



ULST Timisoara
**Multidisciplinary Conference on
Sustainable Development**
15-16 May 2025



AGRICULTURE IN THE CONTEXT OF CLIMATE CHANGE: BETWEEN VULNERABILITY AND ADAPTATION

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Abstract: The climate change represents one of the most pressing global challenges, with profound implications for agricultural systems and food security, particularly in vulnerable regions. The growing frequency of extreme weather events, changes in precipitation and temperature patterns, as well as the degradation of natural resources, directly affect agricultural productivity and the stability of rural ecosystems. In this context, agriculture becomes a vulnerable sector, but at the same time holds significant potential for sustainable adaptation and transformation. This article aims to analyze the multidimensional impact of climate change on agriculture and its cascading effects on food availability, access, and stability. The main objectives of the study are: (1) to identify the key climatic variables affecting agricultural productivity; (2) to assess the vulnerability of different agricultural sectors to climate-related risks; and (3) to explore the implications for national and regional food security.

• Introduction

Climate change represents one of the greatest challenges of the 21st century, and agriculture is among the most affected sectors. Its direct dependence on natural conditions makes agricultural production extremely vulnerable to climate variations such as droughts, floods, or sudden temperature changes. Nevertheless, in the face of these threats, agriculture also holds significant potential for adaptation through innovation, best practices, and sustainable policies. This paper aims to analyze the impact of climate change on agriculture and to explore the main directions for sustainable adaptation in the face of this global phenomenon.

• Material and method

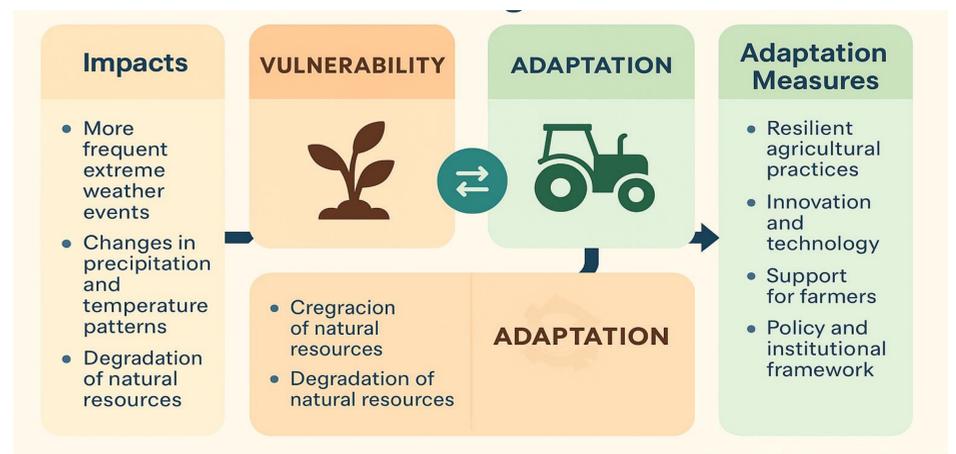
The research employs a mixed-methods approach. Quantitatively, the study analyzes climate data (temperature, precipitation, extreme weather events) and agricultural yield statistics over the last two decades, using regression models to identify correlations and trends. In addition, relevant policy documents were reviewed to evaluate institutional responses to climate-induced food insecurity.

• Results and discussions

Agriculture is one of the most exposed sectors to the effects of climate change due to its direct dependence on weather conditions and the balance of natural ecosystems. The **vulnerability** of agriculture is reflected in declining yields, loss of biodiversity, soil degradation, and increased economic risks for farmers. Regions already affected by drought or flooding are becoming increasingly unstable, which negatively impacts global food security.

On the other hand, agriculture can play an active role in adapting to climate change, becoming a driving force in the ecological transition.

Through the adoption of smart practices, supported by coherent policies, investments, and collaboration between local and global actors, agriculture can become a model of resilience and innovation in the face of the climate crisis. Thus, the transition from vulnerability to adaptation is not only possible, but necessary for a sustainable future.



Agriculture in the context of climate change

This involves:

- ❑ **implementing sustainable farming** practices such as crop rotation, agroecology, or the use of climate-resilient varieties,
- ❑ **integrating modern technologies** (smart irrigation systems, digital weather forecasting, precision agriculture),
- ❑ **strengthening institutional capacity** and providing **financial support to farmers**.

Effective adaptation requires an integrated approach that combines science, innovation, public policy, and local knowledge. Essentially, between **vulnerability** and **adaptation** lies a window of opportunity which, if harnessed, can transform agriculture from a sector at risk into one that is resilient and sustainable.

• Conclusions

Findings reveal a clear negative trend in crop productivity in certain regions due to increased frequency of droughts and unpredictable weather patterns. Climate change has exacerbated existing inequalities in food access, particularly among smallholder farmers. The study highlights the urgent need for integrated adaptation strategies—such as climate-resilient crops, improved irrigation systems, and early warning mechanisms—combined with supportive public policies to mitigate the effects of climate change on agriculture and ensure long-term food security.