

## **The Impact of Global Warming on The Food Crisis in Africa**

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### **Abstract**

Global warming is the main factor which causes changes in climate and it occurs by release of industrial gases in the atmosphere and increasing the earth temperature. Climate change concerns and its effects on food safety are highly predictable in many regions of the world, involving Africa. Africa's food issue is greatly made worse by global warming, which has an impact on socioeconomic stability, animal health, and agricultural output. The growth of crops is disrupted and the yields of basic crops like maize, wheat, and rice are decreased by rising temperatures and changed precipitation patterns. Infrastructure and agricultural productivity are further threatened by an increase in the frequency and intensity of extreme weather events, such as floods and droughts. Warmer temperatures can increase the range and activity of agricultural pests and diseases, which causes extensive crop loss. Additionally, water scarcity and heat stress affect livestock, which lowers output. These climate-related issues drive up food costs, increase food insecurity, and may lead to migration and resource-related conflict. Climate-resilient crops, better water management, sustainable agricultural practices, and investments and policies that support them are all necessary to mitigate these effects. To improve resilience and guarantee food security in Africa in the face of the persistent danger of global warming, a comprehensive strategy is required.

**Keywords:** Global warming, Climate change, Agricultural productivity

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### **INTRODUCTION**

Global warming is the main factor which causes changes in climate and it occurs by release of industrial gases like methane, carbon dioxide, nitrogen oxides and ozone gases continuously in the atmosphere and increasing the earth temperature (Bagdatli and Belliturk, 2016; Bagdatli and Arslan, 2020; Bagdatli and Can, 2020). Increasing Population is also a significant factor for climate variability will cause many problems for global food supply and several nutritional problems could arise in the nearby future. Water, is the fundamental element, for survival of living beings. Rainfall and precipitation are both sources of water and many life events depends on these factors like living life, Agricultural production, living migration and urbanization (Bagdatli and Arslan, 2019; Elsheikh et al., 2022a).

According to scientists, climate is the air that could modify in the atmosphere, means climate known as collection of different atmospheric actions. Generally, Change in climate means variations in weather for centuries which can be occur naturally or by human actions (Elsheikh et al., 2022b; Bagdatli and Arıkan, 2020). These Global climate changes, can be negatively impacted on different atmospheric areas by emitting carbon dioxide in the air (Bagdatli and Can, 2019).

Global climate change poses a threat to it due to rising carbon emissions and the greenhouse gas impact. One of the fundamental components of life is carbon. However, the protecting impact of the bard layer is diminished and inconsistencies in temperature and precipitation are brought about by the steady increase in CO<sub>2</sub> levels in the atmosphere due to human demands and consumption. Research indicates that there will be a 0.1°C rise in temperature every ten years (Bağdatlı and Arıkan, 2020; Bağdatlı and Ballı, 2020a). Global warming is brought on by an increase in CO<sub>2</sub> and other gases in the atmosphere because of industrial activity. Hydrological catastrophes are accelerated by this warming, and it is anticipated that this will lead to an increase in extreme weather events including droughts and floods as well as climate change (Bağdatli et al., 2022).

Food production and assembly is a serious component which can be effected by changing in climate (Bagdatlı et al., 2023). Another important component is an upsurge in sea-level because of changes in climate, leads to the destruction of forests which are key source of food in many countries (Afreen et al., 2022). Global climatic variability produce open surface evaporation inclines to upsurge in temperatures and precipitation, which are very important factors for living lives, will cause continuing reduction of water assets, endangerment of natural life, and have bad effects on agricultural production. Plants growth also effected by climatic variability, which also involve drought and land degradation leads to less agricultural production (İstanbuluoğlu et al., 2013; Bağdatlı and Ballı, 2019).

## **CLIMATE CHANGE EFFECTS ON AGRICULTURE**

As the world's population approaches 8 billion people, it will become increasingly difficult for humanity to meet the expanding population's food demands. Uncontrolled changes in weather factors like temperature and precipitation have a detrimental impact on agricultural productivity. According to Bağdatli et al. (2015), a few of these detrimental impacts include soil erosion caused by water, changes in pH levels, increased salinity, and nitrogen leaching. Climate change concerns and its influence on food safety are increasingly predictable in numerous regions of the world, involving Africa. Many studies developed that Africa is characterized as the utmost susceptible land to climate changes (Bwalya, 2013; IPCC, 2007; Liliana, 2005; Vogel, 2005; World Bank, 2016). The main observation of that studies was changes in climate have a harsh effect on cultivated land, which eventually disturbs food safety. The Inter-governmental panel on climate change indicates that Southern Africa has greater susceptibility to climate change and expects severe consequences, which employing extensive influences on the people livelihoods (IPCC, 2007).

Conferring to the IPCC (2007), productivity of agriculture will decrease in 2080 from 21% - 9% because of climatic variability in sub Saharan Africa. Agriculture is the major key for economic development in Sub-Saharan Africa, where it contributes more than 40% of the Gross Local Product for utmost countries and hiring more than 50% people in those countries. Additionally, agriculture works as the central base for food safety in the state as the mostly people cultivate their personal food (Barrios et al., 2008).

Foods obtained from Agriculture remain sensitive to climate variability, harshness and occurrence rate of extreme climatic conditions (Wheeler and Von Braun, 2013; Challinor et al., 2007). There are two types of effects occur on agriculture due to changes in climate involve biophysical and socio-economic effects. Biophysical effects comprise changes in quality and quantity on water and land resources; while physiological effects comprise quality and quantity of agricultural crops, pasture, forests, and livestock; augmented challenges of weeds, pests, and diseases (FAO, 2007). The minimum and maximum soil temperature needs of the plants to be farmed should be considered to guarantee optimal agricultural yield. For instance, excessively hot soil temperatures in tropical regions can cause several plant illnesses and excessive water consumption, which can result in plant mortality (Bağdatlı and Ballı, 2020b).

The biophysical effects concerns on changes on production conditions of agricultural crops, production of livestock, and fisheries because of growing temperatures, inconsistency in rainfall patterns, frequency and intensity of other extreme natural events. For instance, the production period of agricultural crops might be influenced by climate change through varying suitability of production situations of agricultural crops and limiting the duration of the production period (Nhemachena et al., 2016). Socio-economic effects due to climate change include several factors like reduced production and yields; reduced GDP of agriculture; improved hunger and risks of food security; variations in trade configuration and systems all through states; instabilities in prices of world foodstuff; and migration conflict (FAO, 2007). These factors affect achievement of maintainable development objectives, mainly those associated to agriculture.

In this article we are discussing about global warming effects on food safety in Africa. Distinct effects of climate change on agriculture food schemes were experienced through many locations on the basis of warming severity and fluctuations in rainfall distribution and patterns, higher intensity and occurrence of floods and droughts (Wheeler and Von Braun, 2013; Olmstead, 2014; Arnell et al., 2011). Additionally, the varying climate intensifies hydrologic variability and water stress particularly in arid and semi-arid and states of Southern Africa (Rosenzweig et al., 2014). From previous studies it was indicated that approximately two-thirds part of Africa's agricultural land is anticipated to be vanished by 2025 due to shortage of rainfall and drought because South Africa is not resistant to these influences (Liliana, 2005). It is assessed that 95 percent land of Africa's agriculture is rain fed which makes it highly susceptible to climate change. The growing frequency of scarcities because of climate change predicted to decrease agricultural yield by up to 50 percent in Africa in 2020 (Dube et al., 2016). It was also identified that the long-lasting trend of increasing temperature produced a negative effect on agricultural production for the long duration (Bağdatlı et al., 2014).

It was found that Southern Africa state would face adverse influences on many major crops like wheat, maize and sugarcane due to augmented warming and reductions in rainfall (Lobell et al., 2008). Cereal crop production is estimated to decrease considerably in countries including Ethiopia, Zimbabwe, Nigeria and Sudan. It is expected that in 2050, yields of crop have fallen through up to 20%, and by means of 2100 crop profits in South Africa are estimated to have fell down up to 90% (Hope, 2006).

It was documented in 2009 by European Commission report that climate variability in Africa will decrease crop productivity and in consequently price of food will increase that would force communities to change consumption and production patterns. Numerous studies have enumerated the direct influence of climate variability on production of agriculture (Asseng et al., 2015) markets (Nelson et al., 2014; Lotze-Campen et al., 2014; Von Lampe et al., 2014) and food security (Baldos and Hertel, 2014; Hasegawa et al., 2014). For instance, a latest model of profitable comparison study on global agricultural (Nelson et al., 2014) establish that upcoming climate variability will decrease yields of major crop by 17%, which automatically will rises market prices up to 20% and lessens consumption up to 3% in 2050, after alteration of production crosswise regions.

## **AGRICULTURAL YIELD AND FOOD SAFETY**

Africa has mostly dependent on agriculture for its economic growth, decreasing poverty, and increasing nutrition and food security (FAO, 2014). Agriculture is controlled by small holders who subsidize up to 90 percent of agricultural yield in the constituency (Brown et al., 2018). There is a solid link among natural ecosystem, climate, and African agriculture. Ecosystem facilities and biodiversity are used as many resolutions for maintainable upsurges in agricultural production in Africa which provides both better products for nutrition and food security and lessen climate externalities (Barrios et al., 2018; Bommarco et al., 2018). Those regions which have advanced level of biodiversity usually are most resistant to environmental variations and enhanced agricultural productivity (Winfree and Kremen, 2009). On contrary if natural ecosystems become destroyed decreases their ability to regulate water accessibility, soil foundation, and nutrient and energy flow (Bommarco et al., 2018; Georg et al., 2018).

Most countries of Africa, being affected by higher temperature and precipitation variation in the constituency. For instance, since 1996 to 2003, a decline in rainfall was observed in most regions of Africa which consequently caused decline in long duration crops like slowly developing varieties of sorghum and maize. Long duration crops rely upon rain throughout this normally wet season and advanced moisture insufficiency results in less crop productivity, thus affecting the obtainable food supply (Funk et al., 2005).

It was stated that most African countries have little adaptive capability, topographical and geographical locations make the constituency extremely susceptible to crop failure because of adverse effects of climate variability (Gebreegziabher et al., 2011; Evangelista et al., 2013). Crop productivity present a strong correspondence with climate variability and by the extent of cold or heat waves and fluctuation depend on plant developing stages throughout extreme weather happenings (Hoffmann, 2013).

Changing pattern of precipitation will increase water scarceness and linked drought stress meant for crops and change irrigation water sources. They also decrease the probability for farmers' future planning (OECD, 2014), indirectly, a variation in moisture and temperature levels might lead to a modification in the immersion level of fertilizers and additional minerals, which regulate yield outcome (Tirado and Cotter, 2010). Some scientists documented that climate variability reduces the productivity of maize, wheat, rice, potatoes, and vegetables and endures to reduce really in the upcoming time period (Ignaciuk and Mason-D'Croze, 2014). It was documented in another study that variations in climate will possibly have a general important impact in decreasing the yield of cotton and sugarcane in Ethiopia (Bayrau et al., 2015).

Africa is the world's 10th major producer of livestock production and their products (MacDonald and Simon, 2011), which create around 10% of the African's foreign currency incomes (Pantuliano and Wekesa, 2008). Recurrent and extreme droughts have a significant influence on Ethiopia's livestock production because reduced rainfall cause shortage of presented water sources and decreases the production of rangeland and grassland. The major reason of livestock demises in Africa are lacks of food and water throughout drought (MacDonald and Simon, 2011). Highest temperatures also could affect the performance and metabolism of livestock, like reduction in consumption of food and a deficiency in productivity (Thornton et al., 2009).

Some scientists highlight, that "climate variation is a universal phenomenon" however people will be pretentious by its local effects. It is a local effect that is precarious in the climate variability dissertation since variation must be suitable to the confined circumstances which have established to fluctuate extensively through geographical areas with some regions gaining benefits whereas others have more vulnerability (Hein et al., 2009). The condition of different regions are given below.

### **West Africa**

Climate variability effects in West Africa seem to usually reflection of what occurs in all other regions of Africa. Scientists commenced an extensive research covering the all regions of West Africa to comprehend the effects of climate variations on agriculture production. West Africa include countries like Burkina Faso, Gambia, Verde, Benin, Cape, Guinea Bissau, Niger, Togo, Mali, Liberia, Sierra Leone, Senegal, Cote D' Ivoire, Ghana and Nigeria. Generally, it was concluded from this study that climate variability poses an excessive danger to agriculture production dependent living beings in the West African states (Jalloh et al., 2013).

According to concepts of universal global warming tendencies, the study developed that growing temperatures would negatively impact the growth of specific crops like sorghum, whereas decreased precipitation is too estimated to deteriorate the situation (Jalloh et al., 2013). Scientists observed many factors which makes West African Agricultural productivity vulnerable to climate variation, from which one is rainfall. For instance, in Ghana, only four percent of potential land is underneath irrigation. Extreme poverty stages also subsidize to a general failure to endow into adaptation processes by farmers (Jalloh et al., 2013).

## **Southern Africa**

Southern African region comprise countries like South Africa, Botswana, Zimbabwe, Mozambique, Malawi, Tanzania, Angola, Namibia, Lesotho and Swaziland. This region is usually proposed to become drier and hotter in the future decades. Additionally, it was already presented that patterns of rainfall would become volatile and unpredictable. Presently rainfall periods have present considerable cyphers of shortening, thus disturbing time periods of cropping (Mubaya et al., 2012). Other predictions involve high level of floods and droughts, decreased farming production and enhanced water scarcity (Shackelton and Shackelton, 2012). Even temperature of soil is also an important factor according to selection of plant for good agricultural production (Bağdatlı and Ballı, 2020). Additionally there is anticipation that wet season will be shortened and variations of rainfall patterns will be increased from one season to another season, and this will be extremely risky for agricultural yield (Mubaya et al., 2012).

## **The Sahel Region**

This is one of the most vulnerable regions, which can be effected by climate variability. The Sahel region comprise nine countries which are situated near to the Sahara desert. These involve Burkina Faso, Guinea Bissau, Mali, Niger, Mauritania, Cape Verde, Chad, Gambia and Senegal. This region have low rainfall and high temperatures, highly dependence of local peoples on rain fed agriculture production, have high population and less adaptive ability (Mohamed, 2011; Hein et al., 2009). Scientists noticed that the effect of climate variability has mostly been undesirable in the Sahel region. They also said that more than 50 percent of the people in this region are working in the agricultural area, and agriculture subsidizes from 35 percent to 60 percent of the state economic outcome. Like other regions of Africa, agriculture in the Sahel region also suffered from many factors like the burden of increasing populations on existing land and declining soil fertility. It was also observed from 1960s that Precipitation also decline due to shortage of rainfall as in other regions of Africa, so more drought has been observed (Sissoko et al., 2011). Reduction in precipitation has serious implications for availability of water and livelihoods in the Sahel region including cropping and livestock raising (Mohamed, 2011).

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