

# Climate Change and its Impacts on Access to Water in Africa



## Introduction

Climatic and demographic changes as well as their repercussions on the sustainability of water resources and its developmental aspirations have sharply increased, especially since (1991). The temperature has risen by 0.86 degrees Celsius over the average temperature before (2010), and this increase continued until (2020) became among the three hottest years. Its repercussions have escalated until the African per capita share of water dropped by (4,000) m<sup>3</sup> annually, compared to (9,000, 24,000) m<sup>3</sup> annually for its European and North American counterparts. This threatens that more than (118) million will suffer extreme poverty, drought, and severe floods in Africa and that (3%) of the GDP in sub-Saharan Africa will be lost by (2050). This even aggravates with the increase in the demographics estimated at (1.4) billion people and are expected to reach (2.5, 4.5) billion people by (2050, 2100). In this context, this paper monitors and analyzes the impact of climate changes on access to water in Africa by mapping water resources. It also monitors climate changes in Africa, especially in Egypt, Sudan, Eritrea, Djibouti, Congo, Somali, and Lake Chad, and concludes with a set of recommendations.

## First: the map of water resources in Africa:

Africa has many water resources, including huge rivers, huge lakes, great dams, and widespread groundwater aquifers, feeding mainly on precipitation estimated at (20,215) m<sup>3</sup> annually, from which flows approximately (5000) km<sup>2</sup>, constituting (9%) of the world's water. Therefore, Africa is the fifth continent in terms of water resources. It shall meet the needs of (9) billion people if these rain capabilities are fully utilized, especially in Ethiopia. The abundance of rain is increasing in Ethiopia, to meet the needs of (520) million people, and Kenya, where it meets its needs (6) times its population.

In context of monitoring the map of African water supplies, the Dark Continent has about 17 great rivers in the world, topped by the Nile River, Congo, Niger, Senegal, and the Zambezi, along with (160) fresh lakes, including the second largest lake in the world by area, which is Victoria, and the second largest lake in the world in depth and water, which is Tanganyika, and the largest inland marine basin in the world, Lake Chad. Africa also contains some of the largest hydroelectric dams in the world, such as the Cahora Bassa Dam in Mozambique, the High Dam in Egypt, the GERD in Ethiopia, the Voita and Kariba dams. In addition to its supply of groundwater, this is 15% of the water resources in Africa. It is a major source of drinking water







# Nile for peace Initiative

for nearly 75% of the population of Africa in the north and south of the continent<sup>1</sup>. Those supplies estimated by the Research and geological studies on February 16 (2020) that huge water reserves, the largest part in North Africa, especially Egypt, Sudan, Libya, and Algeria, at an estimated depth of about (250:100) meters below the surface of the earth<sup>2</sup>.

Annual flow rate (billion cubic km)	river length (km)	The area of the basin in km2	rivers
1350	4700	396.0000	Congo
84	6670	300.7000	Nile
263	4160	209.2000	Niger
500	2574	1.390.000	Zambezi
-	1633	1430	Senegal

Source :World Bank 2020: African rivers flow rate

water (km3)	volume	depth (m)	Area (km2)	Natural lakes
	2750	84	68.800	Victoria
	17800	1471	32000	Tanganyika
	7725	706	30900	Malawi
	72	11	18000	Chad
	203.6	109	6405	Turkana
	132	58	5300	Albert

<sup>1</sup> UNEP, Africa water atlas, division of early warning and Assessments (Nairobi, \_\_,2017), p70.

<sup>2</sup> Murray lark, Alan mac Donald, mapping groundwater recharge in Africa from observation and implication for water security, vol16, 16 February 2021,p12.





**Source, World Bank 2020: African Key Lakes**

## Second: climatic changes and their water repercussions in Africa

Climate change has been accelerating in Africa since (1991). The temperature has risen by 0.86 degrees Celsius over the average temperature before (2010), and this increase continued until (2020) became among the three hottest years. Its humanitarian, development, and water repercussions are increasing; it caused the rainy and climatic systems in their two forms: underground and surface to unequal distributions, and determined the degree of its dryness, and made Africa include several different rain systems by their locations: astronomical, geographical, and nature: topographical and topographical of the continent, and its climatic, and in the forefront of which comes the tropical and subtropical system, desert, seasonal rainy in summer, and the rainy Mediterranean in winter. It is in central Africa (51%), Western Africa (23%), Southern Africa (12.5%), Eastern Africa (4.7%), and Northern Africa (2.9%). The Congo River basin is unique by 30% of the total water resources, although it includes 10% of the continent's population and leaves (50%) distributed among ten different rivers. Abundant water reserves in the Great Lakes in East Africa.

Africa becomes the second-largest depleted continent, especially in countries such as Libya, Morocco, Algeria, Sudan, and Somalia in northern and northeastern regions, and countries such as Burkina Faso, Zimbabwe, Cape Verde, Ghana, Nigeria, and Togo in their western fringes, and South Africa. United Nations figures indicate that there are (14) African countries suffering from water scarcity, and (11) countries will join them by (2025). Moreover, 50 (%) of the African population will suffer from water scarcity, that is about 1.45 billion people. The water supplies of Africa are shrinking, like Lake Chad, which lost (90%) of its water in 38 years, due to drought, desertification, and lack of management<sup>3</sup>.

### African Water Resources Statistics (Source, World Bank)

<sup>3</sup> Ilyas Masih Patricia Trambauer,,A Review of droughts in African continent : A geospatial and long term perspective ,"Hydrology and earth system science", April 2014, p3643.





%total water resources	total water resources BCM	African regions
50.6%	2858.08	Central Africa
4.6%	262.04	East Africa
6.1%	345.095	Indian Ocean Islands
2.9%	168.66	North Africa
12.2%	691.35	South Africa
23.3%	1315.28	West Africa
100%	5.641.36	Total Africa

By doing so, climate changes are intensifying in Africa and recording a sharp decline in water resources, especially in light of the increasing population, estimated at 1.4 billion in (2019). The lack of safe and insufficient access to water interacts with the increasing demographics and climate, security, political, economic, and developmental changes in Africa. The impact of climate changes on access to water can be as follows:

## 1. Single access to water:

The average per capita share is low by (4,000) by (4,000) compared to (9,000) for its counterpart in Europe and (24,000) for its counterpart in North America, lower than the estimates of the water poverty line. Its minimum limits are (500) mm<sup>3</sup> in (Egypt, Morocco, Algeria) and Libya) in the north of the continent and (Kenya, Somalia, and Eritrea) in the east. It is most evident in Sub-Saharan Africa, which contains 50% of the world's population without the right to secure, sustainable, and full access to water in the world. 3.36 million Children and 13.5 million females spend more than (30) minutes, respectively, to access water, an internationally estimated limit of 40 billion hours annually in collecting water. It's about (51%) of the population of sub-Saharan Africa lacks safe drinking water, amounting to (4.00) million people in (2019). Only (24) of the African continent population had access to safe water and (28%) to sanitation facilities in (2019).

## 2. Humanitarian access to water:

Concerns are increasing about the climatic situation in the Dark Continent, its infrastructure, and alarming phenomenon such as drought, scarcity, and pollution. 2/3 of the population of





sub-Saharan Africa depends on surface water found in rivers, lakes, and wetlands, where pollution and water hazards are high. It has now recorded 50% of the world's population who do not have safe water and 115 Africans are killed with it every hour because of the spread of water-related diseases. Contaminated water contributes to (40%) of the burden of health and fatal diseases such as diarrhea, malaria, and cholera, and diarrhea alone contributes to killing 502,000 annually, including 315,000 children. And 54% of African hospitals are deprived of access to water and its services, and (66%) of schools lack water needs and services in sub-Saharan Africa. The Nigerian contexts recorded coverage of (36%) of the schools' water needs, with (44%) of them in urban schools and (14%) in rural schools. The contexts of Cameroon, Benin, and Senegal recorded coverage of no less than (30%) of the water needs of schools. That resulted in the lack of water and sanitation services for 244 million children in sub-Saharan Africa.

The rates of meeting basic household needs of drinking and food, estimated at (9%) of the total water resources, remain low, (65%) in favor of urban areas, and (25%) in rural areas. The figures indicate that (650) people die daily due to dehydration; most are children under five. About (51%) of the population of sub-Saharan countries lacks a drinking water supply, and (40%) of them lack clean water. There are at least (6) water-related diseases that more than half of the African continent population suffer; 10 thousand people were infected with cholera in the south of the continent in (2001), according to a report by the World Health Organization.

Reports show that more than (523) million people will not have access to water by (2025). That is ominous in light of the United Nations' expectations of an acceleration of the population of the African continent to reach 2.5 billion people by (2050) and (4.5) billion people by 2100, in conjunction with the expectations of climate change and solutions to drought and water scarcity, especially in North, East and West Africa<sup>4</sup>.

### 3. Economic access to water:

Climate change is one of the economic and development challenges in Africa. It threatens the present and the future of sustainable development and its strategies in various sectors because water is essential in all economic sectors' requirements; agricultural, industrial and commercial.

---

<sup>4</sup>Economic commission for Africa water, the Africa water vision for 2025: Equitable and sustainable use of water (Adis Ababa, \_\_, 2020)





Drought and desertification contributed to the erosion of (65%) of the agricultural land on the continent since 1950 and agricultural production is declining at an accelerated rate. It decreased in Zimbabwe from (1991: 1990) by 45%. The drought periods between (1991 and 2001) led to economic losses estimated at 2.5 billion dollars in Kenya. The Horn of Africa is suffering from droughts that threaten the lives of (230) million people and threaten its agricultural sector; it is estimated at (80%). Similar to the drought waves in the nineties of the twentieth century, and at the beginning of the second decade of the twenty-first century, similar to the situation in (Kina, Somalia, Tanzania, and Eritrea), in Ethiopia, the economic drought losses are estimated at (130) million dollars annually, according to the Environment Development Report<sup>5</sup>. Which is still threatens (2/3) of agricultural lands by (2025), and it is estimated at (35%) of GDP and (40%) of exports and its absorptive capacities are about (70%) of African labor, especially in the agricultural sectors consumed about (85%) of the total water resources, and (95%) of the rainwater as the main activity<sup>6</sup>.

As for the industrial sectors and power generation, the rates of water fulfillment in Africa in support of the industrial sector are poor, estimated at (6%). It is not sufficient to support the industrial sector and its manufacturing requirements, equipment cooling, steam, and power generation. Where water supports hydroelectric power by (2%), and the power generation capacity in sub-Saharan Africa is only about (68) gigawatts. The rate of access to electricity in Africa is low; Where it averages about (20%) of the population. Food security and the water situation in Africa, both quantitatively and qualitatively, led to a decline in food security indicators, such as non-potable water in (South Africa and Libya). As well as the lack of water in sub-Saharan countries: quantity and quality deteriorate the health situation and food safety, according to the report of the "FAO" in 2011, as well as water provide limited quantities for other uses such as fishing, tourism, and transportation<sup>7</sup>.

## Fourth: Models of the Impact of Climate Change on Water in Africa

<sup>5</sup> Michael McClain, balancing water resources development and environmental sustainability in Africa: A review of recent research and finding and applications," the royal swedish academy of science", 14 December 2012.

<sup>6</sup> Tony Allan martin Keurltz, hand book of land water in grabs in Africa: foreign direct investment and food ,water security, European journal of development, vol 25,2013, p844-842

<sup>7</sup> Kumbukani Nyirenda, Emmanuel Vellemu, unlookyng water issues towards food and security in Africa, December 2019, <https://bit.ly/3tcdwhn>





Africa has clear models of climate change and its impacts on Africa, including:

## 1. Sudanese Model

Sudan is suffering from climate change, especially in light of the effects of the Grand Ethiopian Renaissance Dam and unilateral policies, especially in light of its lack of water infrastructure and the possibility of delivering it to homes, the emergence of the State of South Sudan and its water projects and the scarcity of rainfall in the north relative to its south; and its separation and acquisition of most of the rainfall in the south, according to the Sudanese Ministry of Irrigation, and the arrival of 80% of the total water resources in Sudan from outside the borders from the upstream countries, estimated at 18.5 billion cubic meters, and 20% of the internal rain. This can be interpreted in the effects resulting from the policies of the first unilateral filling in July 2020, which led to the confusion of Sudanese dams and the removal of water stations from work, which made thirst and drought hang over Sudan; On July 15, 2020, Sudan announced a decrease in water levels in the Blue Nile River, equivalent to 90 million cubic meters per day; To confirm the closure of the gates of the Renaissance Dam for the first storage; A regression was detected at the El-Dim station on the border with Ethiopia<sup>8</sup>, and on July 19, 2020, it was announced a sudden decline in the Nile waters and its discharge, and the water stations in Khartoum were out of service.<sup>9</sup>

## 2. Egyptian Model

Climate changes in Egypt are so severe that they are considered a model for climate changes and are more vulnerable to fluctuations in economic, social and environmental sustainability, which would affect poverty reduction strategies, especially in coastal areas; where 15% of the total population of Egypt lives, and expectations are increasing about the exposure of coastal areas in the Nile Delta as a result of sea level rise, as expectations indicate that sea level rise by about 0.5 m will lead to the flooding and flooding of 1.800 km<sup>2</sup> of agricultural land. In the delta, the increase in salinity, and its rise by 1 meter may threaten 1/3 of agricultural land, not to mention its effects on water resources and economic capabilities.

---

<sup>8</sup> <https://bit.ly/3qmH8xd>.

<sup>9</sup> <https://bit.ly/3HmFmU3>





In this context, climate changes in light of the GERD portend severe repercussions and effects. The GERD causes a decrease in historical water rights and their quantitative and qualitative balances at a rate of 13: 25 billion m<sup>3</sup> annually, without estimates of water losses out of 86 billion m<sup>3</sup>, divided by about 55.5, and 18.5 billion m<sup>3</sup> between the downstream countries: Egypt and Sudan, which It meets their water needs by about 97%: 80% in succession, and these effects escalate in light of the estimation of its water needs at about 114 m<sup>3</sup> and the increase of its population structure estimated at 116: 192 by 2025: 2050, and its increasing dependence on water the Nile River meets its needs at all levels by 97%; It supplies it with about 55.5 billion m<sup>3</sup>, which is estimated at 72.62 of its total available water resources, in addition to its subsidiary water sources, which are: agricultural drainage water, groundwater, sewage, rain, and torrential rains, estimated 14.5%, 9.8%, 1.7%, 1.12%, 0.17%, respectively, not to mention the low per capita share of water from the ancient Egyptian water abundance between 1947: 1960, and the water sufficiency limit in the period 1970: 1986; After that, it fell below the water safety and poverty lines, starting in 1996; It will reach 550 mm<sup>3</sup> in 2021, and 400, 249 by 2025: 2050.<sup>10</sup>

### 3. Djibouti model

The Djibouti government has developed many policies and initiatives to adapt to climate change, including: the submission of the second national communication in 2014, the submission of the national contribution to the United Nations Convention on Climate Change 2016, and the Prodermo Rural Development Project for the period 2012: 2019 in cooperation With International Development Foundation (IDA) that will repair 116 water access points, save 2 million m<sup>3</sup>, expand irrigation areas to about 84 hectares and distribute small irrigation kits to 50 parks to support private companies.<sup>11</sup>

However, Djibouti still suffers, like other countries in eastern Africa, from drought and water scarcity. In 2018 it was exposed to the hot tropical cyclone "Sagar", which affected 150,000 people. The average rainfall is about 150 mm annually, fresh water flows are absent,

<sup>10</sup> <https://bit.ly/3yUKZuo> .

<sup>11</sup> Mohamed Medouar, for pastoral communities in Djibouti, effective management of water and agro-pastoral resources build resilience from climate shocks, APRIL 22, 2021. Available at: <https://blogs.worldbank.org/water/pastoral-communities-djibouti-effective-management-water-and-agro-pastoral-resources-build>



and the rate of withdrawal of fresh water increased by about 6.3% in favor of 184%, zero, 16 % for the domestic, industrial and agricultural sectors, respectively, and the lack of sewage treatment 0%<sup>12</sup>, which would affect all levels, especially agricultural, estimated at 0.4% of arable lands of the total area of Djibouti.<sup>13</sup>

## 4. Eritrean model:

Eritrea is still under the brunt of climatic changes and drought like other counterparts in the Horn and East Africa; It rains averages between 16: 20 inches of rain annually, and about 80.7% of the population in Eritrea lacks the right to basic water services, especially in rural areas; where about 80% of the population lives, and only 48.6% has access to water; This would have severe repercussions on all levels of humanity, life, economics, and health. This threatens the agricultural sector and its development contributions, estimated at 12% of GDP and 80% of employment, as well as the health sector. Diarrheal disease has become one of the main causes of death, and the educational sector, where 50% of Eritrean schools and health facilities lack clean water.

## 5. Somalian Model

The Somali Government is making outstanding efforts to combat climate change; It submitted its first national contributions in November 2015, the Somalia National Climate Change Policy 2020, the Energy Master Plan 2019, the National Adaptation Action Program 2013, the National Environmental Management Act 2020, and the National Policy Disaster Management 2018, the Strategic Plan for Water Resources Development 2019: 2023 and its goals in July 2021 to reduce greenhouse gas emissions by 30%, with a value of 6.96 billion dollars. Nevertheless, climate change remains one of the growing and growing challenges in the world. Somali contexts by virtue of its geographical location extending into the Horn of Africa; It includes 80% of arid and semi-arid lands compared to 1.6% of the agricultural land area, and 69% permanent pastures, and it witnesses a gradual and continuous increase in temperatures for the period 1991: 2013 between 30: 40 degrees, with its forecast to rise by about 3.2: 4.3 degrees Celsius by 2080, making Somalia uninhabitable, and exposing it to more than 30

<sup>12</sup> PURE Aqua, Reverse Osmosis & Water Treatment in Djibouti, access date 8 December 2021, <https://bit.ly/3Gpl6iH>

<sup>13</sup> <https://bit.ly/3DKN87D>



threats and dangers by 12 cases of drought, and 19 floods during the period (1990: November. 2021).

Climate changes in Somalia carry severe water impacts; it threatens agricultural activities and livestock and their development contributions, estimated at 70% of the GDP, and their economic and life contributions to 60% of Somalis, especially in rural areas, due to their combination with a number of Somali political, security, social, health and cultural challenges. It was monitored that 80% of Somalis suffered from drought and its moderate and severe levels in April 2021, and only about 3 million were displaced during the period from 2016: 2021, which escalated to its peak in 2020 by One million people were displaced, and 112,000 were displaced due to drought during the period January: March 2021, and 11,000 families were displaced from the center of Shabelle due to the floods in “Jowhar” and “Mahadi” during the period May 2021 and August 2021, and 11,000 families were displaced due to Flash floods in Jowhar and Mahadi from central Shabelle, monitoring 2.8 million who are unable to meet the daily food needs due to the drought and its protracted effects, including 840.00 children under the age of 5, and 50% of Somalis who can only access the basic water supplies And the suffering and deprivation of 70% of the Somali family from safe, complete and sustainable access to safe drinking water, according to survey statistics for more than 630 families in 18 Somali regions in 2021. 8,200 families in Afmadow and the surrounding villages in Jubaland state, and the needs of 113,160 individuals in the southwestern state.

## 6. Democratic Republic of the Congo model:

Climate change is still increasing to the extent of its classification 12 out of 188 countries in the list of most vulnerable to climate changes, and 5 in the list of least prepared for them, and climate change expectations are rising about increasing drought episodes by about 100% during the rainy seasons and an increase in temperature between 2:3 Celsius by 2050. ; Thus, climate changes represent major and additional pressures and challenges for the Democratic Republic of the Congo and its development endeavors. Climate changes threaten the right to development and decent standards of living by harming agricultural activities and their development contributions, estimated at 30% of GDP, 70% of employment, meeting the needs of 90% of their population, especially in rural areas, and increasing Food insecurity rates estimated at 26.2 million people, including 3.3 million children from acute malnutrition, increased humanitarian needs, which were monitored by more than 15.64 million people, and







the displacement and displacement of more than 5.2 million people displaced by natural disasters armed conflicts according to statistics 2020; The most evident matter in the rains that occurred during October, November, December, 2019; It caused floods in 16 out of 26 provinces, and contributed to the damage of more than 923,000, and its counterpart in 2021 in eastern Democratic Republic of the Congo affected up to 13,600 families, and destroyed 4,240 houses. The destruction of 100 schools and the deprivation of 396,000 students from school in Tanganyika province. In addition to what led to the volcanic eruptions in Mount Nyiragongo - the most dangerous volcano in Africa - which deprived 500,000 people of access to drinking water; As the main Goma reservoir and the pipelines were damaged, 400,000 people were displaced, and about 3,500 houses were destroyed. And 31 people were killed on May 22, 2021.

## 7. Lake Chad Model:

Climate changes are escalating and looming in the horizons of the Lake Chad basin and its states 4: Chad, Cameroon, Niger and Nigeria, and in combination with the security, political and economic changes in those countries, the lake has shrunk by 90% only during the period 1963: 2001 from 25,000 km<sup>2</sup> of water. over 1,500 km<sup>2</sup>, accelerating the pace of competition over water resources, leaving more than 17 million people in areas affected by violence, conflict, extreme poverty and climate change, lacking 10 million emergency humanitarian aid, and suffering (3.6) million cases of food insecurity and deprivation 49 million livelihood opportunities from fishing, agriculture and livestock, and each of Cameroon, Nigeria and Niger owning only 25% of the total malaria infections in the world, and fears continue in light of the expected disappearance of the lake within the next 20 years.

## Recommendations

Having reviewed and analyzed the impact of climate change in Africa, a set of recommendations can be presented as follows:

1. The African States must jointly seek to develop a coordinated plan and vision among the countries of the continent to respond to and adapt to climate change and the consequences of drought, water scarcity, population surge pressures and increasing water needs, by maximizing the use of water resources, increasing access to control, effective water governance and governance, enhancing access to groundwater and coordinating cooperative efforts to prevent the effects of climate change and droughts.



2. The need for African States to activate existing water diplomacy in line with the 1997 United Nations Convention on Rivers and its principles, in particular equitable and reasonable utilization, non-physical damage, cooperation and investment by river States in the prevention, management and resolution of water disputes and conflicts, the promotion of cooperation, the building of mutual trust and the expansion of dialogue and understanding among African States;
3. The need to provide the practical and effective legal regime agreed upon by African States and taking into account the water and development needs of African States through the drafting of a regional African convention for African States.
4. The need for African States to develop a financing plan to increase the capacity of water security infrastructure in urban and rural areas through irrigation and sanitation projects, the drying of marshes, the removal of plant dams, the regulation of ecosystems and the reduction of their risks.
5. African States are intensifying their efforts to establish a regional organization of African States for the management of African water resources with financial and administrative capacity that will enable them to present coherent policies, take action and respond to water security challenges and emergencies.
6. The need for African States to move towards the settlement of aquaculture and intelligent water governance and to strive for the integration of energy sources, water integration and increased infrastructure investments.

Nile For Peace Initiative