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The Impact of Climate Change on Food Security in Algeria (Analytical Study).

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Abstract: This study tackles climate change and its impact on food security in Algeria, particularly with a rise in temperatures and prolonged drought. It also sheds light on key concepts related to climate change, food security, and self-sufficiency. Finally, it addresses the impact of climate change on the agricultural sector and the measures the Algerian government take to mitigate its risks through diversifying production and improving agriculture in desert areas to cover food shortage. This is in line with the economic policies of the Algerian government aiming at reducing import bills and encouraging local production at agricultural and farming levels.

Keywords: Climate Change; Food Gap; Security; Self-Sufficiency; Food shortage.

1.Introduction

In the last years, climate change has caused a sharp rise in temperatures and a general climate system change. Algeria and North African countries, in general, are among the hottest regions on Earth, where climate change has become a challenge to productive sectors, especially heavy water usage reliant.

Since 2019, Algeria has been striving to cover food shortage by encouraging local production and reducing food import bills. Yet, it still undergoes economic dependency and registers consistent deficit, especially in staple crops. Furthermore, the outbreak of the Corona pandemic in 2019 and the disruptions in food supply have widened the food gap. The Russo-Ukrainian War in 2022, has further complicated the food and economic situation with sharp increase in energy and food prices. All these factors, in addition to the threat of climate change, have created a difficult economic situation. Thus, it is imperative that the Algerian authorities seek alternatives and solutions to revive and improve the agricultural sector and confront climate challenges.

In light of climate changes and the unstable global circumstances, Algeria has registered food deficit in staple crops, though it has 43 million hectares of arable land making it an excellent agricultural pole. However, Algeria loses thousands of hectares yearly due to desertification, sand encroachment and drought. This makes achieving self-sufficiency and maintaining food security challenging, but not impossible.

1.1 Problem Statement:

Climate change, Algeria has witnessed over a long period, has led to a rise in temperatures which affect both plant and animal food production. This results in increased rates of food deficits.

According to the aforementioned, the problem statement is as follows: How does climate change impact food security in Algeria?

1.2 Study Hypotheses:

- Carbone dioxide emissions and increased temperatures impact food supply at both the international and local levels.

- Climate Change leads to a change in lifestyles, as well as in the economic and agricultural levels.

1.3 Study Objectives:

This study aims at:

- Identifying the concepts related to climate change and food security.
- Investigating the extent of the impact of climate change on food security in Algeria.
- Discovering possible solutions to mitigate the impacts of climate change.

1.4 Significance of the Study:

This theoretical study aims to shed light on the key concepts related to food security, self-sufficiency, and climate change in Algeria in the past years. It focuses on studying the impact of climate change on food security in Algeria and the proposed solutions to mitigate it.

1.5 Study Methodology:

To address the research problem, the study adopted the descriptive analytical method due to its suitability for economic studies. This is through collecting data from various sources, analyzing the climate change phenomenon, its impact on food security in Algeria, and the adequate solutions the Algerian government adopt to maintain food security.

1.6 Study Structure:

The study is divided into three main axes:

First Axis: General concepts about climate change and food security.

Second Axis: The impact of climate change on food security and countermeasures.

The third axis: Climate change mitigation measures in the agricultural sector.

2. General Concepts about Climate Change and Food Security:

2.1. Definition of Climate Change:

The term "climate change" is a newly used concept which emerged during the 19th century with the development of the industrial activity and the increase in greenhouse gas emissions in the atmosphere. This led to a change in the ecosystem with rising temperatures.

Climate change is associated with changes in typical conditions such as temperature, humidity, winds, and rainfall for numerous reasons and circumstances.

The Intergovernmental Panel on Climate Change defines climate change as: “a statistically significant variation in the long-term data sets of climate variables over several decades. **(Manzar, 2022, p. 304)**

The Framework Convention on Climate Change in 1992 defines climate change as: “The change that is, directly or indirectly, attributed to human activity, causing changes in the global atmospheric composition, in addition to natural climate variations over periods of time. **(United Nations)**

When discussing a particular region climate, one focuses on particular variables. This includes dynamic weather variables which describe weather conditions, atmospheric conditions, surface air temperature, or atmospheric surface pressure. In literature, it is often referred to climate as the expected weather, implying that the most important variables are weather variables, as well as changes in ocean temperatures, glacier and ice sheet variations.**(Werndl, 2014, p. 4)**

The term "climate change" is recently used in environmental policy to refer to recent changes only. The most important change being referred to is the change in Earth’s temperature, named global warming. The United Nations has referred to human factors causing climate change. **(United Nations)**

2.2. Causes of Climate Change:

2.2.1. Human Causes:

Human activities have been a main cause of climate change and rising temperatures between 0.6º and 3º Celsius over the past twenty years. Energy generation and fossil fuel combustion are primarily producing carbon dioxide or methane, which contribute majorly in greenhouse effect in the atmosphere, leading to global warming. This causes a rise in temperatures due to the inability of the Earth to absorb carbon in the atmosphere. Industrial activity, such as machines and factories operating on fossil fuels, in addition to deforestation, releases carbon dioxide stored in tree trunks, with the annual destroying of roughly 12 million hectares of forests for agricultural purposes or urban expansion. This, along with transportation, contributes to a quarter of the greenhouse gas emissions in the atmosphere. Food production and building energy supply depending on coal and natural gas contribute to a portion of emissions causing global warming. **(McNutt & Ramakrishnan, 2020, pp. 1-22)**

According to the United Nations, cities also contribute to climate change with high proportion, as they consume 78% of the world's energy and produce more than 60% of greenhouse gases. However, their total area is only 2% of the Earth's surface. Energy supplies represent 26% of total global greenhouse gas emissions, transportation sector account for 13%. Residential buildings represent 8%, and waste's contribution is 3%.**(United Nations, 2011, pp. 12-13)**

2.2.2. Natural Causes:

Although contributing to climate change, natural causes inherently have qualities and capacities created by Allah that make it possible for them to adapt to these changes and restore balance to the atmosphere. The sun is the sole source of thermal energy on planet Earth, and as the Earth orbits the sun, its axial tilt may vary slightly. These variations, called Milankovitch changes, and they affect the amount of sunlight reaching the Earth. However, these cycles occur every tens or hundreds of thousands of years and are unlikely to be the main factor of climate change.**(Langloise & Urgelle, 2004, pp. 1-2)**

Temperature is impacted by natural factors such as ice masses and rivers in the Polar Regions, as well as by wind movements. Additionally, continental movements resulting from tectonic movement of the Earth's crust layers, as well as geological disturbances such as earthquakes and volcanoes are contributors to climate change. Changes in the Pacific Ocean's temperature also have an impact on climate change. During El Niño events, the Pacific Ocean temperatures rise, while during La Niña events, they decrease. This has effects on Earth's temperature only in the short term, for months or years.**(Trenberth, 2013, pp. 1-2)**

2.3. Concept of Food Security and Self-Sufficiency:

2.3.1. Definition of Food Security:

Food and Agriculture Organization (FAO) defines food security as "providing all people in a society with sufficient and nutritious food to meet their needs continuously in order to maintain a healthy and active life." **(Al-Jazeera Information Network, 2022)**

According to the United Nations Food Security Committee: Food security means: "the physical, economic, and social ability of every person to obtain sufficient nutritious food to meet his dietary needs to live a healthy and active life. **(Al-Jazeera Information Network, 2022)**

Food security is also related to another concept, which is food sovereignty. It means: "the right of peoples to determine their own agricultural policies to achieve and meet their food needs and priorities."**(Shalighm, 2023, p. 208)**

Experts differentiate between relative and absolute food security. **Absolute food security** refers to food production within a single country that equals or exceeds local demand. It is synonymous with self-sufficiency. **Relative food security** is a country's or group of countries' ability to provide goods and foodstuffs completely or partially and ensure the minimum food requirements regularly.**(Dhou, 2022, p. 83)**

Currently, the concept of food security differs from the traditional concept related to achieving self-sufficiency with the country relying on its resources and capabilities in meeting its local food requirements. Rather, it is food production in a single country that equals or exceeds local demand.

2.3.2. The development of the concept of sustainable food security:

The concept of food security has evolved due to several economic and quantitative considerations, and then due to qualitative and human factors. This has led it to shift from a holistic concept to a partial one and from concern with supply to concern with demand. It has also enabled it to move from the international level to the national, household, and individual levels, and from providing the minimum to focusing on the quality of the food items, while preserving the environment and ensuring the sustainability of food for future generations.**(Boubekir, 2021, pp. 185--186)**

2.4. Definition of Self-Sufficiency:

Food self-sufficiency is the community's ability to fully meet its food needs by relying on itself and its own resources and capabilities to produce all its food needs locally.**(Ben Shaa & Ashit, 2018, p. 113)**

2.5. Food Security and Food Dependency:

2.5.1. Food Dependency:

Food dependency is the inability of a country to meet the nutritional and consumption needs of its population, making reliance on imports inevitable. Any disruption or scarcity of food can threaten the population by famine and diseases. **(Ben Shaa & Ashit, 2018, p. 113)**

2.5.2. Food Security:

Since the 1980s, the world has experienced relative food security because of the increasing use of chemicals in agriculture, which raised concerns about consumer health. This has led to hold discussions for new strategies to improve agricultural productivity in ways that are secure for human health, such as alternative and organic farming methods. **(Ben Shaa & Ashit, 2018, p. 113)**

3. The Impact of Climate Change on Food Security and Mitigation Measures:

Climate change has led to a significant rise in the Earth’s temperatures, causing a reduction in rainfall due to prolonged droughts. This has resulted in lower fresh groundwater levels, decreased river and surface water levels, and the drying up of many of them, threatening various plant and animal species. These changes have also globally and locally impacted agricultural and livestock productivity, leading to the death of millions of people due to famine, malnutrition, and a lack of clean water, along with the spread of diseases caused by the leakage of sewage in freshwater sources with pollution of coastal waters, which threatens future fish stocks.

3.1. The impact of climate change on food security in the world

3.1.1. Impact of Climate Change on Global Agriculture:

Global reports show that if there is a rise in temperatures by 2 to 3 degrees Celsius, the risk of species extinction increases by 30%, as the ability of these ecosystems to adapt or migrate is far less than the pace of climate change impacts. **(Achashi, 2016, p. 246)**

Studies indicate that climate change will not lead to a global agricultural collapse at least in the 21st century in which earth maintains its ability to feed its population. However, at the regional impacts, particularly in Africa, there are future significant climate changes that could double the challenges related to food security. Global warming has caused precipitation patterns to alter. This has affected freshwater supplies, thereby agricultural productivity reduces and food security weakens, especially in developing countries. This leads to food

shortages causing malnutrition, and the death of millions, with children and the elderly represent a high proportion. **(Achashi, 2016, pp. 246-247)**

3.1.2. Global Carbone Dioxide Emissions:

Table 1. Quantity of Global Carbon Dioxide Emissions (1990- 2020)

Unit: Million Kilo tons.

Year	Quantity of Emitted Carbon Dioxide
1990	21.3
1995	22.3
2000	24.3
2005	28.4
2010	30.23
2015	34.07
2020	33.6

Source: (Global Bank, 2020)

The above table shows that the quantity of emitted carbon dioxide in the atmosphere is drastically increasing with 21.3 million kilo tons in 1990 and 33.6 million kilo tons in 2020 with an increase of approximately 12.2 million kilo tons during the last 30 years. This increase may impact the environment and lead to enormous environmental and climatic changes. This has increased temperatures to reach an annual increased average ranging between 1.5º and 2.5º, which in its part caused a rise of infectious diseases and epidemics due to pollution, as well as a reduction in global rainfall and a climatic change, impacting global food supply chains.

3.1.3. Annual Global Withdrawn Freshwater:

Table 2. The Quantity of Annual Withdrawn Freshwater (2014- 2020)

Unit: Billion cubic meters:

Year	Annual Withdrawn Freshwater (%)	Quantity of Annual Withdrawn Freshwater (Billion cubic meters)
2014	9	3847.7
2015	9	3849
2016	9	3890.2
2017	9	3917.3
2018	9	3907.6
2019	9	3920.5
2020	9	3895.5

Source: (Global Bank, 2021)

The table shows that the quantity of annual withdrawn freshwater ranges between 3800 and 4000 billion cubic meters with a value of 9 % of freshwater. It is an enormous quantity which consumes the global stock because most of it is rainfall-based and renewable. This threatens the ground-freshwater stocks. Additionally, withdrawn waters are used in irrigation, as well as daily consumption and industrial activity.

3.1.4. Forests' Area (from Land' Total Area)

Table 3. Global Forests' Area (2014- 2020):

Unit: Million Square Kilometers

Year	Area %	Area (million square meters)
1992	32.9	53.4
1995	32.3	53.11
2000	31	51.9
2005	31.8	50.8
2010	31.6	45.7
2015	31.4	48.4
2020	31.2	46.7

Source: (Global Bank, 2021 Statistics, 2021)

The table shows that forests represent 32 % of the earth's area. They are considered the lung of the world by providing oxygen and absorbing carbon dioxide. The forests' area is drastically decreasing from 53.4 million square kilometers in 1992 to 45 million square kilometers in 2010 with a value of 7.7 million square kilometers between 1992 and 2010. In 2015, it slightly increased by 2.7 million square kilometers. Then, it decreased to 46.7 million square kilometers in 2020 with a decreasing value of 1.7 million square kilometers.

This decrease in the forests' area has a significant impact on global environment and climate because forests have a positive and effective role in absorbing carbon dioxide emitted from human and animals' activities. Therefore, the forests' area is decreasing due to wood-based industries, grazing, agricultural and industrial encroachment and urban expansion. All these affect the environment and lead to a decrease in rainfall.

3.2. The impact of climate change on food security in Algeria

3.2.1. Carbon Dioxide Emissions in Algeria:

Table 4. Quantity of Carbon Dioxide Emissions in Algeria (1990- 2020)

Unit: Thousand Kilo Tons

Year	Quantity of Emitted Carbon Dioxide (thousand kilo tons)
1990	62.9
1995	76.5
2000	80.05
2005	94.8
2010	114.2
2015	156.3
2020	161.5

Source: (Global Bank, 2020)

The table demonstrates that the carbon dioxide emissions in Algeria were estimated in 1990 at 62.9 thousand kilo tons, reaching 161.5 thousand kilo tons with an enormous increase of about 98.6 thousand kilo tons during the last 30 years. This increase had a great impact on spreading diseases and epidemics related to pollution. It, also, led to a rise in temperatures and a reduction in annual rainfall. Moreover, it affected the agricultural sector through shifting towards irrigation-dependent farming, thereby consuming ground-water stocks.

3.2.2. Annual Global Withdrawn Freshwater in Algeria :

Table 5. Quantity of Annual Withdrawn Freshwater in Algeria (2014-2020)

Year	Annual Withdrawn Freshwater (%)	Quantity of Annual Withdrawn Freshwater (Billion Cubic Meters)
2014	39	4.4
2015	45	5
2016	50	5.6
2017	58	6.6
2018	66	7.5
2019	80	9
2020	87	9.8

Source: (Global Bank, 2021)

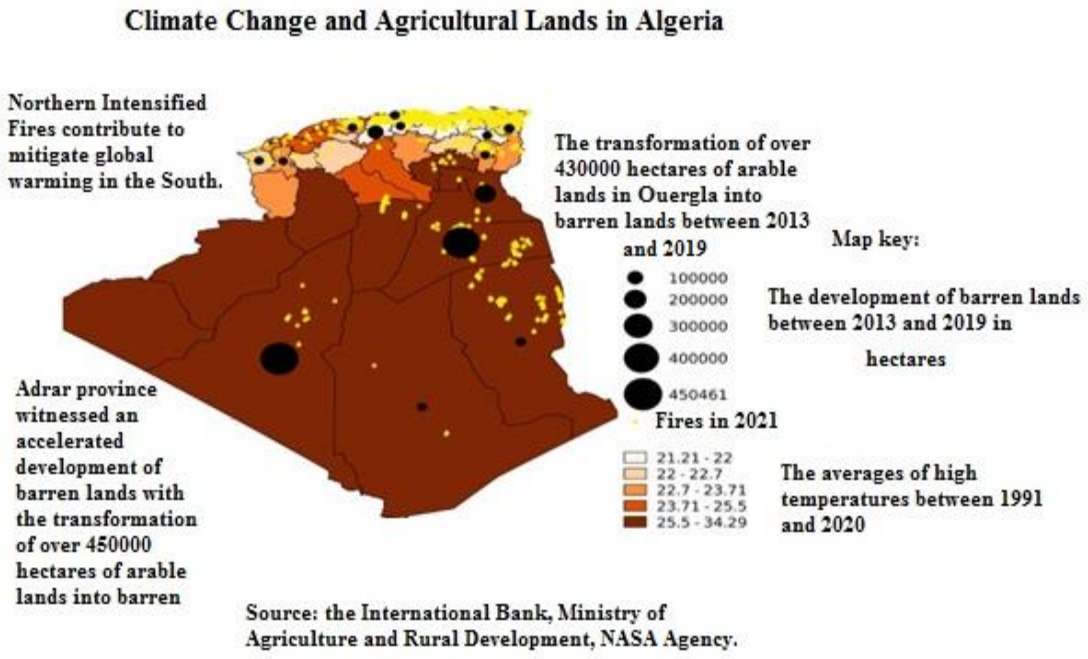
From the table above, we observe that the quantity of annual withdrawn freshwater is increasing from 39 % in 2014 with a quantity of approximately 4.4 billion cubic meters to 87 % in 2020 with a withdrawn quantity estimated at 9.8 billion cubic meters.

These statistics show that Algeria heavily relies on groundwater with a stock estimated at 7.5 billion cubic meters. The local consumption exceeded this quantity, reaching 9.8 billion cubic meters in 2020. Additionally, Algeria shifted towards desalination through establishing desalination plants and relying on groundwater in the desert.

3.2.3. Impact of Climate Change on Agricultural Lands in Algeria:

Climate change has global effects with some regions being more severely impacted. The location of Algeria in North Africa, which is one of the hottest regions on Earth with 84% of its land being desert, makes the agricultural sector vulnerable to climate change due to desertification and sand encroachment on northern regions. An increase in temperatures by just one degree Celsius can turn 100 kilometers of land into barren, uncultivable areas. Additionally, rainfall periods have become shorter and more intense, causing sudden floods, affecting surface and groundwater, and threatening plant and animal species with extinction. Annual wildfires also destroy thousands of hectares of forests, fruit trees, and crops.

Figure 01. Illustrates the impact of Climate Change on Agricultural Lands in Algeria.



Source: (Bessaoud, November 17 th, 2022)

The map indicates that climate change has significantly impacted agricultural areas in Algeria due to increased temperatures between 1991 and 2020. Arable land has been reduced while there is an increase in barren lands. This was accompanied, in 2021, by fires breaking out in northern regions with dense forests, as well as in eastern and central desert areas.

As concerning food security, climate change has generally affected the agricultural sector. Decreased rainfall has deteriorated soil quality, and eroded over 13 million hectares of land. Algeria loses about 400,000 hectares annually because of climate change, leading to a reduction in agricultural productivity. Grain production has decreased by 50%, and experts predict further declines by 2040. Desertification threatens more than 17 million hectares in the steppe regions, which are special grazing areas for livestock. Additionally, climate change has led to increasing daily temperatures by 1.5 to 2 degrees Celsius between 1970 and 2017. This was accompanied by an increasing number of fires in northern forested areas. Although these fires have negative effects they contribute to mitigate global warming in the south. **(Ben Smaine, 2022)**

4. Measures to Mitigate Climate Change in the Agricultural Sector:

4.1. Intensifying Agricultural Activities to Mitigate Climate Change:

Agricultural activities are responsible for about a third of greenhouse gas emissions. Harvesting and burning crop residues to re-cultivate land release carbon dioxide, and approximately 40% of methane emissions come from organic matter decomposition in flooded rice fields. Around 25% of Methane emissions come from livestock waste. **(FAO, 2003)**

Modern methods can be used to reduce emissions, such as utlising drought- and salt-resistant crops, changing farming patterns, reducing chemical fertilizers, and creating livestock waste management programmes to be implemented in organic farming.

Organic farming contributes in absorbing considerable amounts of carbon dioxide in the atmosphere. Through the implementation of the Kyoto Protocol over the next 20 to 30 years, crop farming could absorb 46 to 56 million tons of carbon annually making it the primary carbon absorber on Earth's surface. **(FAO, 2003)**

4.2. Climate Change Mitigation Measures in Algeria:

The agricultural sector measures basically focus on transforming arid and semi-arid lands into arable land through reforestation. The plan aims to improve farmers' incomes and achieve sustainable development by optimizing natural resource use. The strategy implies distributing crops across different arable regions, particularly staple crops, without focusing on one or two areas in the country.

Forage crops are planted in coastal areas, Médéa and the highlands such as Tiaret, Tissemsilt, Relizane, Mila, Skikda, and Bouira. Vineyards are planted in AïnTémouchent, Tlemcen, Sidi BelAbbès, and Mascara. Olive and fruit trees (almonds and pistachios) are cultivated in dry lands, hilly and mountainous areas. Citrus trees are planted in new farms in eastern regions with plentiful groundwater. **(AEPSS, 2023)**

5. Conclusion

Agricultural activity is the sole sector that creates net output according to the physiocratic natural thought. This remains true today due to the agricultural sector's crucial importance in the daily life of human societies. Nevertheless, agriculture's interconnection with other economic sectors, such as industry and commerce, makes the economic life more flexible and complex simultaneously. Additionally, external factors like climate change and global crises shouldn't be overlooked. They can impact agriculture, making it the most vulnerable sector because of events such as the COVID-19 pandemic and the Russia-Ukraine war.

Rise in temperatures and decrease in rainfall have aggravated drought which negatively affect agricultural yields and convert thousands of hectares into barren lands. Decreasing rainfall impacts surface and groundwater levels, which in turn degrade soil quality, turning fertile soil rich of minerals into poor land. Millions of hectares have suffered erosion because of drought.

Algeria loses about 400,000 hectares annually due to desertification, which result in the reduction of farming and agricultural productivity and a move towards irrigation-dependent farming that depends on groundwater.

Moreover, 17 million hectares of steppe regions face desertification due to sand encroachment which threatens grazing lands for livestock in the high plateaus.

Algeria, like other countries, strives to confront climate change by implementing a set of programmes that help distribute various crops according to the geographical characteristics of different regions. Additionally, the country shifts towards focusing on crop farming which ensures food security.

This study shows that the first hypothesis stating that 'carbone dioxide emissions and increased temperatures impact food supply at both the international and local levels' is approved. This is because climate changes are a result of human activities through the enormous consumption of the traditional energy which causes pollution. Other factors also include cutting trees and annual wildfires which devastate thousands of local hectares and millions of global hectares. This in its part impacts food supply chains due to decreased agricultural production caused by water shortages, thereby threatening food security.

As for the second hypothesis stating that 'climate change leads to a change in lifestyles, as well as in the economic and agricultural levels', is also approved considering that climate change increases temperatures and leads many farmers to lose their jobs due to prolonged drought. This, primarily, affects agriculture and decreases food production, thereby disrupting global and local food supplies.

6. Study Findings:

. Climate change is one of the factors hindering food security. However, Alternative solutions to cover the shortfall are essential, such as modern irrigation methods and reliance on groundwater, particularly in the Algerian Sahara.

. Food Security is strategically linked to water security.

. The agricultural sector consumes about 60% of freshwater annually depending on traditional irrigation methods. Therefore, adopting modern irrigation methods is necessary to conserve water and enhance agricultural productivity.

. Climate Change impacts food security as it increases temperatures which lead to annual summer wildfires. This converts thousands of hectares into barren lands. Desertification threatens 17 million hectares in steppe regions.

. The Algerian Sahara's groundwater reserves, exceeding 50,000 billion cubic meters, are vital for the future of food security in the country.

7. Bibliography List:

– Achashi, M. (2016, December). Climate Change and Its Effects on Development in Algeria. *Thought Dialogue Journal, Vol. 11,* Issue 12.

– AEPSS. (2023, 08, 2023). Retrieved from Algerian Encyclopedia of Political and Strategic Studies: https://www.politics-dz.com/ar/, accessed on 18/08/2023 at 04:21 PM.

– Al-Jazeera Information Network. (2022, 07, 18). *Food Security... Food for All Everywhere and at any Time.* Retrieved 08, 23, 2023, from https://www.aljazeera.net/encyclopedia/2022/7/18

– Ben Shaa, M., & Ashit, A. (2018, April). Impact of Agricultural Production on the Food Gap in Algeria (1980-2015). *Algerian Journal of Economy and Finance,* Issue 09.

– Ben Smaine, L. (2022, 09, 27). *Climate Development in Algeria and Its Effects*. Retrieved 08, 13, 2023, from AssafirArabi: https://assafirarabi.com/ar/47711

– Bessaoud, O. (November 17th, 2022). *Rebuilding Agricultural Sovereignty to Confront Climate Change in Algeria.*

– Boubekir, A. (2021, June). Measuring Sustainable Food Security in the Agricultural Sector - A Field Study on Farm Owners in Algeria. *Namaa Journal of Economy and Commerce, Vol. 05,* Issue 01.

– Dhou, K. (2022, January). International Care for Achieving Food Security and Its Protection Mechanisms. *Algerian Journal of Historical and Legal Studies, Vol. 06,* Issue 03.

– FAO, U. N. (2003, May). *Committee on World Food Security, "Impact of Climate Change on Food Security and Its Implications on Production,"*. Retrieved from https://www.fao.org/3/Y9151a/Y9151a.htm

– Global Bank. (2020). (Carbon Dioxide Data Analysis Centre, Environmental Sciences, Oak Ridge National Laboratories, Tennessee, United States of America) Retrieved from https://data.albankaldawli.org/indicator/EN.ATM.METH.KT.CE

– Global Bank. (2021). *2021 Statistics*. (Food and Agriculture Organization (FAO), Water Data Statistics AQUASTAT) Retrieved from https://data.albankaldawli.org/indicator/ER.H2O.FWTL.K3?end=2020&skipRedirection=true&start=1962&view=chart

– Global Bank. (2021). *2021 Statistics.* (Food and Agriculture Organization, Online Electronic Files and Website) Retrieved from https://data.albankaldawli.org/indicator/AG.LND.FRST.ZS

– Global Bank. (2023). *2023 Statistics*. (National Account Data of the World Bank and the Organization for Economic Co-operation and Development in the Economic Field.) Retrieved from https://data.albankaldawli.org/indicator/NV.AGR.TOTL.CD?locations=DZ)

– Langloise, & Urgelle, B. (2004). *Milankovitch and Climate Variation.* France: Emmanuel Cecchi.

– Manzar, I. (2022). Mutual Impacts Between Climate Change and Epidemics - COVID-19 as a Model. *Al-Bahith Journal of Academic Studies, Vol. 09*(Issue 01).

– McNutt, M., & Ramakrishnan, V. (2020). *Climate Change: Evidence and Causes.* National Academy of Sciences, The Royal Society.

– Shalighm, S. (2023). Food Sovereignty in Algeria: Policies and Requirements. *Journal of Political Topics, Vol. 07,*Issue 01.

– Trenberth, K. (2013). *El Niño Southern Oscillation (ENSO).* Boulder, CO, USA: National Center for Atmospheric Research.

– United Nations. (2011). *Global Report on Human Settlements 2011: Cities and Climate Change.* United Nations Program.

– United Nations. (n.d.). *Climate Change/ What is climate change?* Retrieved 08, 23, 2023, from https://www.un.org/ar/climatechange/what-is-climate-change

– United Nations. (n.d.). *United Nations Framework Convention on Climate Change 1992*. Retrieved 08, 22, 2023, from https://unfccc.int/sites/default/files/convarabic.pdf

– Werndl, C. (2014, December). On Defining Climate Change. *British Journal for the Philosophy of Science, University of Salzburg*.

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