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STUDIES ON CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE

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Abstract: At the global level, climate change represents a major factor influencing agriculture, affecting both productivity and the stability of agricultural systems. Rising average temperatures, changes in precipitation patterns, and the increased frequency of extreme events, such as droughts and floods, lead to significant variations in crop yields. At the same time, climate change influences soil quality, the availability of water resources, and the spread of pests and diseases, generating additional pressures on farmers. In the present article, the authors analyse the factors that drive climate change, its effects, as well as certain measures required to limit the impact of these changes.

• **Introduction**

Climate change represents major and long-term transformations of the Earth’s climate, manifested through changes in temperatures, precipitation patterns, and other meteorological phenomena. Although such variations may occur naturally, their pace has increased considerably in recent decades due to human activities, particularly greenhouse gas emissions. Recent changes in the global climate system – evidenced by rising average temperatures, shifts in precipitation regimes, and the reduction of ice and snow cover—generate multiple, quantifiable, and increasingly pronounced effects. Current data indicate that 2024 was the warmest year on record globally, with an average temperature exceeding approximately 1.5°C above the pre-industrial period, confirming the accelerated trend of climate warming.

In this context, the main consequences can be summarised as follows:

- (1) **Decline in biodiversity** – climate change significantly contributes to ecosystem degradation and the loss of natural habitats.
- (2) **Rising sea and ocean levels** – a phenomenon primarily driven by glacier melting and the thermal expansion of ocean water.
- (3) **Intensification of extreme weather events** – climate change leads to a higher frequency and intensity of extreme events, such as heatwaves, droughts, floods, and severe storms.
- (4) **Impact on human health** – climatic effects are also reflected in population health, through the deterioration of air quality, the spread of climate-sensitive diseases, and increased mortality during extreme heat episodes.

Overall, recent data confirm that climate change is no longer merely a theoretical projection, but a current phenomenon with measurable and increasing effects, requiring urgent intervention at a global level. These transformations particularly affect agriculture, especially in regions dependent on traditional farming, where adaptive capacity is limited.



• **Material and method**

The paper analyses climate change in the contemporary context and highlights its effects on society, with emphasis on its influence on agriculture. The study examines the implications and consequences of climatic phenomena in Romania, while also providing a perspective on their impact at the national level. Various methods and strategies are identified and proposed in order to mitigate adverse effects and contribute to the prevention of damage caused by extreme weather events.

The research methodology is primarily based on a bibliographic analysis of recent specialised literature in the field, including volumes and scientific articles indexed in well-established international databases, such as Web of Science, Scopus, and Google Scholar. Furthermore, a comparative analysis is conducted between the current situation in Romania and that at the European level, using data from recognised statistical sources, such as Eurostat and INSEE.

• **Results and discussions**

Climate change represents long-term modifications of the global climate system, manifested through variations in average temperature, precipitation patterns, and the frequency of extreme weather events. These transformations result from the interaction between **natural and anthropogenic factors**, which influence the Earth’s energy balance.

Among **natural factors**, **solar variability** plays an important role, as changes in solar activity lead to fluctuations in the amount of solar radiation received by the planet. **Volcanic eruptions** also contribute to climate change by releasing particles and aerosols into the atmosphere, which reflect part of the incoming solar radiation and may cause temporary cooling of the climate. **Earth’s orbital cycles**, known as the Milankovitch cycles, influences the distribution of solar energy across the Earth’s surface and are associated with the alternation of glacial and interglacial periods.

Anthropogenic factors exert a dominant influence on climate evolution. **Human activities**, particularly **the combustion of fossil fuels in industry, transport, and energy production**, lead to increased concentrations of greenhouse gases. **Deforestation** reduces the capacity of ecosystems to absorb carbon dioxide. **Industrial pollution** and **atmospheric aerosols** influence the climate by altering cloud formation processes and the radiative balance.

Category of Factors	Factors	Effects
Natural	Solar variability	Modifies the amount of energy received from the Sun
	Volcanic activity	Atmospheric aerosols → temporary cooling
	Milankovitch cycles	Orbital changes → long-term climate variations
Anthropogenic	Greenhouse gases	CO ₂ , CH ₄ , N ₂ O → global warming
	Deforestation	Reduce CO ₂ absorption from the atmosphere
	Agriculture	CH ₄ from livestock, N ₂ O from fertilisers
	Industry	Fossil fuel combustion → CO ₂ emissions
	Aerosols	Modify solar radiation and cloud formation

Extreme events have become more frequent and more intense. Agriculture is particularly vulnerable, being affected by the alternation between drought and excessive precipitation, which leads to production fluctuations and economic losses. Climate change has significant effects on agriculture, influencing productivity, crop stability, and the natural resources required for agricultural production. Romania is facing an intensification of the effects of climate change, with direct implications for the economy and society, thereby highlighting the need to adopt effective measures for adaptation and risk reduction.

• **Conclusions**

Policies and scientific research play an essential role in supporting the agricultural sector, through the development of innovative solutions and the promotion of responsible resource management. Agriculture must continuously adapt to new climatic conditions in order to ensure food security and long-term sustainability.

The adoption of modern and innovative agricultural production methods is required, involving the implementation of advanced, highly digitalised technological systems for land preparation and management, with the aim of optimising soil water retention and limiting degradation processes such as erosion. The cultivation of crops in protected environments, where suitable, represents a reliable and efficient method. The principles of sustainability should be integrated into the overall framework of strategic decision-making in the agricultural sector at the national level.