

Climate Change: Global Concepts, Human Adaptation, and Regional Perspectives

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Abstract - Global climate change is one of the most important challenges facing today's world and directly affects both natural systems and human life. It is mainly caused by increased greenhouse gas emissions resulting from human activities such as fossil fuel use, deforestation, and industrial development. Climate change leads to rising temperatures, changing rainfall patterns, more frequent extreme weather events, and environmental degradation. Albania, as part of the Mediterranean region, is particularly sensitive to these changes. In recent decades, the country has experienced warmer summers, irregular precipitation, longer drought periods, and an increased risk of floods and heatwaves. These impacts affect everyday life, especially agriculture, water availability, ecosystems, and human health. This topic introduces students to the global causes and consequences of climate change while using Albania as a practical and familiar example. The educational approach aims to raise awareness, encourage critical thinking, and promote responsible environmental behavior among young people. Understanding climate change at both global and local levels is essential for building an informed and environmentally conscious generation.

Keywords: Climate Change, Human Adaptation, Regional Perspectives, Albania

Introduction

In exploring the relationship between the Earth system and human society, climate and climate change are key subjects for discussion. The term "climate" refers to the long-term patterns of temperature, precipitation, wind, and other atmospheric factors, while "weather" refers to short-term fluctuations in these conditions. The scientific community's information indicates that the global climate system is undergoing rapid change, primarily due to human activities. This shift is significantly impacting ecosystems, economies, and civilizations globally.

Several components of the solar system influence Earth's climate. The components of the Earth system comprise the biosphere, lithosphere, cryosphere, hydrosphere, and atmosphere. These components continuously interact with each other through the transfer of energy and matter. This contact is perpetually

occurring. Greenhouse gases, including carbon dioxide, methane, and nitrous oxide, regulate Earth's temperature. Since the onset of the Industrial Revolution, human activity has significantly contributed to the greenhouse effect, which regulates temperatures.

Climate-resilient agriculture involves developing crop varieties that can withstand droughts, floods, or heat stress, as well as diversifying farming systems to reduce vulnerability to single shocks. Farmers may adopt agroforestry, conservation tillage, or precision agriculture to maintain productivity under changing conditions.

Climate Change and Driving Forces

Current climate change is mainly driven by anthropogenic (human-related) activities that alter the natural balance of the Earth's climate system. The most significant driving force is the combustion of fossil fuels—such as coal, oil, and natural gas—for energy production, transportation, and industry. These activities release large amounts of carbon dioxide (CO₂) into the atmosphere, enhancing the greenhouse effect and leading to global warming.

Additional drivers include deforestation and land-use change, which reduce the planet's capacity to absorb carbon dioxide, as well as industrial processes that emit greenhouse gases during manufacturing and construction. Agriculture also plays an important role through methane emissions from livestock and rice cultivation, and through nitrous oxide emissions from fertilizer use. Furthermore, waste management practices, particularly landfilling and untreated waste decomposition, contribute to methane emissions.

Together, these factors increase atmospheric greenhouse gas concentrations, resulting in rising global temperatures, altered precipitation patterns, melting ice, sea-level rise, and a higher frequency and intensity of extreme weather events such as heatwaves, droughts, floods, and storms.

Human Society and Climate Adaptation

Adaptation refers to adjustments in human and natural systems to reduce harm from climate impacts. It is a dynamic process that reflects both immediate responses to hazards and long-term strategies to build resilience. Human societies adapt in diverse ways depending on geography, culture, and resources, but common approaches include climate-resilient agriculture, improved water management, strengthened infrastructure, and public health preparedness.

Improved water management is critical as climate change alters rainfall patterns and increases the frequency of droughts. Strategies include rainwater harvesting, efficient irrigation systems, and integrated watershed management to ensure sustainable access to freshwater.

Strengthened infrastructure helps communities withstand extreme events such as floods, storms, and heatwaves. Examples include flood-resistant housing, coastal defenses, and transportation networks designed to remain functional during climate disruptions.

Public health preparedness addresses the growing risks of climate-related illnesses, such as heat stress, vector-borne diseases, and respiratory conditions linked to air quality. Investments in surveillance systems, emergency response plans, and equitable healthcare access are essential to protect vulnerable populations.

Adaptive capacity — the ability of societies to implement these measures — varies widely across regions. Wealthier nations often have greater financial and technological resources, while poorer regions may rely more on community-based initiatives and traditional knowledge. Governance plays a decisive role: transparent institutions and effective policies enable coordinated responses, whereas weak governance can hinder adaptation. Education and knowledge dissemination also matter, as informed communities are better equipped to adopt adaptive practices and innovate solutions.

Ultimately, adaptation is not a one-time adjustment but a continuous process of learning, planning, and responding to evolving climate risks. Strengthening adaptive capacity requires investment in resources, governance, and education, ensuring that societies can respond effectively to climate challenges while safeguarding livelihoods and ecosystems.

Current Global Situation

Globally, the Earth's climate system is undergoing rapid and measurable changes. Average surface temperatures have increased significantly over the past century, with the most pronounced warming occurring in recent decades. This warming has led to widespread melting of glaciers and polar ice sheets, particularly in the Arctic and Antarctic regions. As a result, global sea levels are rising due to both ice melt and the thermal expansion of warming oceans, increasing the risk of coastal flooding and erosion worldwide.

Climate change is also reflected in the growing frequency and intensity of extreme weather events. Heatwaves are becoming longer and more severe, droughts are affecting large regions, and heavy rainfall events are increasing the risk of floods and landslides. At the same time, tropical storms and cyclones are showing stronger intensity in many regions, causing widespread damage to infrastructure, ecosystems, and human settlements.

The impacts of these changes extend beyond the natural environment and increasingly affect human societies. Agriculture, water resources, energy production, and public health are particularly vulnerable to climate variability. Food security is threatened in many regions due to reduced crop yields, while water scarcity is becoming a major concern for both urban and rural populations.

Despite growing scientific evidence, international agreements, and increased public awareness, global greenhouse gas emissions remain high. Economic growth, continued dependence on fossil fuels, and uneven implementation of climate policies slow progress toward emission reduction goals. This situation highlights the urgent need for coordinated global action, stronger mitigation efforts, and effective adaptation strategies to limit future climate risks and protect both present and future generations.

Climate Change in the Mediterranean Region

The Mediterranean region is widely recognized as a climate change hotspot due to its unique geography and vulnerability to shifting weather patterns. Over the past decades, observed trends include steadily rising average temperatures, declining rainfall, and prolonged periods of drought. Extreme heatwaves have become more frequent and severe, often pushing infrastructure and public health systems to their limits. At the same time, the risk of wildfires has escalated, threatening both rural landscapes and urban areas. These environmental changes have profound consequences: water scarcity is intensifying, placing stress on agriculture and food production; ecosystems and biodiversity are under pressure as species struggle to adapt;

and tourism, a cornerstone of the region's economy, faces challenges as traditional attractions are disrupted by heat, fire, and ecological degradation. Together, these impacts highlight the urgent need for adaptation strategies and sustainable resource management across Mediterranean societies.

Climate change impact on Albania

Albania is particularly vulnerable to the impacts of climate change due to its Mediterranean climate, mountainous terrain, and dependence on climate-sensitive sectors such as agriculture, hydropower, and tourism. In recent decades, the country has experienced steadily rising temperatures, prolonged droughts that strain water supplies and crop yields, and increasingly irregular rainfall patterns that disrupt traditional farming cycles. Floods have become more frequent and destructive, damaging infrastructure and livelihoods, while coastal erosion threatens communities along the Adriatic and Ionian shores. These environmental pressures are compounded by socio-economic challenges, making resilience-building a national priority. Strengthening climate education can raise awareness and empower communities to adopt adaptive practices. Improved governance and institutional coordination are essential for implementing effective policies, while sustainable resource management—particularly in water, energy, and land use—will play a decisive role in safeguarding Albania's future development. Together, these measures form the foundation for enhancing national resilience in the face of accelerating climate risks.

Future Projections

Climate models consistently project continued warming across the globe throughout the 21st century, with the magnitude of change depending on future greenhouse gas emission pathways. Even under moderate scenarios, average temperatures are expected to rise significantly, intensifying the frequency and severity of extreme weather events such as heatwaves, droughts, and heavy rainfall episodes. Water stress is anticipated to worsen, particularly in regions already facing scarcity, while sea-level rise threatens coastal zones with flooding, saltwater intrusion, and habitat loss. These changes pose serious risks to food security, as shifting climate conditions disrupt agricultural productivity and supply chains. Ecosystems will face mounting pressures, with biodiversity loss accelerating as species struggle to adapt to rapidly changing environments. Vulnerable regions such as the Mediterranean are projected to experience disproportionate impacts, given their reliance on climate-sensitive sectors and limited adaptive capacity. These projections underscore the urgency of global mitigation efforts and the need for robust adaptation strategies to safeguard communities, economies, and natural systems in the decades ahead.

Conclusion

Climate change is one of the defining challenges of the modern era, affecting natural systems and human societies at local, regional, and global scales. Human activities are the primary drivers of recent climatic changes, intensifying environmental pressures and social vulnerabilities. The Mediterranean region, including Albania, illustrates how climate-sensitive areas face compounded risks from warming temperatures and water scarcity. Future projections emphasize the urgency of mitigation and adaptation, but also highlight the role of education in building long-term resilience. By improving climate literacy and promoting sustainable practices, societies can better prepare younger generations to respond responsibly to climate change and contribute to a more sustainable future.

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