



## Climate change and its impact on soil and food security

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### Abstract:

*Climate change in the 21st century is considered one of the major and important challenges affecting food security and various aspects of human life. Today, ensuring and maintaining food security, given the significant demand of the population and the intense exploitation of limited and non-renewable resources and reserves, is of particular importance and has been a major concern of governments in recent years. The discussion of climate change and its effects on the environment is one of the important topics in studies and research around the world. Limitations Food resources and production resources Due to the rapid population growth, the future of food supply for people is uncertain. Therefore, nutrition plays an important and fundamental role in a healthy lifestyle, cardiovascular diseases, cancer, and the survival of the generation. Ensuring food security, sustainable agriculture, and preserving water and soil resources, along with ecological and social issues and characteristics, and its important strategies and policies, is a controversial approach, given the importance of the issue. The occurrence of droughts, increasing temperatures, greenhouse gas production, and increased factory activity are clear reasons for climate change and the deterioration of food security. Food security and climate change are two inseparable components that directly affect each other. The agricultural sector is considered an important institution in the field of food production, which today faces the challenge of reduced rainfall, soil fertility, climate change, and lack of production potential. Unfortunately, in the past two decades, the phenomena of changing agricultural land use, construction of parks, industrial estates, and infrastructure development have been occurring at an ever-increasing pace, accelerating, and expanding, and are considered a significant threat to food security and threatening the country's economy in the agricultural sector. The purpose of this research is to collect the results of research and materials conducted on this subject and to examine and analyze the effects of climate change on components involved in food security, such as water resources, agriculture, forestry and land use, health, industry, food security, and sustainable national security; and effective methods and solutions have been discussed in this regard.*

**Keywords:** Climate change, food security, strategic planning.

### Introduction:

*The increase in the temperature of the Earth's atmosphere, precipitation fluctuations, reduction of the Earth's water, floods caused by heavy rainfall, drought, soil erosion, heavy winds, severe storms, fog, and others have had the greatest impact on the production of agricultural products and food, natural resources and the environment, and human societies. The occurrence of droughts and the increase in temperature and the production of greenhouse gases and the activity of factories have caused global warming and the phenomenon of climate change. In recent years, the discussion of climate change and its effects on the environment has been one of the important issues related to humans and other creatures (Pearce et al., 2015). The effect of climate change on health and well-being, environmental hazards, conflicts and security of countries, water resources, bio-climate, tourism, agriculture, food security, economy, etc. are important and practical topics in research. The occurrence of droughts and ensuring food security have been one of the criteria and goals of the elites and the governance systems of countries since ancient times. From the perspective of optimal management and principled and sustainable exploitation of production resources such as soil water, vegetation, pastures and forests, etc., in*



accordance with ecological capacity and land use planning, it is an essential and undeniable matter in achieving and maintaining food security. Among the important challenges facing the country's agriculture are the excessive decline of groundwater tables, salinization of water resources, and the conversion of cultivated lands into saline lands, the results of which we are witnessing the impact of which on the threat to food security (El-Ramady et al., 2024).

*Effects of climate change on food security Appropriate solutions:*

*Reduction in agricultural production: Economic and social development, ensuring food security of the people and access to sufficient food depend on access to and sustainable management of water resources. Drought stress is one of the most important environmental factors that reduce the growth and performance of many crops, especially in arid and semi-arid regions of the world. Reduction in photosynthesis due to the closure of stomata, reduced plant growth, and lack of photosynthetic materials necessary for filling seeds are among the most important effects of drought on plants. Water shortage affects the process of photosynthesis, respiration and transpiration by affecting cell swelling and, as a result, the opening and closing of stomata, and on the other hand, negatively affects plant growth by affecting enzymatic processes that are directly controlled by water potential (Majumdar et al., 2024). Climate change affects water resources in general and access to surface and groundwater in particular by changing precipitation patterns, intensity, duration and frequency of rainfall. In recent years, climate change has attracted much political, economic, social, and cultural attention due to its direct impact on water availability. The agricultural sector is most affected by climate change due to its strong and undeniable dependence on water. In addition, agricultural production, especially rainfed agriculture, is very vulnerable to the effects of this issue. For example, in Africa and South Asia, according to research, reduced rainfall will reduce average crop yields by about 8 percent by 2050. According to predictions made in the not too distant future, with an increase in natural events such as storms, floods, hail, droughts, and other climate fluctuations, agricultural yields, food prices, and food production, and ultimately food security, will be affected. Among the effective strategies and policies in this step to manage the effects of climate change on sustainable agricultural production are the following: ( Shariati et al., 2019)*

*1- Changing the timing and pattern of cultivation: Farmers can avoid unfavorable weather periods when conditions are not favorable by changing the timing of planting and harvesting, and thus increase crop productivity.*

*2- Improving water resource management: Water is an important and vital element in the agricultural sector and plays an important role in adapting to the climate.*

*Managing water resources through the use of advanced systems and technology and replacing old irrigation methods can help with irrigation efficiency.*

*3-Rainwater storage and management: Building reservoirs, resources, and methods that can store rainwater during times of the year when rainfall occurs and uses it during drought periods and seasons when we face a water shortage crisis (Xu et al., 2020).*

*4- Use of technologies and modernization of agriculture:*

*The use of modern technologies that we see in advanced countries helps to improve efficiency and productivity in agriculture; for example, the use of satellite data (data related to regional rainfall, soil texture, flood history, etc.), geographic information management*

*5-Cultivation of plants resistant to adverse environmental conditions:*

*By breeding and genetic modification: Use of varieties, species, seeds and plants resistant to diseases, pests, and genetically modified and compatible with the climate and climatic conditions of the desired region. For example:*

*Crop crops: barley, sorghum, millet, and some varieties of wheat and legumes are adaptable to water shortage conditions (Abbasnouvinpour et al., 2022).*

*Cultivation of garden, ornamental and medicinal plants: Plants such as aloe vera, cacti, succulents, geraniums, lavender, lilies, or resistant shrubs such as elderberry and azalea, and trees such as pistachio, elderberry, azalea, eucalyptus, and pine, which are resistant to drought conditions due to their strong root systems and help preserve soil and reduce erosion.*

*6- Development and promotion of sustainable agriculture: Development and promotion of sustainable agriculture means using modern programs and strategies focused on preserving the environment, plant and animal ecosystems for economic, social and cultural sustainability in the field of agriculture. This national approach aims to preserve water and soil resources and preserve non-renewable resources, reduce the use of chemical inputs, protect biological resources and promote organic and sustainable agriculture.*



*The importance of sustainable or ecological agriculture is achieved by reducing soil and water pollution, preserving biodiversity, reducing greenhouse gas emissions, using biological and organic fertilizers, limiting the use of chemical fertilizers and pesticides with the aim of meeting the food needs of the present and future generations without endangering natural resources (Ahmed et al., 2021).*

#### *7\_ Agricultural education and promotion:*

*Education and promotion play an important role in raising awareness and literacy levels of farmers and promoting methods of adapting to climate change. Training farmers, holding training courses, practical workshops, and promoting the experience of successful farmers in this field, as well as international cooperation with relevant countries, organizations, and bodies in the field of sustainable agriculture are helpful measures.*

#### *8- Use of organic and biological fertilizers to maintain sustainable agriculture:*

*Industrial, agricultural, and urban activities have caused the production and disposal of waste and have created short-term and long-term problematic consequences for environmental health. In order to increase soil organic matter, it is necessary to use all organic sources, including agricultural waste; one of the aspects of sustainable agriculture is the combined use of organic biological fertilizers and nitrogen instead of chemical fertilizers or the combined use of chemical and organic fertilizers, which is an effective solution for crop production and maintaining yield at the desired level. According to recent research, organic fertilizers reduce the side effects of chemical fertilizers by producing humus and improve their effect (Allen et al., 2019).*

*The use of animal manure, vermicompost, which is common in sustainable soil management systems, and the use of 5 to 10 tons of animal manure per hectare can neutralize the negative effects of machinery on the soil. The positive effects of animal manure on soil fertility, increasing soil organic matter, plant growth and development, and soil enrichment have been frequently mentioned in the sources. Another organic material is vermicompost, which is produced by processing organic waste such as animal manure and plant waste by a group of earthworms. These materials have high porosity, high absorption and retention power of mineral elements, proper ventilation and drainage, high water retention capacity, no unpleasant odor, and no pathogens. Today, its use in sustainable agriculture is common to improve the growth and quality of crops and gardens; they contain most of the elements needed by plants, are a suitable alternative to chemical fertilizers, and can fertilize the soil in the long term by creating a nutritional balance. In addition to environmental pollution and limiting the population of beneficial soil organisms and microorganisms such as bacteria, fungi, ants, etc., and the lack of micronutrients, the performance of crops is reduced, and as a result, soil acidification, reduced biological activities, and changes in soil physical properties lead to. Therefore, one of the important pillars in sustainable agriculture is the use of beneficial soil microorganisms as a supplement or alternative to chemical fertilizers, which today are known as biofertilizers. Growth-promoting bacteria, by improving nutritional conditions and producing growth-promoting compounds in plants, improve and accelerate various stages of growth such as germination and seedling (American et al., 2024).*

**Conclusion:** *Climate change has widespread effects on the agricultural sector, global food security, and various aspects of human life, and can be considered a major threat. Today, in every corner of the world, we are witnessing phenomena caused by climate change, including drought, subsidence, water shortages in underground passages and dams, economic changes and social unrest, health and well-being, pollution and dust, and recognizing the adverse effects of this phenomenon and raising awareness among the heirs of the earth to adapt to the effects of climate change in order to reduce vulnerability, control the process of environmental destruction and restore the damage done to nature is an important matter. Factors affecting climate change include construction activities, facilities and constructions, factories, deforestation, transformation and changes in plant and animal ecosystems, industries and refineries, which have been realized by human hands. Given the current conditions, ensuring and maintaining food security is of particular importance due to the significant increase in population and climate change; Therefore, it is expected that with policies, strategic plans, and proper and reasonable strategies, by officials, governments, and relevant organizations and bodies, various aspects of water resources and soil erosion and the environment will be preserved, planned, and reviewed. Using and implementing methods that can replace traditional and old-fashioned agriculture by farmers to increase the efficiency and productivity of agricultural production and increase their level of literacy and information in this field is considered a positive and effective step. However, in order to overcome this major problem in order to align the increasing demand for food and population growth, the application of smart technologies and advanced technologies*



that we are witnessing in advanced countries, adapting adaptive plant cultivation patterns, replacing renewable resources with fossil fuels, and reducing greenhouse gas production can undoubtedly be very effective in preventing the consequences and harms of climate change.

Based on the above-mentioned information, the importance of climate factors in various areas, including the food system, in other areas such as architecture, energy, transportation, storage and processing, health and wellness, and ultimately the reduction in access to resources and the threat to livelihoods and food security, which have been a trend in the country in recent years, is undeniable.

In this research and study, the effects of climate change were examined separately and separately, and the impact that these factors have on life and society was measured from various aspects, and practical and efficient solutions were described in this regard.

## REFERENCES

- [1] Abbasnouvinpour, E., Karimi, F., & Rezaie, H. (2022). The prediction of groundwater level in Ghorve plain using MODFLOW model in different scenarios of LARS-WG climate change. *Water And Soil Science*, 4(32), 61-73. <https://doi.org/10.22034/ws.2021.30465.2197> [In Persian].
- [2] Ahmed, M., Aqnouy, M., & El Messari, J. S. (2021). Sustainability of morocco's groundwater resources in response to natural and anthropogenic forces. *Journal Of Hydrology*, 603, 126866. <https://doi.org/10.1016/j.jhydrol.2021.126866>.
- [3] Allen, M., Antwi-Agyei, P., Aragon-Durand, F., Babiker, M., Bertoldi, P., Bind, M., ... & Zickfeld, K. (2019). Technical Summary: Global warming of 1.5 C. An IPCC Special Report on the impacts of global warming of 1.5 C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. <https://pure.iiasa.ac.at/15716>.
- [4] American Meteorological Society. (2024). Climate change. In glossary test. *ametsoc. net* dictionary. Retrieved 10:22, 26 March 2024 from [https://glossarytest.ametsoc.net/wiki/Climate\\_change](https://glossarytest.ametsoc.net/wiki/Climate_change).
- [5] El-Ramady, H., Brevik, E. C., Abowaly, M., Ali, R., Saad Moghanm, F., Gharib, M. S., & Prokisch, J. (2024a). Soil degradation under a changing climate: management from traditional to nano-approaches. *Egyptian Journal of Soil Science*, 74 (1).
- [6] Majumdar, A., Mullick, D., & Srivastava, S. (2024). 'Save Soil 'by managing soil nutrient losses, agronomic practices and crop-microbial interaction: World Soil Day 2022. *Frontiers in Sustainable Food Systems*, 8, 1360937.
- [7] Pearce, J. A., & Robinson, R. B. (2015). *Strategic management: Planning for domestic & global competition*. (No Title).
- [8] Shariati, S., Pourbabaee, A. A., Alikhani, H. A., & Rezaei, K. A. (2019). Assessment of phthalic acid esters pollution in Anzali wetland, north of Iran. *International Journal of Environmental Science and Technology*, 16, 7025-7036.
- [9] Xu, Z., Cheng, L., Luo, P., Liu, P., Zhang, L., Li, F., & Wang, J. (2020). A climatic perspective on the impacts of global warming on water cycle of cold mountainous catchments in the Tibetan plateau: A case study in Yarlung Zangbo river basin. *Water*, 12(9), 2338. <https://doi.org/10.3390/w12092338>.

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**7**<sup>th</sup> International Conference on  
**Studies of Agricultural Engineering  
Farming and Plant Breeding**

