



Climate Change and Their Impact on Food Security

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ABSTRACT

The extensive impact of climate change on food security and presents strategies for alleviating its effects. Climate change leads to alterations in temperature and precipitation patterns, which disturb agricultural systems and result in diminished crop yields. It also has repercussions for freshwater resources, disproportionately impacting vulnerable communities, especially small-scale farmers who depend on rain-fed agriculture. Moreover, global fisheries are being disturbed, affecting the accessibility of marine protein sources. To tackle these challenges, a comprehensive approach is essential, encompassing climate-resilient agriculture, enhanced water management, and social safety measures. International collaboration and efforts to reduce emissions are of paramount importance. In essence, climate change represents a significant menace to food security, underscoring the necessity for coordinated actions across all levels to ensure a sustainable and resilient food supply for the expanding global population.

KEYWORDS

Climate, Food Security, Fisheries, Overfishing, Social

Introduction

Global climate variations are linked to significant sources of greenhouse gases, notably carbon dioxide, methane, and nitrous oxide, emitted into the atmosphere due to activities like fossil fuel burning, intensive agriculture, and deforestation. Researchers universally agree that climate change affects 36 different agricultural categories. With the world's growing population, changing dietary habits, and increasing incomes, the demand for food is anticipated to rise [1]. Food security denotes the capacity of individuals to obtain essential, nourishing food. According to the United Nations' Committee on World Food Security, it means that everyone should have the physical, social, and economic means to access adequate, safe, and nutritious food that aligns with their preferences and dietary requirements for a healthy life (United Nations' Committee on World Food Security, as cited in Ayinde et al., 2011). The World Food Summit in 1974 defined food security as the continuous availability of essential food supplies to support increased consumption and compensate for production and price fluctuations (World Food Summit, as cited in Ayinde et al., 2011).

What is climate change

Climate change, often characterized by enduring alterations in temperature and atmospheric conditions, can arise from natural phenomena like fluctuations in the solar cycle. Nonetheless, since the 1800s, human actions have become the predominant driver of climate change, primarily due to the combustion of fossil fuels such as coal, oil, and natural gas. The burning of these fossil fuels generates emissions of greenhouse gases, which act like a thermal insulator around the Earth, trapping solar heat and leading to temperature increases. Notable examples of greenhouse gas emissions responsible for driving climate change include carbon dioxide and methane. For instance, these emissions are produced when coal or fuel is burned to heat a structure. Furthermore, deforestation and changes in land use can release carbon dioxide into the atmosphere. The primary source of methane emissions is waste disposal sites. Key sectors contributing to these emissions include energy production, industrial processes, transportation, construction, agriculture, and land utilization.

Food security:

Food security pertains to the presence, availability, and effective utilization of sustenance for both

individuals and communities. Put differently, it signifies that individuals possess the means to acquire an adequate, safe, and nutritious food supply that aligns with their dietary requirements and personal food preferences, facilitating an active and healthy lifestyle. Conversely, food insecurity arises when individuals lack access to a sufficient food supply to fulfill their fundamental necessities. This condition may stem from various factors, such as poverty, conflict, climate change, and natural calamities. Attaining food security necessitates a comprehensive strategy that encompasses the entire food ecosystem, encompassing production, distribution, consumption, and waste management. This encompasses enhancing agricultural methods, expanding farmers' access to markets and financial services, reducing food wastage, and enhancing nutritional education and healthcare access.

Impact of climate change on food security:

Global food security is significantly impacted by climate change. Crop productivity, food prices, and access to food can all be impacted by changes in weather patterns, temperatures, rainfall, and extreme weather events. Here are a few ways that climate change may have an impact on food security.

Reduced crop yields:

Higher temperatures and changes in rainfall patterns can lead to reduced crop yields. For example, crops may not get enough water to grow properly or may be damaged by extreme weather events such as floods or droughts. When crop yields are reduced, food prices tend to rise. This can make it difficult for low-income families to afford enough food to eat.

Food availability and quality:

Climate change can affect the availability of certain foods. For example, changes in temperature and rainfall patterns can affect the growth of certain crops, leading to food shortages. Changes in weather patterns can also affect the quality of food. For example, warmer temperatures can lead to the growth of harmful bacteria and fungi, making food unsafe to eat.

Impacts on fisheries:

Climate change has significant and far-reaching effects on food security, including in the context of fisheries. The impacts of climate change on fisheries are complex and multifaceted, affecting both the availability and quality of seafood resources. This can have profound implications for global food security, as seafood is a vital source of protein and essential nutrients for millions of people worldwide.

1.Changing Ocean Temperatures and Fish Distribution:

As global temperatures rise, ocean temperatures also increase. This leads to shifts in the distribution of marine species, including fish. Fish that were once abundant in certain regions may move to cooler waters, affecting local fisheries (Cheung et al., 2013).

2. Ocean Acidification:

Increased carbon dioxide (CO₂) levels in the atmosphere lead to ocean acidification. This can harm marine ecosystems, particularly species with calcium carbonate shells or skeletons, such as some shellfish and plankton. Changes in the food web can have cascading effects on fisheries (Doney et al., 2009).

3.Extreme Weather Events:

Climate change has led to an increase in the frequency and intensity of extreme weather events, such as hurricanes and typhoons. These events can damage fishing infrastructure, disrupt fishing operations, and result in economic losses for fishers (Halpern et al., 2019).

4.Loss of Habitat and Ecosystem Changes:

Rising sea levels and coastal erosion can lead to the loss of critical fishery habitats, such as mangroves and coral reefs. These ecosystems are essential for the breeding and feeding of many

marine species (Perry et al., 2018).

5.Overfishing and Fisheries Management Challenges:

Climate change has the potential to worsen overfishing by diminishing the overall productivity of fisheries. Furthermore, it can complicate the management of fisheries as changing environmental conditions make fish populations less predictable (Cheung et al., 2010). Overfishing represents a significant challenge in global fisheries, with profound consequences for marine ecosystems, fish populations, and food security. It arises when fish are harvested at a rate surpassing their natural capacity for reproduction and growth, resulting in the depletion of fish stocks. Overfishing is characterized as "the extraction of more fish from a population than is sustainable," causing a decline in fish populations and the possibility of ecological impacts (Pauly et al., 2002). Overfishing can lead to reduced catches, economic losses, and adverse ecological effects, including alterations in the composition of marine ecosystems (Worm et al., 2006). This problem is pervasive, as a worldwide assessment in 2015 revealed that approximately 33% of fish stocks were overfished, with an additional 60% fully exploited (FAO, 2018). These statistics underscore the imperative for the adoption of sustainable fisheries management

approaches. The drivers of overfishing include growing demand for seafood, advancements in fishing technology, and inadequate fisheries governance. The tragedy of the commons, where individual self-interest results in the depletion of shared resources, is a fundamental concern (Hardin, 1968).

Overfishing can culminate in the collapse of fisheries and job losses for those reliant on fishing. Additionally, it can impact global food security, given that seafood constitutes a crucial protein source for billions of people (World Bank, 2020). The implementation of sustainable fisheries management is indispensable for addressing overfishing. Measures such as catch limits, gear restrictions, and the establishment of marine protected areas are essential to replenishing fish stocks and ensuring their long-term viability (Costello et al., 2012).

6. Food Security Implications:

The impacts of climate change on fisheries can lead to reduced fish catches, increased food prices, and reduced access to nutritious seafood. Vulnerable communities that rely heavily on fish as a primary protein source may face food insecurity and malnutrition (Thiault et al., 2019).

7. Adaptation and Mitigation Strategies:

To address the food security challenges posed by climate change, it is

crucial to implement adaptive and mitigative measures. These may include sustainable fisheries management, aquaculture development, and policies to reduce greenhouse gas emissions (Allison et al., 2009). Efforts to mitigate climate change, protect marine ecosystems, and improve fisheries management are essential for ensuring the long-term food security of coastal and fishing-dependent communities.

Climate change-induced agricultural challenges:

Climate change significantly affects agriculture and poses various challenges for farmers on a global scale. It is responsible for prolonged droughts in numerous regions, which can diminish crop yields and lead to soil degradation. The reduced rainfall also places pressure on farmers to seek alternative water sources for irrigation. Conversely, climate change can also trigger extreme weather events such as heavy rainfall and floods, resulting in crop damage, disruptions in supply chains, and food shortages. Variations in temperature and humidity can amplify the proliferation of pests and diseases, causing harm to crops and reducing yields. This may also necessitate increased use of pesticides and other chemical treatments, with potential adverse environmental consequences. Soil erosion and a decline in soil quality are

also consequences of climate change, adversely impacting crop growth and yields. Soil degradation can further lead to diminished water retention and increased nutrient loss, contributing to a deteriorating agricultural landscape. Moreover, climate change can alter growing seasons by shifting temperature and rainfall patterns, making it increasingly challenging for farmers to predict the optimal timing for planting and harvesting crops. These shifts can result in disruptions within supply chains, creating uncertainty within the agricultural industry, and potentially impeding future crop cultivation efforts.

Mitigating climate change effects on food production:

Climate change is one of the biggest challenges facing the global food production system, with changing weather patterns, rising temperatures, and extreme weather events all contributing to reduced crop yields and food insecurity. Here are some ways to mitigate the effects of climate change on food production.

Promote sustainable farming practices:

Sustainable farming practices, such as conservation agriculture, agroforestry, and crop diversification, can help reduce the impact of climate change on food production. These practices can increase soil health and fertility, reduce soil erosion, and conserve water resources.

The use of renewable energy, such as solar and wind power, can help reduce greenhouse gas emissions from agriculture. Farmers can also use renewable energy sources to power irrigation systems, reduce the use of fossil fuels, and improve their energy efficiency.

Improve food storage and distribution:

Better storage and distribution systems can help reduce food waste and increase the availability of food during times of scarcity. This can be achieved through improved transportation infrastructure, better refrigeration systems, and the use of innovative technologies such as blockchain to track food from farm to table.

Educate farmers and consumers:

Education and awareness-raising campaigns can help farmers and consumers understand the impacts of climate change on food production and the importance of taking action to mitigate these effects. By working together, farmers, consumers, and policymakers can develop strategies to ensure food security in a changing climate.

Climate change and global food trade:

Climate change and global food trade are closely interconnected. The effects of climate change, such as rising

temperatures, changing precipitation patterns, and extreme weather events, have significant impacts on global food production and trade. Climate change can lead to reduced crop yields, water scarcity, and increased incidence of pests and diseases, which can lead to food price volatility and supply chain disruptions. For example, droughts in major grain-producing regions can cause crop failures and drive up prices, affecting the availability and affordability of food in importing countries. Global food trade can also exacerbate the impacts of climate change. As the world becomes more interconnected through trade, the effects of extreme weather events, such as floods or droughts, can spread more quickly and have a greater impact on global food prices and availability.

Conclusion:

Climate change has significant impacts on global food security, and its effects are expected to intensify in the coming years. Changes in temperature and precipitation patterns, extreme weather events, and the spread of pests and diseases all have negative effects on crop yields and food production. Moreover, climate change also affects the availability and quality of water, which is a critical resource for agriculture. Ensuring food security in the face of climate change requires concerted efforts to mitigate

greenhouse gas emissions and adapt to the changing climate. This can be achieved through the adoption of sustainable agricultural practices, such as conservation agriculture, agroforestry, and the use of drought-resistant crops. Furthermore, water-efficient irrigation systems, improved storage and distribution systems, and effective land-use planning can also help to ensure food security in the face of climate change. Addressing climate change and food security requires a multi-faceted approach that involves collaboration between governments, international organizations, and local communities. It is essential to invest in research, development, and implementation of sustainable and climate-resilient agricultural practices to secure food production and ensure food security for present and future generations.

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