought	1801–1802; La Niña [c] 1805; La Niña [c] 1806; El Niño [c]	Conflicts between Xhosas and whites [10]; Famine (termed Sekoboto in Sesotho), livestock died, food production fell, people ate wild plants, human migration and conflicts for resources occurred in Southern Africa [10,11,26]
1811–1812	Drought	1812; El Niño [e]	Conflicts between Xhosas and whites [10]; Food scarcity [26]
1816–1819	Drought	1817, 1819; El Niño [e]	Tribal settlements dependent on rural economy in southern Africa [65]; Rinderpest and crop rust [10,66]; Conflicts between Xhosas and whites [10]; Rust, cattle plague [26]; Wetter Kalahari in 1816 [22]; Occupation of settlers north of Orange River [67]
1820/1823/ 1826/1828	Drought	1828; El Niño [e]	Tribal wars started 1823; No stored grains due to previous drought and rinderpest, rivers and pastures, livestock not recovered [10]; Invasion of locusts—dried locusts provided nourishment for human and livestock [26]; Food scarcity caused migration of people towards northern coast of Mozambique, promoting conflicts and slave trade [10]
1834	Drought	Neutral unclassified	Food reserves used to avoid famine [26]; dry confluence of Orange and Vaal Rivers [18]; Game became major source of food as constant raiding prevented successful cropping [66]; Native unrest [67]
1835–1839	Wet	1837–1838; El Niño dry [a] 1838–1839; El Niño neutral [a]	Wet episodes towards the end of the 1830s [22]; Matebele of Mzilikazi driven north of Limpopo River, massacre of Boers by Dingaan and later overthrow of Dingaan [67]
1838–1841	Wet	1838–1840; Neutral unclassified [a] 1839–1840; Neutral unclassified [a] 1840–1841; La Niña unclassified [a]	Orange River flooded in 1840–1841 [22,52]
1841–1843	Drought	1841–1842; La Niña neutral l [a] 1842–1843; Neutral normal [a] 1843–1844; La Niña wet [a]	Famine [26]
1846–1847		1846–1847; El Niño neutral [a]	Xhosa's war of the axe, lost large stock of cattle [18]
1847–1848	Wet	1847–1848; El Niño wet [a]	British Sovereignty established (1848) between Orange and Vaal Rivers, and to the east of the Drakensberg Plateau [18]
1849	Snowfall	1848–1849; La Niña wet [a]	Snowfall [45]; Lesotho territory reduced to area between Vaal and Orange Rivers [18]
1850–1852	Drought	1850–1851; La Niña wet [a]	Drought conditions [68]; Native rebellion and wars [67]
1854–1855	Wet	1853–1854; El Niño dry [a] 1855; El Niño [d]	Xhosa–British war, cattle lung disease killed two-thirds of cattle [18,22]
1857	Drought	1856–1857; El Niño wet [a] 1857–1858; El Niño dry [a]	Xhosa's prophetic cattle-killing delusion caused by distress of famine and invasions by settlers, mass migration for jobs, start of black urbanization [18,48]
1858–1859	Drought	1857–1858; El Niño dry [a] 1858–1859; El Niño wet [a]	Famine, typhoid, Basotho–Boer war [11,26]; Cattle killing [67]
1860–1863	Drought	1860–1861; La Niña neutral [a,c] 1861–1863; La Niña dry [a] 1863; La Niña [c]	Severe drought, Caledon ceased to flow, livestock died, known as "great drought" or "red dust", little dairy left communities surviving by eating roots, necessitating calls by chiefs for priests to pray for rain in Lesotho, water scarcity causes Batlhaping people of Kuruman to migrate [26,56,68]
1864–1865	Wet	1864–1865; La Niña wet [a]	Malaria infestation in northwestern Zambia causes triumph of Sebetwane over Lozis in 1840, short-lived [48]
1865	Drought	1865–1866; El Niño dry [a]	Famine in Southern Africa, typhoid [26]; Famine, Basotho–Boer war, Moshoeshoe ceded much of his land, conflicts between Moshoeshoe's sons, Lesotho annexed as Cape/British colony [11]
1868	Drought	1868–1869; El Niño dry [a,c]	Typhoid epidemic [26]; Lesotho annexed to Britain as Basutoland [11]

Table 1. *Cont.*

Period	Climate Condition	ENSO Status	Major Historical Events That Coincided with or Were Caused by the Droughts
1869		1868–1869; El Niño dry [a]	Boundary of Lesotho and Orange Free State settled [11]
1877–1878	Drought	1877–1878; El Niño dry [a,c,d] 1878–1879; El Niño dry [a]	Famine in Southern Africa, religious consequences [26]; Economic depression 1876 [65]
1879–1880		1879–1880; La Niña wet [a] 1879–1880; La Niña [c]	Moorosi's rebellion and Gun war [58,65]; End of economic depression after discovery of goldfields in Witwatersrand [67]
1883–1885	Drought	1884–1885; El Niño dry [a]	Famine, civil war in Lesotho, smallpox epidemic [26]; Gun war in Lesotho [58]; Basotho were indebted to the traders and pledged with livestock, arrangements for repayments were made for the 1886 winter harvest [65]
1886	Wet	1885–1886; El Niño wet [a] 1886–1887; La Niña dry [a]	Harvest plenty, railway from Cape aimed at transporting cheaper imported grains from United States and Australia reached Kimberly, goldfields at Witwatersrand opened [65]
1890–1891	Wet	1891; El Niño [c]	Wet conditions [68]
1892–1898	Drought	1894–1895; La Niña neutral [a] 1896–1897; El Niño dry [a] 1897–1898; El Niño dry [a] 1893–1894; La Niña [c]	Rinderpest killed approximately 90% of livestock, wheat failed completely, growing dependence of Africans on migrant job opportunities by colonial markets, permanent change of structure of African society [48,58,62,63]; Fish River ceased to flow, famine in parts of South Africa, years of troubles, locusts destroyed crops [18,58]; Civil war between Moshoeshoe's sons, Masupha and Lerotholi [58]; Locusts destroyed crops, Basotho reconsigned grains from traders, railway from Cape transporting grain flour imported from abroad through Bloemfontein reached Witwatersrand in 1893 [65]
The 20th Century			
1902	Snow	El Niño [c]	Thousands of livestock died; Draught power diminished, migrations for jobs in mines; South African war [58]
1903	Drought	El Niño [b]	Food import and migrant labor started in Lesotho [58]
1905	Drought	Neutral [b] El Niño [c]	Locusts, wheat failed completely [63]; Poor trade due to recession and drought led to general scarcity of money [63]
1908–1809	Drought	1907–1808; Neutral [b] 1909–1810; La Niña [c]	Lice destroyed wheat, maize by drought, wool and mohair sales steadily increased [63]
1913–1814		1912–1814; Neutral [b] 1912–1815; El Niño [c]	Famine [65]; Violent storms in Durban [67]
1916	Floods, droughts	Neutral [b]	Phenomenal rains in Cape Province, great floods in Gamtoos River valley, serious drought in several parts of South Africa, bubonic plague near Theunissen in the Orange Free State [67]
1917	Floods	La Niña [b,c]	Floods in Transvaal [67]
1918	Floods	La Niña [b] El Niño [c]	Abnormal rains and floods in Witwatersrand (Johannesburg), devastating floods in Natal [67]
1919		El Niño [b]	Massive crop production in Lesotho, wheat exports record high [63]
1925	Wet	La Niña [b]	Wet conditions for most of South Africa [69]
1926	Drought	El Niño [b,c]	Severe drought of greater than 6 months [69]
1932–1933	Drought	Neutral [b]	Crop production declined except for wheat; half of the livestock died [63]; Record import of maize in South Africa [70]
1939	Floods	La Niña [b]	Vaal dam flooded [12]
1945–1947	Drought	1944–1949; Neutral [b] 1940–1942; El Niño [c]	Famine covered Southern Africa [71]; Food prices inflated [11]
1948	Wet	1944–1949; Neutral [b]	Wet conditions for most of South Africa [69]

Sources: [a] [72]; [b] [73]; [c] [74]; [d] [75]; [e] (Historical El Niño Events—Causes and Consequences of the Medieval Warm Period (google.com (accessed on 4 August 2022)).

4. Climate and Loss of Economic Power of Native Societies in the 20th Century

4.1. Droughts, Famines, and Migration of Natives to Cities

The 20th century, unlike its predecessor, ushered in a period free of wars. The land had been conquered and was owned by the colonial warriors. Nonetheless, agriculture remained a pillar supporting the livelihoods of all communities. Its economic value, however, dwindled continuously as the century progressed and migrant labor grew in Southern Africa. The blooming mining industries in Kimberly and Witwatersrand (the current Johannesburg) opened new economic opportunities for the African communities and distant migrants. A combination of erratic climate, which often compromised production, and protectionist policies that promoted grain production in South Africa drove African farmers in Lesotho, Botswana, and Eswatini out of market and necessitated their migration to South Africa [48].

Southern Africa had just survived a rinderpest epidemic, when a disastrous snowfall in 1902 killed thousands of the remnant livestock in southeastern Southern Africa [62]. The impact of the Anglo–Boer war of 1899 to 1902, and the economic recession at the time exacerbated the prolonged poverty. Although the snow may have been good for wheat production, the impacts of limited draught power and closed trade markets in South Africa had possibly reduced grain production and exports to the mines because of the war.

Climate variability in the region continued to bring oscillating impacts to the livelihoods of the people. A malaria epidemic, which was an indication of flooded surfaces, was reported in the northeast of the region around 1905, and again in the northwest along the banks of the Orange River in 1909 [76]. In between these floods, however, there are reports of drought and lice that affected maize and wheat productions, respectively, in Lesotho, in 1908–1909 [63]. These climate variabilities continued to put primary livelihoods at risk in the new living conditions. They made agricultural systems unfavorable, but at the same time promoted and shifted sources of livelihoods towards migrant labor.

A growing agriculture and mining industry in South Africa required a constant supply of water throughout the country. Dryland agriculture was constantly affected by erratic seasonal rainfall, and the country had to develop mechanisms to improve the water supply. However, although 1877 can be regarded as the start of modern irrigation in South Africa, the construction of irrigation dams gained momentum in 1912, not only for water security, but to also improve the living conditions of the impoverished settlers' communities by providing them with job opportunities [12,77]. There was heavy rainfall towards the end of the second decade of the 20th century. The volumes of water in the Vaal River were 37 times the normal in 1917–1918 [12].

Southern Africa was dry in the early 20th century, particularly in the 1920s and the 1930s [78]. The global economic recession of the 1920s to 1930s, dubbed the Great Depression, did not only affect the Western economies in isolation, but had significant negative impacts to the mining and agricultural sectors of Southern Africa [79]. Mining outputs declined as a result of reduced demands of minerals, grain requirements fell, and retrenchments were unavoidable. This period was also amongst the driest periods in Southern Africa [78,80]. The rainy conditions that caused the surpluses in 1924 to 1925 and that flooded the Orange River to three times its normal runoff [12] were equivalent to providing a few drops in the vast desert. The Great economic depression of 1929–1934 caused by the collapse of the New York stock exchange, the surpluses of agricultural produce in 1925 to 1928 that deflated commodity prices, a foot-and-mouth epidemic, the closing of some diamond mines, and a crippling drought immediately after the surpluses caused further widespread distresses in the region [81].

4.2. The Consequences of the Drought of the 1930s

The culmination of the recession in the mid-1930s coincided with a severe drought that nearly destroyed half of the national livestock population in Lesotho in 1932–1933 [63,82]. While the flow in the Vaal river was only an eighth of the normal flow, the Orange river downstream did not record any flow for 38 days around November 1933 [12]. As a result

of recurring droughts, the Vaal River became dry over several winters between 1906 and 1935 [12]. The dire fiscal situation that ensued made the government administrators in Southern Africa that were collecting revenue reduce in number, because of reduced collections [58]. This drought is famous for its widespread dust bowls (lerole) that continue to be a reference point for the elderlies who cannot remember their birth years. Large degrees of urbanization that were caused by a migration of black people from cities intensified around 1929, climaxed in the 1930, and continued to the late 1940s [55,83]. Outward migrant labor from the countryside and neighboring countries to the mines and nearby cities in South Africa sharply increased.

Torrential rains experienced on desert lands immediately after the 1932–1933 drought accelerated soil erosion and land degradation in Lesotho [54]. Uncontrolled dongas that formed after these successive extreme climate events grew every moment to what they became to be today. Land degradation in the 1930s was exacerbated by the floods that came a few years later, when the Vaal dam was flooded in 1939 [12]. A severe malaria outbreak struck the neighborhoods of Durban between 1929 and 1933, leaving behind a trail of over 22,000 fatalities, while the epidemic killed more than 9000 people in Transvaal in 1939 [76].

Socio-economic hardships that were brought about by the economic recession of the 1920s and the droughts of the 1930s affected societies and their livelihoods. Rapid urbanization occurred, largely by the black population, and the growth of informal settlements occurred around cities in response to failing livelihood systems in rural areas and the after-effects of the mobilization that was mainly influenced by industrialization in cities, particularly in Johannesburg during World War II [17,84]. There were unsuccessful attempts by the government to prevent job-seekers migrating to urban centers [83].

4.3. Climate and Agricultural Production in the Early 20th Century

Agricultural production in Southern Africa is highly vulnerable to climate variability. The lowest levels of national and commercial production since the use of synthetic fertilizers in the 1950s were in 1952 and 1992 (Figure 2). The production in 1933 was the lowest on record. Many Southern African countries recorded significant maize imports because of this drought [63,70]. Non-commercial systems contribute little to the total maize produced in South Africa. Droughts have the potential to reduce production from high to low levels during consecutive harvests (i.e., 1982 vs. 1983). These production variations caused notable consequences to the history of people in Southern Africa in general, and to their socio-economic conditions. With a continuous decline of tonnes of maize produced per capita in South Africa [85], any negative impacts of weather and climate on grain production in the country can be detrimental to food security. The climate in dryland agricultural systems was always going to continue to be a major limiting factor in the 20th century. It played a significant part in the economic and demographic challenges during the century, which instigated and defined the history of the region. Climate variability also continued to cause disruptions to food security systems and livelihoods.

4.4. Lessons to Learn from the Historical Impacts of Climate Variability in Southern Africa

Historical records show that both inter- and intra-seasonal climate variability have been high in Southern Africa, and recent data indicate that climate in the region is rapidly changing. Historical climate conditions have been confirmed by recent research that has used modern techniques (i.e., [22,39,51]). Poverty-induced migrations have been experienced in other parts of the world, including Europe [66]. Together with governance issues, and weak resilience and adaptive capacity, climate hazards have caused instability in many parts of the world, including Europe and Asia [67]. Unmitigated climate impacts have been shown to influence migrations in many countries in the world [68].

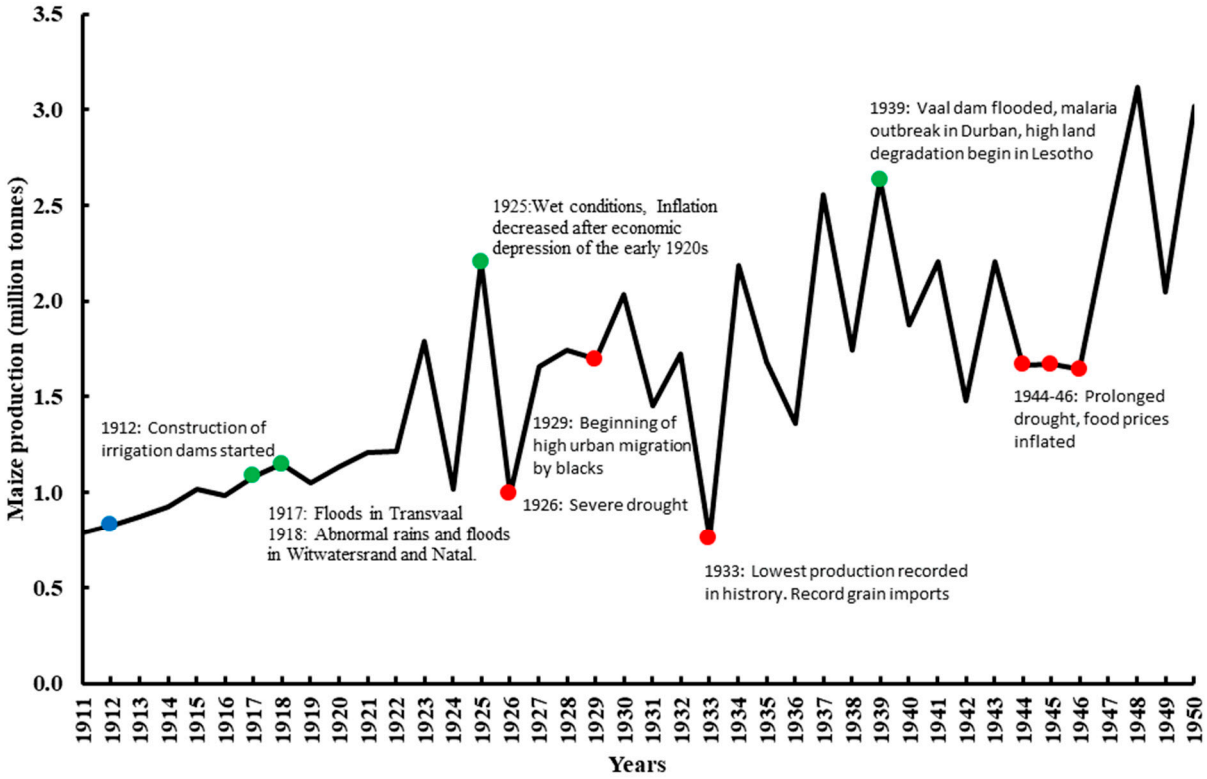

Figure 2. Historical maize production trends in South Africa (Data source: [86]).

It is projected that the changing climate will negatively affect livelihood systems in the region. Although societies in Southern Africa have, with time, declined in their dependence of agriculture, this sector remains the major source of livelihoods in the region, particularly in rural areas that still support the majority of population. Increasing temperatures and more erratic rainfalls are expected to cause failures in agricultural production by reducing yields, and therefore increasing food insecurity [69]. Poverty associated with failures in food production causes migrations, particularly of young people, away from agriculture-based economies to urban areas where the livelihoods of residents are less directly dependent on agriculture [70,71]. To mitigate this out-migration of farming communities from agriculture to other sources of livelihoods in urban centers requires policies that will promote infrastructure and technological investments at the local level [72].

Southern Africa is largely semi-arid and water scarce. Rising temperatures due to climate change will increase water losses through evaporation, thereby exacerbating the situation on the limited available water in the region. As a result, water resources are always vulnerable to climate variability, and the intensifying climate change will increase pressure on water security in the region [73]. Stressed water resources will not only affect the agriculture sector that is responsible for over 60% of the surface water consumption in South Africa [74], but it will also increase the vulnerability of rural communities that already live with poor infrastructure and weak coping mechanisms to climate change [75]. Water scarcity for shared resources will likely cause conflicts amongst communities and nations, as has happened in the past [76].

The health of human beings and livestock can be affected by climate conditions. Climate conditions influence vector-born disease outbreaks and pandemics [77]. As an adaptation measure, it is important that disease surveillances are increased [78]. Diseases can be associated with poverty, which will be highly influenced by the climatic conditions in the future. Poverty is also linked with crime, particularly in poor societies [79]. As a lesson from the historical impacts of climate change, it is important that holistic adaptation measures are developed and implemented to mitigate the negative impacts of climate change that are projected for the future.

5. Conclusions

Climate has had influences in the evolution of the history of Southern Africa. Its ability to determine the suitability of crops that can be grown in a particular region, and the provisions that it can offer to livestock, determined the first patterns of human settlements in Southern Africa. It played a part in the historical conflicts between the African people and the wars that were caused by the settlers from European in the quest for land in the 1800s. Migration from all places in Southern Africa to urban centers to look for mainly non-agricultural jobs in the mines in South Africa were accelerated by extreme weather events that affected agricultural productivity.

The world is faced with unprecedented challenges of anthropogenic climate change. Frequent droughts and floods that will be more intense than any previous episodes are projected to occur in Southern Africa. Famines and hardships will increase as traditional food production systems will fail to cope with the rapid changes. Human traditions and ways of living will have to change. Historical events have shown that the impacts of an erratic climate can cause disturbances and conflicts among communities. Governments will have to develop policies that will assist communities in surviving the fast-coming challenges. Climate change will add yet another layer to already existing socio-economic challenges that governments and their citizens are facing. Without a radical change of course, human life will forever be stretched to the limits of uneasiness.

The historical impacts of climate have influenced the demographic formation of the current Southern Africa. Climate change is widely projected to cause hardships in the future. If not addressed promptly, the impacts of climate change in the coming years may resemble the experiences of the past. Similar to historical times, drought and high intensity rainfall will be common in the future, but with increased frequency. Human lives and livestock will be affected. Governments in Southern Africa will need to have progressive policies and plans to protect their citizens, assets, and ecosystems. Governance systems and appropriate adaptation-based investments in rural communities are important to build. These will improve the resilience of communities and reduce out-migration to cities. Rapid population increases in cities require proportional infrastructure developments that are climate-proofed. The growing destruction of infrastructure and community livelihoods in many developing countries will cause continuing instability into the future.

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