

Impacts of Climate Change on Food Security in Africa

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Abstract: Africa is the region with the lowest total and per capita greenhouse gas emissions in the world, but it bears the brunt of the adverse effects of climate change. Due to its special geographical location, spanning north and south of the equator, Africa has a vast territory, a large population, and a diverse climate, and its economic and social development is relatively lagging behind, especially the low urbanization and industrialization rates, a large agricultural population, and huge inter-regional climate differences. The existing research mainly focuses on the political, economic, geopolitical, and poverty, education, and health aspects of Africa. The research theme of this paper is the impact of climate change on food security in Africa; using the literature research method, we study the impact of climate change situation on food security in Africa; the purpose of the research is to draw the attention of the international community to climate change and food security; increase the attention and support to Africa, so that Africa can become better. The purpose of the study is to draw the attention of the international community to climate change and food security, and to increase the attention and support to Africa so that Africa can better adapt to the impact of climate change.

Keywords: Africa, climate change, food security

1. Introduction

In recent years, due to the influence of abnormal climatic conditions, large-scale famines have occurred in various regions of Africa several times, which has aroused widespread concern of the international community. Due to the special geographical location of Africa, spanning north and south of the equator, with an area of 30.2 million square kilometers and a population of 1.4 billion, tropical desert, savanna, and tropical rainforest climates coexisting, and large inter-regional climate differences, climate change has had serious impacts on agriculture and food security in Africa. The current research topics mainly focus on political, economic and cultural issues as well as geopolitical, educational, health and poverty issues in Africa, and there is a lack of research on the impact of climate change on food security in Africa. This paper analyzes the past and current situation of climate change impact on food security in Africa through literature research method and qualitative method, aiming to draw the attention of the international community to climate change and food security in Africa, and the international community to help Africa develop measures to cope with climate change, increase food production, ensure food security and better maintain global security and stability while increasing aid to Africa.

Studies have shown that climate change has already posed a serious threat to food security in Africa and has had a negative impact on it. If the climate continues to deteriorate, it will further aggravate food shortage and even trigger political, economic and social chain reactions. This paper elaborates on the impact of climate change on food security, climate deterioration exacerbates the risk of food security, and calls for a global response to enhance Africa's capacity to adapt to climate change and guarantee food security.

2. Underlying Cause Affecting Food Security in Africa

Africa has a low degree of urbanization and industrialization, lagging economic and social development, and a weak ability to withstand natural disasters brought about by climate change. Climate change has a huge impact on agriculture and food security in Africa, which is in a natural economy.

2.1. Insufficient Water Resources

Climate change has led to a shortage of water resources in Africa, affecting food production. "With food production systems being among the most vulnerable to climate change, and Africa's food production systems being among the most vulnerable in the world, the risks and challenges posed by climate change to African agriculture will far exceed those of any other region and country or even directly threaten the food security of some African countries." [1] For a long time, many glaciers in Africa have been affected by global warming, and many glaciers in Africa have shrunk in size by melting, reducing surface water and river runoff in some areas, lacking irrigation for crops, and continuing to decline in food production. Studies have shown that glaciers in the tropical highlands of East Africa are receding, river flows in West Africa are becoming lower, and water temperatures in Lake Kariba are rising. "Between 1912 and 2000, the glacier area of Mount Kilimanjaro decreased by 81%, and if the situation continues to deteriorate, glaciers and ice caps will disappear completely." [2] Water shortages have led to dry soils, increased sand and dust, loss of nutrients, and a significant reduction in crop yields to the point where food must rely on imports and international aid to meet needs.

2.2. Uneven Distribution of Precipitation

Africa's plateau of 500 meters to 1000 meters above sea level accounts for more than 60% of the total area, precipitation is more north and less, more west and less east uneven distribution, the most precipitation in the western coastal areas can reach more than 2000 mm per year, the least precipitation in the northern areas of less than 200 mm per year, in extreme drought years or even no rain all year. The African continent has a large area of deserts and desertification, with evaporation greater than precipitation in some regions, and 31% of the land is threatened by desertification. "Between the 1990s and 2000, 1,374 square miles of land in Africa became desert each year." [3] "Precipitation in the Congo Basin and along the Gulf of Guinea averages 2,000 mm per year, with a significant decrease in summer precipitation in the Sahel and an average of more than 300 dry days per year." [4] Huge differences in precipitation, drought in the north and flooding in the south.

2.3. Persistent High Temperature and Drought

Africa has high temperatures and dry climate, and about 3/5 of the area belongs to semi-arid and arid zones. According to studies, the average warming rate in Africa between 1991 and 2021 is about +0.3°C/decade, which is faster than the warming rate from 1961 to 1990, when it was +0.2°C/decade. Over the past 50-100 years, surface temperatures have increased by at least 0.5°C over most of Africa."

[5] “The frequency of droughts in East Africa has increased significantly, with the Horn of Africa experiencing an exceptional drought in 2011, with precipitation ranging from only 5% to 50% of normal years.” [6] Studies have shown that rising global temperatures have caused food production in Africa to decline by 1% to 5% per decade over the past 30 years, and rising temperatures may also cause disruptions in the growth cycle of agricultural commodities, causing cereals, maize, and other crops in the tropics to plummet in yield. By mid-century, a 2°C increase in average temperature is expected to reduce agricultural yields in Africa by 20% [7].

2.4. Multi-hazard Interactions

Sea levels along the African coast are rising faster than the global average, especially along the Red Sea and Southwest Indian Ocean, at rates approaching 4 mm/year, eroding land and salinizing land. Between 108 and 116 million people in Africa are projected to be threatened by sea level rise by 2030. Drought in East Africa continues to worsen, leaving nearly 60 million people in a state of severe food insecurity; South Sudan, Nigeria, the Republic of Congo, the Democratic Republic of Congo, Burundi and other countries in West Africa suffer from severe flooding and food deficits; Tunisia, Algeria, Morocco and Libya in North Africa continue to suffer from high temperatures and low rainfall, wildfires and sand and dust, affecting food production.

3. Increased Food Security Risks Due to Climate Change

Africa’s agricultural infrastructure is backward, the penetration rate of agricultural technology is not high, and the ability to withstand natural disasters is weak. According to a report released by the UN Food and Agriculture Organization, sub-Saharan Africa has the highest rate of population malnutrition, with 2/3 of the total population suffering from hunger, and 20 of the 30 countries in the world in urgent need of food aid [8]. According to a warning issued by the World Food Program, about 13 million people in northeastern Africa, such as Djibouti, Ethiopia, Eritrea and Somalia, face the threat of severe hunger. 300,000 people will die from food shortages in 2022, and Africa is expected to add 32 million hungry people by 2030, with severe climate stress being the main cause of this situation.

3.1. Reduced Food Production

The latest report from the World Meteorological Organization states that water stress and hazards such as droughts and devastating floods are hitting African communities, economies and ecosystems hard; climate change is disrupting Africa’s precipitation zones and rainfall seasons, shrinking and drying up major lakes and rivers, severely affecting agricultural production and causing significant reductions in food production. In 2020, the World Food Programme’s Global Hotspots Report noted that 10 of the world’s 15 “hotspots” where food security is deteriorating and needs urgent attention are located in The African continent. In the first half of 2020 alone, Africa is expected to have millions of people in need of emergency food assistance, and about a quarter of its 1.4 billion people are undernourished. Climate change is reducing food production, but population growth is not slowing down. Africa’s population is expected to reach 2.5 billion by 2050, with population growth far outpacing the increase in food production, and food security will face even more serious challenges.

3.2. Frequent Pest Infestations

Warming, environmental degradation, over-cultivation, coupled with insufficient pesticides and other chemical pesticides, locusts, grassland moths, stick insects and other pests have posed a serious threat to Africa’s food supply and production. In recent years, severe desert locust invasion disasters have

occurred in many parts of Africa, exposing about 19 million people to serious food insecurity risks; data from the Center for Applied Biosciences International (CABI) in the UK show that in just two years, grassland moths have invaded 3/4 of Africa. The pest infestation has made Africa's already fragile food security more dangerous, and the food crisis has even evolved into political, economic and social problems, affecting global peace and security. The Food and Agriculture Organization of the United Nations launched a \$76 million fundraising program, hoping to use the power of the international community to help Africa to resist the locust plague, through the food security crisis. It is estimated that by 2050, climate impacts could cost African countries \$50 billion a year.

3.3. Lack of Food Purchasing Power

The deteriorating climate environment is one of the main causes of poverty, and poverty makes food consumption power insufficient. The impact of global warming on Africa is inevitable. 17 October 2022, the United Nations Development Programme (UNDP) released online the Global Multidimensional Poverty Index 2022, covering 111 developing countries with approximately 1.2 billion people living in poverty out of 6.1 billion people, or 19.1% of the total population of developing countries, and nearly half of them are children. In 17 November 2022, the UN World Population Prospects Report 2022 announced that the global population surpassed 8 billion, but absolute poverty increased by 93 million, and the poor have little purchasing power and declining consumption of food. The report highlights the severity and scale of the current challenges and the destruction of the environment for survival and development, with the cascading and intertwined crises having a cascading effect on human food and nutrition, health, education, environment, and peace and security conditions. The comparison reveals a high degree of overlap between the maps of climatic anomalies, areas of reduced food production, areas of concentrated poverty and areas of political unrest in Africa, indicating that climate change, food security, poverty and political stability are highly interrelated.

4. Tackling Climate Change Together

Climate change is having an impact on food security systems, making Africa, which already has a weak agricultural base, more vulnerable and inefficient. Food security in Africa is not only a matter of survival for the African people, but also a global humanitarian crisis. As globalization continues to intensify, there is a clear tendency for local crises to spread globally, and a crisis in one region can easily trigger a global change, affecting world security and stability.

4.1. Focus on Climate Change

The Copenhagen Accord of 2009 set for the first time the specific amount of funds that developed countries will provide for climate change adaptation and mitigation in developing countries. Paragraph 6 of the Paris Agreement states, "the Parties recognize the importance of supporting adaptation efforts and international cooperation in the direction of adaptation efforts, and the need to take into account the needs of developing country Parties, in particular those that are particularly vulnerable to the adverse effects of climate change." To implement the Paris Agreement's goal on adaptation, in October 2018, the Global Adaptation Council was established in The Hague, Netherlands and released the report *Adapt Now: a call for global leadership for climate resilience* stating that global agricultural output will decline by 30% by 2050 if adaptation measures are not taken soon. Adaptation to climate change involves many areas such as humane, environmental, economic and social, and legal, "so to finally address adaptation to climate change, its importance in the political sphere must be elevated and integrated into mainstream decision-making for economic

and social development.” [9] The climate change challenges faced by African countries and their own capacity constraints are the main objects of practice advocated by the international community.

4.2. Strengthen International Cooperation

In the face of climate change and food crisis, Africa alone can hardly solve the problem, and must rely on the assistance and support of the international community to carry out transnational and cross-sectoral collaborative cooperation and jointly find countermeasures. WFP and FAO have already cooperated with the agricultural sector in Zimbabwe to promote drought-tolerant small grain cereal cultivation and improve the resilience of affected small farming households to climate change risks, Ethiopia, Zambia, and Senegal; Ethiopia’s Productive Safety Net Program; and Senegal’s preparations to develop rice cultivation and increase food yields, among others.

4.3. Multiple Measures to Strengthen Agriculture

In the long run, aid will lead to a more insecure, unsustainable and uncertain dependence, and the ultimate solution to food security must be to improve the capacity to cope with climate change through our own efforts, rather than simply relying on relief or aid. The first measure is to support agricultural production, promote the application of new agricultural technologies, build agricultural infrastructure, and establish integrated networks for irrigation, transportation and storage; the second measure is to expand industrial production of fertilizers and pesticides, and develop policies on education, scientific research, and credit services; the third measure is to improve agricultural support policies and financial policies, improve the food distribution network system, stabilize food markets, and combine production and marketing, land and market; the fourth measure is to pay attention to synchronizing population growth with food production to ease food supply conflicts; the fifth measure is to perform the land distribution system to release agricultural productivity. African countries should take strong policy measures as soon as possible to build their own food security system, get rid of their dependence on aid, and not let food problems turn into social problems and political crises.

5. Conclusion

The above studies show that the impact of climate change on food security in Africa is becoming more and more serious and has a tendency to continue to deteriorate, becoming a major factor of political, economic and social instability in Africa. It is urgent to increase the capacity to cope with climate change and enhance food security, which requires global attention and vigilance.

The research in this paper has some limitations, and the comprehensive use of other research methods as well as data and information is not enough. The literature is limited to climate data such as temperature, precipitation, and drought, and there is a lack of research on deeper variables such as the atmosphere, soil, sunshine, and the Earth’s climate cycle. There are still some differences of opinion between different researchers and the application of research methods, especially the prediction of future climate change, how to adapt to climate change, and the spread of science and technology, and even the impact of political and economic factors are not accurate. Climate change and food security is a comprehensive, complex, and changing issue, and the evaluation process is limited and influenced by many factors, and there is still a large uncertainty in its results. Future research will apply comprehensive research methods, consider more influencing factors and climate variables, and explore more efficient and feasible measures in line with the regional characteristics of Africa, so as to better cope with the profound impact of climate change on food security in Africa and improve the response capacity.

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