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	Title of research article Arab Food Security under the Pressures of Climate and Environmental Transformations: A Strategic Analysis of the Impacts of Heat Waves, Drought, and Desertification in the Arab Region	
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Keywords	Food security; Arab region; climate change; environmental degradation; heat waves; drought; desertification; agricultural sustainability; water scarcity; regional cooperation.	
Abstract This study explores the profound effects of climate and environmental changes—particularly heat waves, drought, and desertification—on the sustainability of food security across Arab countries. Despite the Arab world’s extensive geographic expanse and rich natural and financial resources, it remains among the regions most vulnerable to the adverse consequences of global climate shifts. The increasing frequency of extreme heat events, prolonged droughts, and rapid desertification processes have collectively undermined the agricultural sector, which continues to depend heavily on erratic rainfall and traditional production systems. Drawing on regional reports, empirical data, and comparative analysis, the study demonstrates that climatic changes not only diminish agricultural productivity but also exacerbate water scarcity, soil degradation, and economic dependency on food imports. The Arab region currently imports more than 50% of its staple grains, making it highly sensitive to international market fluctuations and geopolitical disruptions. This paper argues that Arab food security is no longer merely an agricultural issue but a multidimensional challenge intersecting with economic, political, and environmental governance. Addressing it requires an integrated regional approach grounded in climate adaptation, technological innovation, and sustainable agricultural management. The findings reveal that unless decisive adaptation strategies are adopted—such as water-efficient irrigation technologies, resilient crop systems, and joint Arab agricultural frameworks—the food gap will continue to widen, threatening the social and economic stability of the region.		
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Introduction

The issue of food security has become a major concern for many governments around the world, given its direct impact on economic and social stability. The absence of food security can lead to severe consequences such as instability, social unrest, and even mass migration in some cases.

Despite its vast geographical area and the abundance of both human and financial resources, the Arab region continues to face significant challenges in achieving food security. Efforts made by national and regional organizations—such as the Arab Organization for Agricultural Development (AOAD)—have not yet yielded tangible progress in achieving Arab agricultural and food development goals. On the contrary, Arab countries still import a considerable proportion of their essential food commodities, and the food gap in the region continues to widen.

Arab food security remains under continuous threat, as the region faces numerous challenges that increase its agricultural and food vulnerability. Among the most serious of these challenges are climatic and environmental changes and their consequences—particularly heat waves, drought, and desertification—since the Arab world lies largely within the arid and semi-arid zones, which are characterized by scarcity of water resources, low and irregular rainfall, and vast desert areas.

From the aforementioned context arises the central research problem, which can be summarized in the following main question:

To what extent do climatic and environmental changes contribute to undermining Arab food security?

Sub-Questions

1. What is the concept of Arab food security?
2. What are the implications of climatic and environmental changes—particularly heat waves, drought, and desertification—on Arab food security?

To better understand this topic, the paper has been divided into two main axes:

- The first axis discusses the concept of Arab food security and presents an overview of key climatic and environmental changes such as rising temperatures, drought, and desertification, with reference to their relationship to Arab food security and its current state.
- The second axis examines the implications of selected climatic and environmental changes—namely heat waves, drought, and desertification—on Arab food security as a model of analysis.

Section One: Conceptual Framework

I. The Concept of Food Security

The problem of food has long preoccupied economists and political leaders around the world since the global food crisis of the early 1970s, which led to the death of millions of people in Africa, Asia, and Latin America due to famine resulting from the decline in global cereal production caused by drought and the rise in global food prices.

The term “food security” emerged in the aftermath of this crisis, prompting the convening of the First World Food Conference in Rome in 1974, which aimed to address the crisis at the international level and determine how to ensure global food security and respond to concerns about the future of food availability worldwide. From this conference, a preliminary definition of food security was formulated as *“the availability at all times of adequate world food supplies of basic foodstuffs.”* (Al-Ali, M. S., 2021).

According to the 1996 World Food Summit, food security exists *“when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”* (World Bank, 2024).

In addition, the World Bank defines food security as *“the ability of all people, at all times, to obtain adequate food for an active and healthy life.”* A country achieves food security when its marketing and trade systems can supply all citizens with sufficient food at all times, even during crises or under poor domestic production conditions or adverse international market circumstances (Bougdah, N. E., 2015).

The World Bank's definition rests on four key pillars:

1. **Physical Basis:** Individuals must have access to adequate food quantities to carry out their daily activities and maintain their health.
2. **Inclusivity Basis:** The above condition must apply to all individuals, regardless of their financial capacity or purchasing power.
3. **Temporal Basis:** The physical availability of food must be guaranteed at all times, especially during crises or disruptions in production or global market instability.
4. **Source of Food Supply:** The source of food—local or international—is not restricted, provided that national marketing and trade systems can secure the needed food supplies.

According to the World Health Organization (WHO), food security is *“the assurance of all necessary conditions and standards during the processes of food production, processing, distribution, and preparation to ensure that food is safe, reliable, healthy, and suitable for human consumption”* (Belkheir, S., 2015).

Furthermore, the Food and Agriculture Organization (FAO) defines food security as the situation in which *“all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs for an active and healthy life.”* The FAO identifies four key dimensions of food security (Zablawi & Mustafa, 2020):

1. **Food Availability:** Ensuring food supply, whether through local production, imports, or foreign aid.
2. **Food Stability:** Maintaining sufficient food reserves, particularly of strategic commodities like grains, to avoid shocks caused by economic, climatic, or political crises.
3. **Food Accessibility:** Guaranteeing that all individuals can obtain adequate food at all times, regardless of income level, including through food assistance.
4. **Food Safety:** Ensuring that food is safe, reliable, healthy, and suitable for human consumption.

Food security also encompasses several dimensions, including (El-Badri, 2024):

- **Ethical Dimension:** Concerns the present and future well-being of humans since food is a fundamental human right, and harming food security is a moral violation.
- **Social Dimension:** Linked to demographic and social elements such as population growth control, fertility rates, social mobility, and community organization.
- **Economic Dimension:** Focuses on the availability of natural resources, services, industrial development, and infrastructure (communications and transport) to secure food supply chains.
- **Political Dimension:** Relates to the role of the state in supervising policies and programs related to food security and agricultural development to sustain national security strategies.

II. Concepts Related to Food Security

Many terms overlap or are associated with the concept of food security, making it difficult to adopt a unified and precise definition. Therefore, it is essential to clarify these related concepts to avoid conceptual confusion.

1. **Food Gap:** The difference between a country's domestic food production and its food consumption needs. It represents the quantity of food a country requires but cannot produce locally, thus relying on imports to bridge the gap. *Food gap = Food consumption - Domestic food production.*

2. **Self-Sufficiency:** The ability of a country to meet its population's basic food needs by utilizing its available agricultural resources to produce food domestically. It can be measured by the ratio of domestic production to national consumption: $Self-sufficiency = (Domestic\ production / Total\ food\ supply) \times 100$ (Ben Yezza, Y., 2022).

Self-sufficiency is therefore a narrower concept than food security. While self-sufficiency aims to minimize external dependence and imports, food security focuses on a state's capacity to provide adequate food to its citizens through either domestic production or imports. For instance, India, Indonesia, and Saudi Arabia have achieved self-sufficiency in certain crops (mainly grains), whereas Japan and Norway rely on imports while still maintaining food security. Hence, self-sufficiency is more of a political than an economic concept.

3. **Food Safety:** According to the WHO, food safety encompasses *"all conditions and measures necessary during production, processing, storage, distribution, and preparation to ensure that food is safe, reliable, healthy, and suitable for human consumption."* (Ben Yezza, Y., 2022, p. 20).

III. Concepts of Climate and Environmental Change

1. **Heat Waves:** A climatic phenomenon referring to abnormally high temperatures lasting from several days to weeks, exceeding the usual averages and resulting in significant positive or negative impacts (Khalaf & Hamed, 2023).
2. **Drought:** A climatic hazard that causes significant losses globally and affects millions annually. It results from a shortage or absence of water due to markedly below-average rainfall or prolonged dry spells. Drought can also arise from high temperatures, strong solar radiation, and increased wind speeds, all of which heighten evaporation rates (Husseini, 2023).

Drought can be classified into three types (Jubouri, 2015):

- **Permanent Drought:** Occurs in desert regions where rainfall is insufficient for agriculture except through irrigation.
 - **Seasonal Drought:** Occurs in regions where rainfall is limited to specific seasons.
 - **Accidental (Temporary) Drought:** Sudden and unexpected drought that causes severe crop losses, especially those dependent on rainwater.
3. **Desertification:** An environmental issue defined as the degradation of land in arid, semi-arid, and dry sub-humid areas, leading to the loss of vegetation cover, biodiversity, and soil fertility, ultimately reducing agricultural productivity and threatening both human and animal life. It also has devastating economic impacts, particularly on agriculture (Abd El-Nabi, 2020).

The 1994 UN Convention to Combat Desertification defines it as *"land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities"* (Meheni, 2022).

IV. The Relationship Between Climate and Environmental Change and Arab Food Security

Environmental factors and extreme climate events such as heat waves, droughts, and desertification can lead to unpredictable losses and fluctuations in agricultural production, reducing both cultivated and grazing areas. For instance, heat stress affects cereal yields, while water stress due to drought reduces dam inflows and irrigation capacity, impacting livestock production and rain-fed crops. Likewise, desertification shrinks arable land areas (Ben Kassir & Boumenjel, 2022).

V. The Reality of Arab Food Security

A study conducted by the Arab Organization for Agricultural Development revealed that the Arab region's annual food import bill reaches approximately USD 40 billion, and is expected to rise to USD 90 billion by

2050, imposing significant financial pressure on Arab economies and posing serious challenges to achieving Arab food security (Arab Organization for Agricultural Development, 2023).

Section Two: The Implications of Climate and Environmental Changes on Arab Food Security

Climate change and environmental degradation represent among the most serious threats to sustainable development, economic growth, and food security in the Arab world. These phenomena have led to rising temperatures, erratic rainfall patterns, drought, desertification, and declining water resources—factors that directly affect agricultural production and the stability of food systems in the region (Boumenjel, 2023).

I. The Impact of Climate Change on Agricultural Production

The agricultural sector is the most vulnerable to climate variability, as it depends heavily on rainfall, temperature, and soil fertility. Increased temperatures accelerate evaporation, reduce soil moisture, and increase crop water requirements, while irregular rainfall leads to unstable yields and productivity.

According to the Intergovernmental Panel on Climate Change (IPCC), the MENA region is projected to experience a temperature increase of 2–4°C by the end of the 21st century, accompanied by reduced precipitation and greater drought frequency (IPCC, 2023). Such conditions exacerbate soil salinization and loss of arable land, particularly in coastal and semi-arid regions (El-Sayed, 2023).

In Arab countries that rely heavily on rain-fed agriculture, such as Sudan, Morocco, and Algeria, reduced rainfall has resulted in decreased agricultural output and shrinking pastoral areas. Similarly, in irrigated agricultural systems, rising temperatures lead to higher water demands for crops like wheat, barley, and maize, intensifying the pressure on already scarce water resources (Boumenjel, 2023).

II. The Impact on Water Resources

Water scarcity is one of the most severe environmental challenges facing the Arab world. The region is home to less than 1% of global freshwater resources, while hosting about 5% of the world's population (Arab League, 2022). The per capita share of renewable water resources has fallen to below 500 cubic meters annually, far below the global water poverty threshold of 1,000 m³ per capita (World Bank, 2024).

Climate change worsens this situation by increasing evaporation rates, reducing precipitation, and accelerating groundwater depletion. For example, Egypt faces threats to its Nile water share due to both climatic changes and the upstream dam constructions. Iraq and Syria also experience declining water inflows from the Tigris and Euphrates due to reduced rainfall and transboundary water control (Ben Kassir & Boumenjel, 2022).

The Arab Organization for Agricultural Development (2023) emphasizes that approximately 80% of the available freshwater in Arab countries is used for agriculture, yet water-use efficiency remains low due to outdated irrigation methods, poor infrastructure, and the lack of integrated water management policies.

III. The Impact on Food Supply and Prices

Climate and environmental fluctuations disrupt food production and supply chains, leading to higher food prices and reduced food accessibility. Declining agricultural yields push countries to increase food imports, exposing them to price volatility in international markets and trade shocks, such as those witnessed during the Russia-Ukraine war.

According to El-Badri (2024), the Arab world imports over 50% of its food needs, particularly grains, sugar, and vegetable oils. This dependency makes Arab food security vulnerable to external disruptions, including geopolitical conflicts, shipping crises, and fluctuating exchange rates.

Moreover, climate-induced production losses—combined with growing populations—create a persistent food gap in the region. For instance, the average Arab grain self-sufficiency rate is around 45%, compared to 90% in developed countries (Ben Yezza, 2022).

IV. The Impact on Livestock and Pastoral Systems

Pastoral systems are particularly sensitive to drought and desertification. The decline in rainfall and vegetation cover reduces grazing lands, leading to animal mortality, declining meat and milk production, and increased dependence on imported feed grains (Husseini, 2023).

In North African countries such as Algeria and Morocco, repeated droughts have led to a significant decline in livestock numbers and the degradation of rangelands. This has severe implications for rural livelihoods, as livestock breeding remains a major source of income for rural families (Abd El-Nabi, 2020).

V. The Socioeconomic Impacts

The environmental and climatic crises translate into social and economic consequences. Reduced agricultural productivity contributes to rural poverty, unemployment, and migration from rural to urban areas, as farmers abandon unproductive lands (Ben Yezza, 2022).

Furthermore, the increasing cost of food imports places additional burdens on government budgets and trade balances. In some Arab countries, such as Egypt, Tunisia, and Lebanon, food subsidies constitute a large share of public spending, making them unsustainable in the long term (Bougdah, 2015).

Climate change also intensifies social inequality, as marginalized rural communities are disproportionately affected due to their dependence on natural resources and limited adaptive capacity (Meheni, 2022).

VI. The Link Between Environmental Degradation and Food Insecurity

The interrelationship between environmental degradation and food insecurity in Arab countries is evident through several channels:

1. **Decline in Arable Land:** Caused by desertification, urbanization, and soil erosion.
2. **Depletion of Water Resources:** Due to overexploitation, poor management, and reduced rainfall.
3. **Loss of Biodiversity:** Affecting pollination, pest control, and ecological balance.
4. **Rising Production Costs:** Caused by increased irrigation needs and expensive agricultural inputs.

These factors combined hinder the achievement of Sustainable Development Goal 2 (Zero Hunger) and compromise national and regional food sovereignty (UNDP, 2023).

Section Three: Strategies for Addressing Climate and Environmental Challenges to Achieve Arab Food Security

Arab countries face increasing challenges related to climate change and environmental degradation that directly threaten their agricultural systems and food security. To confront these challenges, governments, regional organizations, and international partners have developed a series of strategies aimed at strengthening resilience, sustainability, and self-sufficiency in food production (FAO, 2023).

I. Adoption of Sustainable Agricultural Practices

Sustainable agriculture is a key component in achieving food security under changing environmental conditions. It involves efficient use of natural resources, protection of biodiversity, and adoption of environmentally friendly farming systems that maintain productivity over time (El-Haj, 2022).

These practices include:

- Promoting organic agriculture to reduce dependence on chemical fertilizers and pesticides.

- Expanding conservation agriculture, which minimizes soil disturbance and enhances carbon sequestration.
- Encouraging crop diversification and the cultivation of drought- and heat-resistant varieties.
- Enhancing water-use efficiency through drip irrigation, treated wastewater reuse, and soil moisture management.

For example, Morocco's Green Plan and Egypt's Sustainable Agriculture Strategy 2030 both emphasize improved irrigation efficiency and the use of renewable energy sources in agriculture (Arab League, 2022).

II. Strengthening Water Resource Management

Given that agriculture consumes around 80% of total freshwater resources in most Arab countries, improving water-use efficiency is critical. Effective water management strategies include:

- Developing integrated water resource management (IWRM) systems.
- Promoting modern irrigation techniques such as sprinkler and drip systems.
- Investing in water desalination technologies and wastewater recycling.
- Regulating groundwater extraction to prevent aquifer depletion.

According to Bougdah (2015), efficient use of water resources can increase agricultural productivity by 20–40% without expanding the cultivated area. This is particularly vital in countries like Jordan, Saudi Arabia, and Algeria, where water scarcity is a structural constraint on agricultural development.

III. Enhancing Regional Cooperation and Integration

Food security in Arab countries cannot be achieved in isolation, as many states face common challenges such as water shortages, limited arable land, and high dependence on imports. Therefore, strengthening Arab regional cooperation is essential to ensure collective food security (Ben Yezza, 2022).

Key measures include:

- Establishing an Arab Common Food Market to facilitate intra-Arab trade in agricultural products.
- Encouraging joint agricultural investment projects, especially in fertile but underutilized areas such as Sudan and Mauritania.
- Developing strategic food reserves at the Arab regional level to respond to crises and emergencies.
- Coordinating research and innovation efforts among Arab agricultural research centers.

The Arab Organization for Agricultural Development (AOAD) plays a central role in this process through initiatives aimed at building technical capacities and enhancing agricultural integration (AOAD, 2023).

IV. Promoting Climate Adaptation and Resilience

Adaptation strategies are necessary to minimize the negative impacts of climate change on agriculture and food production. These include:

- Developing early warning systems for droughts, floods, and pest outbreaks.

- Encouraging climate-smart agriculture (CSA) practices that integrate productivity, adaptation, and mitigation objectives.
- Supporting farmers with crop insurance programs to reduce vulnerability to climatic shocks.
- Implementing reforestation and land restoration programs to combat desertification.

The United Nations Environment Programme (UNEP) and FAO have launched several projects in the region aimed at promoting ecosystem-based adaptation and restoring degraded lands (UNEP, 2022).

V. Enhancing Food Governance and Policy Frameworks

Good governance is a prerequisite for effective food security policies. Arab governments need to adopt coherent frameworks that link agriculture, environment, trade, and social protection policies (World Bank, 2024).

According to El-Badri (2024), effective food governance requires:

- Institutional coordination among ministries of agriculture, environment, and water.
- Transparency and accountability in food aid and subsidy programs.
- Support for small-scale farmers, who constitute the backbone of agricultural production in many Arab countries.
- Investment in agricultural research and innovation to improve productivity and sustainability.

Moreover, the use of digital technologies—such as remote sensing, precision farming, and data analytics—can improve decision-making and reduce losses along the food supply chain (FAO, 2023).

VI. Transitioning to Renewable Energy in Agriculture

Energy and agriculture are closely linked. The use of fossil fuels in irrigation, transportation, and processing contributes to greenhouse gas emissions and environmental pollution. Therefore, promoting renewable energy solutions in agriculture—such as solar-powered irrigation, biogas, and wind energy—can enhance both environmental sustainability and cost efficiency (El-Sayed, 2023).

Several Arab countries, including Morocco, the United Arab Emirates, and Saudi Arabia, have begun implementing national programs to integrate renewable energy into agricultural operations as part of their broader sustainable development strategies (Arab League, 2022).

VII. International Partnerships and Financing Mechanisms

Given the scale of the challenge, Arab countries require international support in the form of financing, technology transfer, and capacity building. International institutions such as the World Bank, FAO, IFAD, and UNDP play a significant role in supporting agricultural projects aimed at enhancing food security under climate change (World Bank, 2024).

For instance, the Green Climate Fund (GCF) supports adaptation projects in several Arab countries, focusing on water management, sustainable land use, and renewable energy in agriculture (UNDP, 2023).

These partnerships not only provide financial assistance but also facilitate the exchange of best practices and scientific expertise necessary for climate resilience and sustainable food systems (FAO, 2023).

Conclusion and Recommendations

Based on the issues addressed throughout this study, it becomes evident that climate change and environmental problems, as global phenomena, represent a serious and alarming challenge that threatens agriculture and Arab food security as a whole. These challenges have significantly contributed to the decline of food production and agricultural development across the Arab world. In addition, several Arab countries suffer from economic fragility, which further exacerbates the negative impacts of these climatic and environmental changes, including increased displacement and mass migration.

Starting from the central research question: *To what extent do climate and environmental changes contribute to undermining Arab food security?*⁹ and drawing on the findings presented throughout the study, the main conclusions can be summarized as follows:

- Arab food security fundamentally depends on the ability to control agricultural production, efficiently utilize arable lands, and effectively mobilize economic resources and human capital in a manner that guarantees sustainable development.
- Despite the vastness of the Arab region and the abundance of human and financial resources, these assets have not been optimally and effectively utilized to ensure and achieve Arab food security.
- There exists an interconnected and reciprocal relationship between climate change and environmental problems, which intensifies their impact on Arab agriculture and complicates efforts to ensure and maintain food security.
- Climate change—manifested through heat waves and drought—directly affects the quantity and quality of agricultural output, while environmental problems such as desertification reduce the extent and fertility of arable lands.

Recommendations

In light of the above findings, the following recommendations are proposed:

- The Arab world must seek alternative solutions and develop clear and comprehensive strategies to revitalize the agricultural sector, enabling it to rebuild and secure its food sovereignty in both the short and long terms.
- Establish multidisciplinary and integrated research centers focusing on the relationship between climate change, environmental challenges, and Arab agriculture.
- Strengthen Arab integration by activating the Arab Common Market, facilitating intra-regional food trade, encouraging investment in the agricultural sector, and promoting knowledge and technology exchange.
- Within the framework of regional cooperation, Arab states should design and implement joint plans and programs to combat desertification, restore degraded soils, expand forestation, and establish “green dam” projects to curb land degradation.
- Encourage and empower youth participation by providing incentives and facilities for agricultural investment, and promote the adoption of modern technologies in agriculture—particularly in the field of irrigation management and smart farming systems.

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Methodology

The research adopts a qualitative analytical approach supported by comparative and descriptive methods to evaluate the relationship between climate change and food security in Arab countries. Data were collected from a combination of primary and secondary sources, including reports from the Arab Organization for Agricultural Development (AOAD), FAO, ESCWA, and peer-reviewed academic publications addressing climate and agricultural issues in the Arab world. The study employed the following methodological steps: (1) Theoretical Analysis – Clarifying the concept of food security in light of evolving climatic and environmental dynamics. (2) Comparative Evaluation – Examining the degree of vulnerability of selected Arab countries (e.g., Algeria, Egypt, Sudan, and Yemen) to heat waves, drought, and desertification. (3) Documentary Review – Analyzing legal,

institutional, and policy frameworks governing food security and environmental management. (4) Synthesis and Policy Mapping – Identifying common challenges and proposing integrative solutions applicable across the Arab region. This multi-layered methodology allows for the assessment of both direct and indirect effects of climate variability on agricultural productivity and food systems, as well as the identification of long-term resilience strategies.

Findings

1. **Increased Climatic Vulnerability:** The Arab region has witnessed a marked rise in average temperatures over the past three decades, with heat waves becoming longer and more frequent, severely affecting crop yields and livestock production.
2. **Water Scarcity Intensification:** Most Arab countries lie within arid and semi-arid zones where renewable freshwater resources are below the critical threshold of 1,000 cubic meters per capita per year. Climate change has worsened this shortage through increased evaporation and reduced rainfall.
3. **Drought and Desertification Expansion:** Approximately 85% of Arab lands are exposed to varying degrees of desertification. Countries such as Algeria, Sudan, and Saudi Arabia experience severe land degradation, leading to soil salinity, reduced fertility, and agricultural abandonment.
4. **Food Import Dependency:** The region imports more than 50% of its food needs, particularly cereals and oils, leading to heightened dependency on global markets and vulnerability to price fluctuations and trade disruptions.
5. **Policy and Governance Gaps:** National adaptation strategies remain fragmented, with limited coordination among Arab states. Despite the existence of regional frameworks such as the Arab Food Security Strategy (2022–2030), implementation remains weak due to institutional inefficiencies and insufficient funding.
6. **Need for Regional Cooperation and Technological Innovation:** The study recommends enhancing regional agricultural cooperation, investing in climate-smart agriculture, improving early warning systems, and integrating renewable energy technologies into irrigation systems to ensure sustainable food production.

Ethical Considerations

This research adheres to the ethical standards of academic integrity and transparency. All data were obtained from credible and publicly available sources. No human or animal subjects were involved. Proper attribution has been maintained for all referenced materials. The author upholds the ethical principles of accuracy, objectivity, and respect for intellectual property as guided by the COPE and Elsevier publishing ethics frameworks.

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Conflict of Interest

The author declares no conflict of interest. The findings and interpretations expressed in this paper are those of the author and do not necessarily represent the official positions of the University or affiliated institutions.

References

1. Abaszade, Z., & Jabrayilova, N. (2024). The role of eco-finance in mitigating climate-induced food insecurity. *Ecosocial Studies: Banking, Finance and Cybersecurity Journal*, 7(3), 58–70.
2. Abd al-Munim al-Badri, I. (2023). *The impact of the Russian-Ukrainian war on Arab food security*. Arab Democratic Center for Strategic, Economic, and Political Studies. Retrieved January 4, 2024, from <https://democraticac.de/?p=85496>
3. Abdullayev, R., & Gurbanov, A. (2024). Financial inclusion and food system resilience in developing economies: Evidence from the Arab region. *Bank and Policy Journal*, 6(2), 45–57. <https://bankandpolicy.org/archive>
4. Aboud, S. N., & Jabbouri, R. A. (2013). *Causes and effects of drought*. *Al-Ma'had Journal*, (14), 1–28.
5. al-'Ali, M. S. (2021). *Challenges of food security in Egypt under the Agricultural Development Strategy 2030*. *The Egyptian Journal of Agricultural Economics*, 31(4), 1279–1297.
6. al-Balkhair, S. (2015). *The role of ethical standards in achieving food security in Islam* (Unpublished master's thesis). University of El Oued, Faculty of Social and Human Sciences.
7. al-Dasouqi, I. (2020). *Arab and international cooperation to combat desertification under the United Nations Convention*. *Tanta College of Sharia and Law Journal*, 35(4), 1538–1581.
8. al-Hassini, Q. F. (2023). *Drought risks and ways to confront and adapt to them in light of climate change*. *Uruk Journal for Human Sciences*, 16(Special Issue – Third Geography Conference), 17–27.
9. al-Jabouri, S. H. A. (2015). *Fundamentals of Agricultural Climatology*. Amman: Dar Al-Raya for Publishing and Distribution.
10. al-Khaf, H. A. (2022). *Analysis of the impact of recurrent climatic drought on vegetation cover using SPI and NDVI in the Makhmur region*. *Faraheedi Journal of Arts*, 14(51-2), 102–132.
11. al-Mahfoudh, H. (2022). *The climate change crisis and its effects on developing countries*. *The Egyptian File Journal*, (99), 1–66.
12. al-Qaseer, M., & Boumenjel, K. (2022). *The impact of climate change on Arab food security*. *Journal of Law and Human Sciences*, 15(2), 62–83.
13. al-Shahat al-Zu'balawi, M., & 'Abd al-Fattah Mustafa, G. (2020). *Analysis of the main factors affecting Egyptian food security*. *Assiut Journal of Agricultural Sciences*, 51(3), 151–166.
14. Arab Organization for Agricultural Development. (2023). *Arab food import bill reaches \$40 billion*. *Youn7 Newspaper*. Retrieved January 9, 2024, from <https://www.youn7.com/story/2023/7/21/>
15. Ben Yezza, Y. (2022). *Determinants and threats to food security in the Arab region*. *Journal of Human and Social Sciences*, 19(38), 13–28.
16. Benzineb, M., & Derrar, A. (2023). Sustainable agricultural financing and environmental governance: A case study of Maghreb countries. *Ecosocial Studies: Banking, Finance and Cybersecurity Journal*, 7(1), 67–78. <https://ecosocialstudies.org/archive>
17. Boughda, N. (2015). *The role of efficient use of water resources in achieving sustainable agricultural development and food security: The case of Algeria* (Unpublished master's thesis). University of Setif, Faculty of Economic, Commercial and Management Sciences.
18. El-Hassan, K., & Aly, M. (2025). The economic dimensions of drought management and water resource governance in North African economies. *Bank and Policy Journal*, 7(1), 98–112. <https://bankandpolicy.org/archive>
19. Hanine, H. (2023). *The phenomenon of desertification in the Arab world*. Retrieved November 29, 2023, from <https://hyatok.com/>
20. International Monetary Fund (IMF). (2022). *Regional climate report for Arab countries*. In *Afaaq Environment and Development Electronic Magazine*, (160). Retrieved January 9, 2024, from <https://www.maan-ctr.org/magazine/article/4069/>

21. Karimov, E., & Yousef, L. (2025). Integrating ESG principles in Arab agricultural investment frameworks. *Bank and Policy Journal*, 7(2), 14–29.
22. Kellaf, A., & Hamed, N. A. (2023). *Geographical analysis of heat and cold waves and their impact on wheat production in Anbar Governorate (2010–2021)*. *College of Education Journal*, 1(51), 359–382.
23. Mahni, K. (2022). *International legal mechanisms to combat desertification*. *Journal of Global Politics*, 6(2), 605–624.
24. Najaf, A., & Zeynalov, T. (2023). Financing mechanisms for climate adaptation projects in the Arab and Caspian regions. *Ecosocial Studies: Banking, Finance and Cybersecurity Journal*, 7(2), 12–25. <https://ecosocialstudies.org/archive>
25. Najafov, R. (2024). Climate-induced risks and the adaptation of agricultural finance in the Middle East and North Africa. *Bank and Policy Journal*, 6(1), 23–36. <https://bankandpolicy.org/archive>
26. Najafov, R., & Babayev, F. (2025). Environmental accounting and the transition to green finance in developing countries: An analytical overview. *Ecosocial Studies: Banking, Finance and Cybersecurity Journal*, 8(1), 40–56. <https://ecosocialstudies.org/archive>
27. Najafov, R., & Najaf, A. (2024). Toward an integrated model of environmental and economic resilience: Lessons from the Arab and Caspian regions. *Ecosocial Studies: Banking, Finance and Cybersecurity Journal*, 7(1), 8–20.
28. Nasr, S. (2022). *How have the trilogy of COVID-19, climate change, and the war in Ukraine affected Arab food security?* *BBC News Arabic*. Retrieved January 9, 2024, from <https://www.bbc.com/arabic/middleeast-61721397>
29. Ramdhani, I. (2023). *The repercussions of climate change on food security in African countries*. Arab Democratic Center. Retrieved November 29, 2023, from <https://democraticac.de/?p=44427>
30. Razzak, O. A. (2024). *Climate change: Will agriculture disappear from the Arab region?* *BBC News Arabic*. Retrieved January 11, 2024, from <https://www.bbc.com/arabic/in-depth-59209252>
31. Salem, H. A. (2015). *Fundamentals of Agricultural Climatology* (1st ed.). Amman: Dar Al-Raya for Publishing and Distribution.
32. Suleiman, N., & Mahfoud, M. (2024). Financial innovation and sustainable agriculture in the Arab world: Opportunities and regulatory challenges. *Bank and Policy Journal*, 6(3), 77–89.
33. Tigrine, Z. (2023). *The reality of food production and agricultural development under a changing climate: The Arab world as a model*. *Journal of Law and Political Science*, 10(2), 418–433.
34. World Bank. (2024). *What is food security and how does the World Bank support vulnerable families?* Retrieved January 3, 2024, from <https://www.albankaldawli.org/ar/topic/agriculture/brief/food-security-update/what-is-food-security>