

## Study of effects of climatic changes on the Nile River Basin (African Countries) and Egyptian water

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### ABSTRACT

The study mainly aimed at study the effects of climatic changes on the Nile Valley African Countries and on Egyptian freshwater through achieving the following sub-objectives: (1) to learn about the concepts and definitions of climate changes and global warming, and the reasons that led to them. (2) Studying the effects of climate change and global warming on the Nile Valley African Countries and on Egyptian water resources. (3) Studying the effects of climatic changes on the Egyptian coastal beaches. (4) A study For economic integration between Egypt and the Nile Valley African Countries.

The most important findings of the study were strengthening the implementation of the multi-hazard early warning system: it is an important mechanism for collecting and analyzing information on the various risks and threats associated with climate change, and working to nominate the best possible and potential paths to deal with them efficiently, accelerating the establishment and activation of national frameworks for climate services: which is contributes to enhancing the involvement of various stakeholders and will develop and distribute climate services to support government policies and strategies to deal with climate change.

Adopting a practical approach to climate adaptation in Africa: It includes strengthening the capacity of African countries with regard to

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climate analysis and providing climate services through the relevant national institutions, identifying and selecting priorities for climate action, and formulating and implementing national climate-related policies, including the most climate-sensitive goals of the sustainable development goals, Availability of financial support from the international community: It is necessary to enhance the ability of countries to fully implement the contributions set for them at the national level, This support can be achieved through several sources, perhaps including capacity building, technology transfer, grants and soft loans, Developing new varieties of agricultural crops that bear high temperature, salinity and drought, which are the conditions that will prevail under conditions of climatic changes, developing new varieties whose growing season is short to reduce the necessary water needs for them, changing planting dates to suit new weather conditions, as well as cultivating suitable varieties in appropriate climatic regions. It has to increase the crop yield per unit water for each crop, and to move in three parallel paths:

1. It is represented in the national track by adopting relevant national plans and policies, whether by adapting to climate change or mitigating the risks and threats inherent to it.
  2. It lies in adopting joint arrangements and policies based on environmental coordination to reduce the risks of climate change.
  3. It consists of supporting the various international frameworks concerned with combating climate change and enhancing coordination with various international parties in this regard.
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## **Introduction**

The issue of climate change and the unprecedented rise in global temperatures, its expected repercussions on global economies, and gaseous emissions resulting from human activity in various areas of energy use have led to global warming, and the global effects of climate change are wide-ranging and unprecedented. In terms of size, as a result of changing weather patterns that threaten food production, and rising sea levels that increase the risk of catastrophic floods, adapting to these effects will be more difficult and more expensive if radical measures are not taken to limit the

expected negative effects of global warming on the agricultural sector in general, and the development of water resources in particular. The continent of Africa is considered the continent most affected by the climate change crisis that the world is facing in general, and the Arab Republic of Egypt in particular is the country most affected by global warming because most of the Egyptian lands are desert and semi-arid areas. Egypt is considered the country most affected by the negative effects of climate fluctuations, and evidence confirmed that the summer 2021 has witnessed an unprecedented rise in temperatures in 5 years, as the temperature recorded an average rise of (3-4) degrees Celsius above normal rates, which prompted the Egyptian government to take more serious and effective measures, programs and policies to adapt to the emerging climate changes. Fresh water resources are highly sensitive to changes in weather and climate. Climate change is expected to affect the availability of water in areas where the amount of water in rivers and streams depends on the melting of snow, and an increase in temperatures leads to an increase in the percentage of precipitation falling in the form of rain. Snow, which leads to excessive annual spring water flow at an early period of the year, and this may lead to the possibility of winter flooding and a reduction in the water flow rate in rivers in the late summer period. Climate changes are also expected to affect water loss. The Nile River accounts for about 80% of its flow. The rise in sea levels leads to the entry of salt water into fresh ground water and fresh water tables, and this leads to a decrease in the amount of fresh water available for drinking and agriculture, and the hotter water temperatures also affect the water quality and increase the speed of its pollution, which results in climate change dangerous effects such as changes in the Sea level, plant life and mass extinction processes, as it affects human societies.

**The importance of the study:**

Climate changes in the Earth's climate system lead to the emergence of new climate patterns that remain in place for a long period of time, and this time period may reach only several decades or may reach millions of years, and since the industrial revolution, the climate is increasingly affected by human activities that lead to Global warming. The Arab Republic of Egypt is one of the countries most affected by the negative effects resulting from climate change, and these damages are summarized in sea level rise, water poverty, and the deterioration of public health and environmental systems, which leads to economic losses estimated at billions, which affects their food security. Climate change also affects the nature of rain, evaporation, snow, the flow of water springs, and other elements that affect the abundance and quality of water worldwide.

Fresh water resources are highly sensitive to changes in weather and climate. Climate change is expected to affect the availability of water in areas where the amount of water in rivers and streams

depends on melting snow, and an increase in temperatures leads to an increase in the percentage of precipitation falling in the form of rain instead of snow. Snow, which leads to excessive annual spring water flow at the beginning of the year, which may lead to the possibility of winter flooding and reduce the flow rate of rivers in the late summer period, and the rise in sea levels leads to the entry of salt water into the water groundwater and freshwater streams, This leads to a decrease in the amount of fresh water available for drinking and agriculture, and the hotter water temperatures also affect the water quality and increase the speed of its pollution, resulting in climate change dangerous effects of changes in sea level, plant life and mass extinctions, as well as affecting human societies, The issue of climate change and the unprecedented rise in temperatures concerns the whole world, and its expected repercussions on global economies, Gaseous emissions resulting from human activity in various areas of energy use have led to global warming. The global effects of climate change are wide-ranging and unprecedented in scale, from changing weather patterns that threaten food production, to rising sea levels that increase the risk of Catastrophic floods, and adapting to these effects will be more difficult and costly if drastic measures are not taken to limit the expected negative effects of global warming on the agricultural sector in general and on the development of water resources in particular.

### **Study problem:**

The problem of the study lies in the fact that the issue of climate change is of great importance and includes many dimensions:

1. **The developmental dimension:** as the phenomenon of climate change is considered a global phenomenon, its impact varies from one country to another on the surface of the globe due to the nature and sensitivity of environmental systems that differ from one country to another and from one region to another.
2. **The economic dimension:** Global economic growth over the past five decades is linked to a rapid deterioration in the global environment, as there was no interest in economic thought in issues of depletion of natural resources, and today the issue of climate change and the uncontrolled rise in the global average temperature is preoccupied by expected repercussions on global economies.
3. **The social dimension:** Climate changes affect sectors of vital importance to Egyptian society, in terms of water, agriculture, temperature changes that affect crops and drought, and people who depend more on nature for their livelihoods are more affected by these changes.

4. **The environmental dimension:** The mechanisms of adapting to climate change and reducing the negative effects of global warming are the most important requirements for sustainable development to reduce the negative impact on human and environmental development indicators in Egyptian society.
5. **The water dimension:** The issue of climate change is considered one of the most important issues facing the world at the present time, given the clear and increasing effects of climate change on water resources and food production around the world, causing a rise in sea levels and the unexpected impact on the amounts of rain at the sources of rivers, and that 70 % of natural disasters in the world are related to water, such as floods, droughts, etc., which requires urgent action, as adapting to these effects will be more difficult and costly in the future if radical measures are not taken at the present time, which requires increased cooperation and exchange of experiences, between different countries of the world in the field of water.

#### **Objectives of the study:**

1. Learn about the concepts and definitions of climate change and global warming, and the reasons that lead to them.
2. Studying the effects of climate change and global warming on the Nile Valley African Countries and on Egyptian water resources.
3. Studying the effects of climate change on the Egyptian coastal beaches.
4. A study for economic integration between Egypt and the Nile Valley African Countries.

#### **Methods and Data Sources:**

The research was based mainly on the available data related to the subject of the study, which was collected from the publications and periodicals issued by the Ministry of Water Resources and Irrigation, the Central Agency for Public Mobilization and Statistics, the National Center for Agricultural Research, the Central Administration of Agricultural Economics at the Ministry of Agriculture and Land Reclamation, the National Center for Water Research, and the relevant ministries. That subject to the study, the Food and Agriculture Organization and the World Bank, in addition to the data that can be obtained from the international communication and information network "the Internet", as well as the use of research, publications, international conferences and scientific thesis closely related to the field of study.

#### **Results and Discussions:**

The current study is concerned with the negative effects of climate change and possible solutions to limit its effects in the Arab Republic of Egypt, as human activity in general, and fossil fuels, coal, oil and gas in particular, are the largest contributors to global climate change, as they represent more than 75% of global greenhouse gas emissions and about 90% of all carbon dioxide emissions, Due to their presence in the Earth's atmosphere, greenhouse gas emissions trap the sun's heat, and this leads to global warming that results in climate change. In weather patterns and disturbances in the usual balance of nature, which poses many risks to humans and all other forms of life on Earth, Figure No. (1) Shows the global economic losses resulting from climate changes.

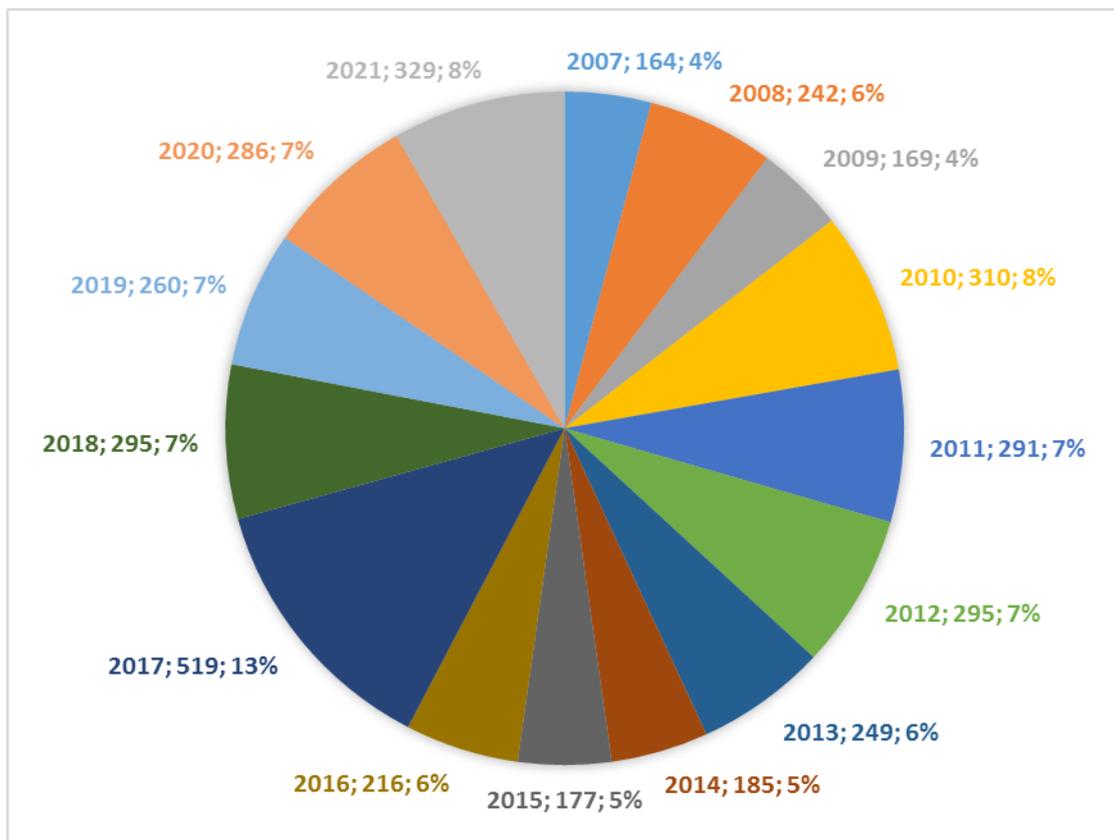


Fig. (1): Global economic losses in billions of dollars resulting from climate change during the period (2007-2021). **Source:** Weather climate and catastrophe insight, ann Accessible, 2021.

## 1- Concepts and definitions of climate change and global warming:

### A- Climate Change:

They are the changes that occur in the global atmosphere, which shows a clear variation in the state of the climate or its fluctuations, and the climate change that occurs on the earth may continue for long periods that exceed decades or more, and the climate changes began since the formation of the

earth, as the earth went through many climate changes Such as the ice ages and heat waves that took possession of the earth for millions of years, as the ice caps and forests spread and the sea level rose and decreased, all of which is mainly due to climate changes, and a distinction must be made between climate changes and weather diversity, as climate changes continue for very long periods of time, while weather changes It lasts for relatively short periods.

### **B- The difference between weather changes and climate changes:**

**The concept of weather:** The weather can be defined as the daily state of the atmosphere, and the changes that occur in it during a short period, ranging from a few minutes to several weeks, as the concept of weather and its daily fluctuations is a combination of temperature values, humidity levels, cloud density, level Visibility, wind directions, and most changes in weather conditions occur in the troposphere layer of the atmosphere closest to the Earth's surface, which leads to changes in weather all over the world and over a period of time that varies from several minutes to several weeks, while the concept of climate revolves around About describing the weather over long periods, in contrast to the concept of weather, which expresses short-term changes in the atmosphere, and the terms temperature value during a specific season, wind intensity, and even amounts of rain and snow falling are used to describe the climate in a specific area in a specific season, In order to explain the difference between climate and weather in a brief and clearer way, the weather helps determine what people wear on a particular day, while the climate provides information about the type of clothing that must be present during a period of time that may be decades or centuries.

### **C- Global warming:**

The phenomenon of global warming defined as an increase in the average temperature of the atmospheric air present in the lower layer of the earth's surface, during the past century or two, and this phenomenon occurs when the sun's heat is imprisoned or retained in the earth's atmosphere after entering it, which It raises the earth's temperature and makes it warmer, and this is done by absorbing atmospheric gases such as carbon dioxide of the sun's energy and imprisoning it near the earth, which contributes to a rise in the earth's temperature.

### **D- The most important reasons that led to the occurrence of global warming:**

There are many reasons that led to the emergence and occurrence of the phenomenon or crisis of global warming on Earth, and most of these reasons are due to the action of human activity, including: (1) the extraction and burning of coal at the beginning of the process of spreading and expanding industrial activities, which played a major role in the emission of gas Carbon dioxide in a huge way, (2) the process of developing the use of fuel known as oil in a very wide and large way,

which worked on the release of more carbon dioxide gases, specifically when human expansion began and increased its dependence on the use of planes and cars. (3) The gas used in various refrigeration systems is freon, which was one of the most important causes of the erosion of the ozone layer in the Earth's atmosphere. In the increase in the proportion of carbon dioxide gas in the atmosphere, and therefore a decrease in oxygen gas.

## **2-Indicators of worsening conditions of climate change and global warming in the Nile Valley African Countries :**

Climate change is one of the global natural phenomena from the perspective of geographical spread and its accompanying effects. Africa is responsible for about (2-3%) of global greenhouse gas emissions, and it is considered one of the parties most affected by the negative effects and repercussions of climate change at various levels.

**A- The steady increase in temperatures:** The rise in temperatures (the rate of warming) has increased, with an average growth rate estimated at (+0.3) degrees Celsius during the period (1991-2021), which is faster than the rate of warming that occurred during the period (1961-1990). ) as it reached (+0.2) degrees Celsius per ten years. The year 2021 came as the third year in terms of the high temperature rate recorded historically, and all sub-regions in Africa recorded an increase in the trend of temperatures during the period (1991-2021) compared to the period (1901-1930), noting that the North Africa region recorded the highest rates. An unusual rise in temperatures compared to other regions, reaching about (0.41) degrees Celsius per ten years during the period (1991-2021), which is double the rate recorded during the period (1961-1990), which amounted to about (0.19%). ) for every ten years.

**B- Growing sea level rise:** The rate of sea level rise along the African coasts is higher than the global average, especially along the Red Sea and southwestern Indian Ocean, as it is close to 4 mm per year, followed by the coasts of Tanzania and Mozambique, and the eastern coast of South Africa. Africa, where the rate exceeds 3.9 mm per year, and the rate of sea level rise along the western coasts of South Africa is much higher than the global average, reaching about 3.9 mm per year, and the rate exceeds 3.6 mm per year along the coasts of the Atlantic Ocean Northwest Africa and the Gulf of Guinea region from Gabon to Angola and Somalia, While the coasts of West Africa witnessed a rate of sea level rise close to the global average, at a rate of 3.3 mm per year, the relative rise in sea level is likely to continue in the future, which may contribute to increasing the frequency and intensity of coastal flooding in low-lying cities. And along most of the sandy coasts and increasing the salinity of groundwater.

**C- Disturbances in the rate of rainfall:** It is one of the indicators of the climate crisis in Africa, as it witnessed during the year 2021 conditions of instability regarding the rate of rainfall, which was less than usual in most parts of North Africa, especially in the coastal regions of Morocco, Tunisia and North Africa. Western Libya, and in the West African region, we find that it has witnessed a delay in the start of the rainy season, as most of the rain fell during the months of July and August, as well as in the southern African region, we find that there is a noticeable deficit in the rate of precipitation of more than 160 mm across eastern Angola, Zambia, Zimbabwe and central Mozambique along the coast of southern Africa, and in the East African region, Ethiopia, Uganda, parts of southern Sudan, southern Somalia, Kenya and Tanzania recorded drier-than-normal conditions.

**D- The change in the water level in the Great Lakes:** which is directly related to the phenomenon of climate change. In Lake Victoria, which is the largest freshwater lake in Africa, and extends over areas of Kenya, Tanzania and Uganda, we find that about 80% of the lake is replenished from rain. Direct, and only 20% of the drainage basin, and then the changes in the water level mainly reflect the patterns of precipitation, and the lake has witnessed large differences in the water level with sharp rises in rainfall during the years (1997-1998) and (2019-2021), This is in contrast to a decrease during the period (1998-2006), and this can be explained in light of the combined effect of climate change on the one hand and severe pressure on water resources by humans on the other hand, and this may result in a decrease in the area of arable land and grazing sites and a decline in fish production. and loss of biodiversity.

### **3-The repercussions of climate change:**

**A- Growing waves of population displacement:** Population displacement is one of the most prominent effects associated with the phenomenon of climate change, as floods, chronic droughts, sea level rise, and extreme weather phenomena are among the main factors affecting displacement patterns within and across international borders. They live in the most fragile and conflict-affected areas and refugees and internally displaced persons in Africa are on the front lines in terms of being affected by climate emergencies. In 2021, about 14.1 million people were internally displaced in sub-Saharan Africa, with about 11.5 million people due to conflict and violence, About 2.5 million people are affected by disasters, and many of them live in climatic zones with high temperatures, where they usually lack the necessary resources to adapt to existing environmental conditions in a way that may constitute an increasingly unstable state for them, and it is estimated that high water stress affects affecting about 250 million people in Africa and is expected to displace up to about 700 million people by 2030, Climate-induced migration may increase population density and

contribute to the growth of informal settlements. Taken together, these factors lead to an escalation of the risks of ethnic tensions and conflicts, including the exacerbation of pre-existing tensions between communities dependent on scarce resources, and the deepening of existing inequalities. , particularly gender inequality, as well as the further entrenchment of poverty, which seriously harms the achievement of the Sustainable Development Goals.

**B- Declining levels of food security:** Decreased levels of food security constitute one of the aspects of the impact resulting from climate change, as rising temperatures lead to a decrease in agricultural productivity growth by about 34% since 1961, in a way that exceeds any other region in the world. In the East African region, it was found that there was a significant increase in food prices, in a way that hindered the possibility of providing food and access to it, which led to the presence of more than 58 million people living in conditions of acute food insecurity, as a result of the effects that these regions are witnessing. The failed cumulative rainy seasons, in addition to the escalating waves of endemic conflicts in the region and the associated displacement of the population, and the restrictions related to the Corona pandemic, In addition to the accompanying effects of the Russian-Ukrainian war since late February, this trend is expected to continue in the future, which increases the risks of severe food insecurity and malnutrition in Africa, as global warming is likely to reach 1.5 degrees Celsius, accompanied by a decrease of about 9 degrees Celsius. percent of the maize crop in West Africa, the decline in the wheat crop by about 20% to 60%, and a decrease of more than about 12% in marine fishing, and climate change will have serious effects on jobs and labor productivity in the agricultural sector, with the increase in global warming by (3) degrees Celsius.

**C- Threatening the stability of water resources:** Water resources are among the aspects affected by the phenomenon of climate change, as it leads to a state of instability and high fluctuations in water levels in lakes. It also affects river drainage and groundwater recharge rates. Rivers lead to an increase in temperature, drought, and an increase in the demand for water. Of course, this matter has serious effects on the water-dependent sectors, in the production of hydroelectric power, agriculture, health, and access to potable water. The limited availability of water resources is also considered as a major source of causes. for conflicts. And it faces many gaps in capabilities in the field of high-quality and reliable climate services related to water, as only about 27% of the Nile Basin countries provide water-related climate services, such as through forecasting or warning of drought, and the difficulty of the existing reality in this regard is reinforced by the fact that it is still About 418 million people lack a basic level of drinking water services in Africa, and about 779 million people lack sanitation services, in addition to that about 27 African countries have

insufficient capacity to effectively implement the elements of integrated water resources management, according to a report State of the Climate in Africa 2021.

**D- Increasing risks to coastal cities:** The effects associated with climate change in Africa, to high population growth and rapid urbanization in Africa, increase the exposure of citizens and infrastructure to climatic risks, as it is expected that about 108 to 116 million people in Africa will be exposed to a high level of pollution. sea level by 2030, which in turn will lead to an increase in the frequency of coastal flooding, coastal erosion and soil salinity due to seawater intrusion, which poses an increased rate of risk to Africa's coastal settlements, economies and ecosystems, as damages associated with sea level rise could reach to about 2-4% of GDP by 2050.

**E- The escalation of political and security unrest:** The issue of climate change is inseparable from the political and security unrest, as the repercussions resulting from climate change produce new societal demands that put pressure on the ruling regimes and demand them to respond quickly, as many reports reveal that climate change phenomena, such as desertification and drought It is considered one of the catalysts for the outbreak of local conflicts between farmers and pastoralists over resources and lands suitable for grazing, which leads to more security and political fragility in many countries, as shown in Figure (2).

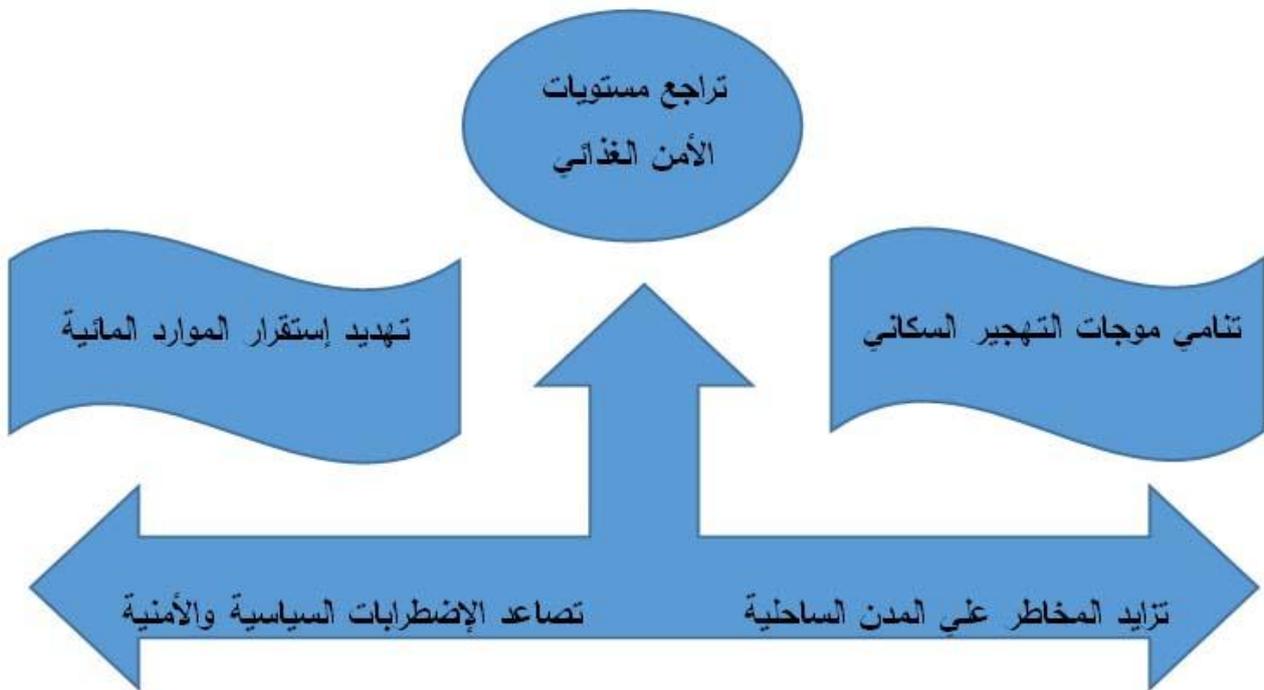


Fig. (2): The repercussions of climate change

The increase in human activities that led to global warming and thus was the main cause of climate change, which is now threatening an important and essential source of life and the Nile River, and by the year 2050 and with the continuous increase in the population, this will cause huge pressures on the water supply and thus a decrease in the per capita share. Governments face challenges in providing food sources in the Nile Valley region, where the economy and the lives of its inhabitants depend on agriculture, livestock and fishing.

Uganda is considered rich in natural water bodies, and depends on fisheries, which have an important role as a basis for securing sustenance and livelihoods. Lake Victoria is the largest and most important national fishery in economic terms, although other great lakes, including George, Edward, Albert and Kyoga along with the Nile River and a large number It consists of various swamps and streams, and also contributes significantly to the annual national fishing output, which constitutes a large proportion of the country's gross domestic product, which will be greatly affected by climate changes and global warming. The state of South Sudan uses the Nile as a primary means for transporting goods and travelers in the Bahr al-Jabal and Bahr al-Jabal rivers. El Ghazal, and in Ethiopia with the largest number of tributaries, the Blue Nile remains the largest source of hydroelectric power, The Arab Republic of Egypt faces many threats as a result of climate change, although Egypt's emissions of greenhouse gases that cause climate changes represent only 0.57% of the total emissions of the world, but Egypt is considered one of the countries in the world most affected by the effects of climate changes, and reports and studies indicate Which was supervised by the Climate Change Unit of the Environmental Affairs Agency, that the rise in sea level could lead in the medium and long term to the exposure of varying areas of the Nile Delta and the governorates of Lower Egypt to the possibility of drowning, which threatens the loss of huge areas of fertile agricultural land inhabited by the population and causes the migration of millions of its inhabitants governorates to the south and the loss of many industrial and tourist facilities, Global warming leads to fluctuations in the Nile River's water revenues, so that it can suddenly rise by up to 28%, and it can also suddenly decrease in another year by up to 76%, due to the imbalance in the distribution of the rain belts quantitatively and spatially, especially over the Nile River basin. The different scenarios for the repercussions of climatic changes on Egypt also indicate the possibility of a noticeable decline in the national product of grain, and this is not only in Egypt, but in all countries that depend on river water for irrigation, in addition to the negative effects of the rise in sea water temperature, which leads to bleaching of reefs. Coral reefs located in the Red Sea, which is reflected in the tourism movement to this area, which attracts tourists.

Global warming threatens the demise of the delta, as studies conducted on the Egyptian coast expect that many areas in the north of the delta and coastal cities will be exposed to drowning as a result of

the expected rise in sea level. of the population of Egypt and includes large agricultural areas, and the direct economic losses resulting from this are estimated at about 35 billion dollars, in addition to social and health losses, The industrial zone in Port Said will also be one of the areas most vulnerable to damage due to sea level rise, and the Red Sea region, which is rich in coral reefs, will have heavy losses, given that the Red Sea is distinguished by its unique geographical location and the diversity of its marine environments, which is considered one of the most important Egyptian treasures for tourism and the environment.

## **2- The effects of climate change and global warming on the Egyptian coastal beaches:**

It is clear from the general estimates of the facts of the United Nations that the seas and oceans cover about 70% of the Earth's surface, and that 75% of marine organisms play an important role in regulating the Earth's temperature and are the main producers of oxygen, and coral reefs that make up about 0.5% The area of the ocean floor is a complex three-dimensional structures formed during thousands of years as a result of the sedimentation of calcium carbonate structures formed by coral species that build reefs, and these reefs are considered the rainforests of the seas. According to the Fourth Assessment Report on Climate Change, global warming over the past century is primarily due to human activities, such as burning fossil fuels, deforestation, and converting land to agricultural uses. Global concentrations of carbon dioxide have increased from 280 parts per million in the middle of the last century to about 388 parts per million at the beginning of the current century. This will lead to:

1. Global warming affects coastal areas by submerging some low-lying areas in the northern delta and some other coastal areas.
2. Increasing the rates of beach erosion and the penetration of salt water into the soil.
3. Interference of seawater with groundwater, which leads to salinity of fresh groundwater, and thus a decrease in agricultural productivity in many strategic crops.
4. The impact of fish production as a result of the change of ecosystems in coastal areas and the rise in sea water temperature.
5. The sea level rise from about 20 cm to about 60 cm, in addition to the economic and social impacts of these phenomena.
6. Increased rates and intensity of hot and cold waves.
7. The low productivity of some strategic crops such as rice and wheat, and the difficulty of cultivating some other crops.
8. The fluctuation of the rainfall rate quantitatively and spatially.
9. Increased rates of desertification and drought.

10. The disappearance of some types of marine organisms and fish that provide 4.3 billion people with about 15% of animal protein.
11. The melting of the earth's crust and ice caps, which will lead to a rise in the surface of the seas and oceans.
12. The spread of malnutrition and, consequently, the spread of epidemics and diseases.

This may result in an increase in the population of the Nile Delta as a result of the displacement of about 2 million people working in agriculture, fishing, trade and industry, and the loss of approximately 214 thousand job opportunities estimated at about 35 billion dollars of land and property, and as a result of the rise in sea level, tourist areas will be affected by losses Unprecedented, as the rise in water levels in the White and Red Seas leads to the sinking of about 600 tourist products and international hotels. As a result of the increase in temperatures, current projects and investments will be affected. It also affects, in particular, the bleaching of coral reefs and the escape of many marine organisms, and thus the deterioration and decline of coastal beaches. And, as a result, low rates of tourism and high unemployment.

#### **B- Possible Solutions:**

1. Exerting the necessary efforts at the local level to build the capacity of coral ecosystems to cope with the effects of climate change through work activities to restore coral reefs, and to identify species capable of withstanding stress.
2. Reducing overfishing and establishing marine protected areas, where the establishment of marine protected areas is the best way to preserve coral reefs and other marine environments, as fishing ban areas allow the growth of large numbers of marine organisms, and thus the renewal of marine environmental resources.
3. Adaptation alone is not enough, as there needs to be a serious global response to mitigate the effects of climate change by working hard and directly to reduce emissions, improve energy efficiency, and reduce deforestation.
4. The expansion of the use of electricity through clean energy, especially since it has become easy for many countries in the world to generate electricity from solar energy, and to reduce the use of coal and oil, and the next era must be the era of clean electricity.
5. Expansion of agriculture, planting trees and forests is one of the most important factors influencing reducing the risks of climate change on the environment, seas and oceans, and planting forest trees absorbs high heat and helps reduce it in general.

6. Reducing greenhouse gas emissions, achieving the mitigation targets set by the Paris Agreement on Climate Change and keeping the increase in the global average temperature well below 2°C above pre-industrial levels.

### 3- Foreign trade between Egypt and the Nile Basin countries:

Table (2) shows the trade balance between Egypt and the Nile Basin countries, as it was found that the exports and imports of the Arab Republic of Egypt increased during the years 2018 and 2019 compared to 2017, and decreased in 2020. This decrease may be due to the spread of the Corona epidemic, which negatively affected all activities.

Economic to the countries of the world, as it was found that Egypt's exports in 2018 and 2019 were about 1197, 1227 million dollars, respectively, while it was found that Egypt's imports during the years 2019 and 2019 were about 621, 623 million dollars, respectively, while Egypt's exports to the Nile Basin countries decreased in 2020 to 1197 million dollars, and Egypt's imports from the Nile Basin countries decreased in 2020 to 561 million dollars.

It was found that the minimum exports of the Arab Republic of Egypt to the Nile Basin countries during the period (2008-2020) amounted to about 788.3 million dollars in 2008, at a rate of about 1.06%, and the maximum amounted to about 31746.3 million dollars in 2011, at a rate of about 42.56%, with an average Annually, it amounted to about 5737.6 million dollars during the same period, and it was found that the minimum imports of the Arab Republic of Egypt from the Nile Basin countries during the period (2008-2020) amounted to about 272.1 million dollars in 2009, at a rate of about 3.94%, and the maximum amounted to about 1038.8 million. dollars in 2011, at a rate of about 15.05%, with an annual average of about \$530.9 million during the same period.

Table (2): Total imports and exports of the Arab Republic of Egypt in million dollars to and from the Nile Basin countries during the period (2008-2020)

<b>The years</b>	<b>Egypt's exports to the Nile Basin countries</b>	<b>%of Egypt's exports to the Nile Basin countries</b>	<b>Egypt's revenues from the Nile Basin countries</b>	<b>%of Egypt's imports from the Nile Basin countries</b>	<b>Trade balance</b>
2008	788.3	1.06	272.3	3.95	516.0
2009	802.2	1.08	272.1	3.94	530.1

2010	1153.3	1.55	272.6	3.95	880.6
2011	31746.3	42.56	1038.8	15.05	30707.6
2012	30840.3	41.35	983.8	14.26	29856.5
2013	1076.4	1.44	428.6	6.21	647.8
2014	955.9	1.28	587.7	8.52	368.2
2015	1220.4	1.64	407.4	5.90	812.9
2016	1271.5	1.70	444.3	6.44	827.3
2017	1113.2	1.49	380.5	5.51	732.7
2018	1197.0	1.60	629.0	9.11	568.0
2019	1227.2	1.65	623.2	9.03	604.0
٢٠٢٠	1196.7	1.60	561.1	8.13	635.6
Total	74588.7	100.00	6901.4	100.00	-
Average	5737.6	-	530.9	-	-
Minimum	788.3	-	272.1	-	-
Maximum	31746.3	-	1038.8	-	-

**Source:** Central Agency for Public Mobilization and Statistics, Bulletin of Trade Exchange between Egypt and the Nile Basin Countries, separate issues.

#### **Recommendations:**

1. Enhancing the implementation of the multi-hazard early warning system: It is an important mechanism for collecting and analyzing information on the various risks and threats associated with climate change, and working to nominate the best possible paths to deal with them efficiently.
2. Accelerating the establishment and activation of national frameworks for climate services: This contributes to enhancing the involvement of various stakeholders and will work on developing and distributing climate services to support government policies and strategies to deal with climate change.
3. Adopting a practical approach to climate adaptation in Africa: This includes strengthening the capacity of African countries with regard to climate analysis and providing climate services through the relevant national institutions, identifying and selecting priorities for climate action, and formulating and implementing national climate-related policies, including the most climate-sensitive goals of the sustainable development goals .
4. Availability of financial support from the international community: It is necessary to enhance the ability of countries to fully implement the contributions set for them at the

national level. This support can be achieved through several sources, perhaps including capacity building, technology transfer, grants, and soft loans.

5. Developing new varieties of agricultural crops that can withstand high temperatures, salinity and drought, which are the conditions that will prevail under the conditions of climate change.
6. Developing new varieties with a short growing season to reduce their water needs.
7. Changing the planting dates to suit the new weather conditions, as well as planting suitable varieties in suitable climatic regions to increase the crop yield from the water unit for each crop.
8. Reducing the area of crops wasteful in water consumption, or not increasing the area prescribed for them (such as rice and sugar cane).
9. Cultivating alternative crops that give the same purpose and have less water consumption and growing season, such as cultivating sugar beets instead of sugar cane (in this strategy, it must be taken into account that this crop is a major crop in Upper Egypt, in addition to factories, secondary industries, and employment based on this crop).
10. Irrigation at the appropriate times and with the appropriate amount of water in each irrigation in order to preserve every drop of water, which we will be in dire need of under the conditions of climate changes.
11. Solidarity and integration between the Nile Basin countries in cultivating appropriate crops in each country and trade exchange between these countries to work for the benefit of the people away from any international disputes and disputes.
12. Work on afforestation of public and secondary roads to reduce the negative impact of global warming and increase oxygen gas.

**And move in three parallel tracks:**

1. It is represented in the national track by adopting relevant national plans and policies, whether by adapting to climate change or mitigating the risks and threats inherent to it.
2. It lies in adopting joint arrangements and policies based on environmental coordination to reduce the risks of climate change.
3. It consists of supporting the various international frameworks concerned with combating climate change and enhancing coordination with various international parties in this regard.

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