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Impact of climate change on global food systems: An Empirical study of production, distribution, and consumption patterns

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Abstract

The global economy is in danger because of how climate change is altering the world's food systems and posing serious risks to food security. The food supply chain is vulnerable to unfavorable climatic circumstances like droughts, floods, and other extreme weather events, which can result in crop losses, decreased yields, and fluctuating food prices. Other elements, such as population increase, shifting food trends, and poor infrastructure in underdeveloped nations, add to these effects. Food production and distribution are both impacted by the multifaceted climate change's effect on food systems. Nutritional quality and crop yields are declining because of climate change's changes to the growing environment. Sea-level rise and extreme weather also have an impact on fish and other aquatic resource output. Hunger, malnutrition, and food insecurity may result from climate change's effect on food systems. The world's food systems are seriously threatened by climate change. The food system's vulnerability to climate change must be reduced through mitigation and adaptation measures. These techniques can include creating crops that are resistant to climate change, better water management, and making the food systems more resilient to extreme weather. Achieving food security globally and lowering poverty requires addressing the climate change's effect on food systems.

Keywords: Agriculture, Drought, Soil degradation, Food waste, Supply chains.

Introduction:

Most serious challenges of present time are climate change, which is having a noticeable influence on the world's food systems. The agriculture industry is facing unprecedented difficulties because of rising temperatures, shifting weather patterns and extreme weather events, which could have an impact on livelihoods, nutrition, and food security. The influence on crop yields is one of the most visible of the many and complicated climate change's effect on food systems **(Hoegh-Guldberg, O., & Bruno, J. F. 2010).** While changes in rainfall patterns can make it more difficult to cultivate crops in some locations, rising temperatures can affect the yields of significant crops like wheat, rice, and maize. In addition, extreme weather conditions like floods, droughts, and storms can harm crops, resulting in a shortage of food and an increase in price. These consequences extend beyond only agriculture because the entire food system is linked with other industries including transportation, storage, and processing. Extreme weather

conditions, for instance, might cause delays and deterioration in the shipment of food. The quantity and quality of water, which are crucial for the growth of crops, the care of animals, and fisheries, can also be impacted by changes in weather patterns **(Nardone, A. 2010).** Some regions and populations are more sensitive than others to climate change's effect on food systems, which are more to be unequally distributed. The developing world, which already struggles with poverty and food insecurity, is expected to be struck the worst because it is less able to adjust to changing circumstances.

Small-scale farmers, who frequently rely on traditional knowledge and have restricted access to resources like loans and insurance, are likely to be disproportionately affected. Additionally, climate change affects food production as well as the nutritional quality of food. Changes in rainfall patterns and temperature, for instance, can have an impact on crop nutrition and lower levels of vital vitamins and minerals. Furthermore, as temperatures rise, pests and diseases may become more prevalent, which may reduce the nutritional value of crops and cattle **(Altieri, et al. 2015)**. Climate change's effect on food systems is not simply a potential issue for the future; they are currently being felt in many regions of the world. For instance, droughts have caused crop failures and food shortages in some parts of Africa, and floods have devastated crops and resulted in large economic losses in Asia. Also, as temperatures rise, fisheries, a major source of protein for many populations worldwide, are becoming less productive **(Nelson et al. 2010)**.

A variety of actions are required to address how climate change is affecting food systems. They cover both adaptation and mitigation tactics that can aid increase adaptability to varying environmental conditions while also lowering greenhouse gas emissions. Improvements in water management, the promotion of environmentally friendly farming methods, and giving farmers access to cutting-edge tools and knowledge are all examples of adaptation efforts **(Tol, R. S. J. 2009).** Reducing food waste, encouraging plant-based diets, boosting the effectiveness of the system of food are some examples of mitigation techniques. Also, international collaboration and cooperation will be necessary to address climate change's effect on food systems. To increase resilience and adapt to shifting conditions while also lowering their own greenhouse gas emissions, developing countries will need assistance from wealthier ones. To reduce and reduce emissions, the worst climate change's effect, all nations will need to cooperate. **(Lobell, D. B., & Gourdji, S. M. 2012)** Impact of changing climate on the world's food systems is a complicated and pressing topic, with repercussions for livelihoods, nutrition, and food security. The opportunity to create more resilient and sustainable food systems that can adjust to altering conditions and lessen the effects of climate change outweigh the enormous challenges. All interested parties, including the public and corporate sectors, civic society, and people, must work cooperatively to achieve this.

Literature Review:

Climate change has an impact on food systems of the world. The distribution, consumption of food and production, processing is referred to as the "food system," which also includes the

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resources needed for these processes, such as water, land, and energy. Indirect and direct effects of changing climate on food systems include variations in temperature, rainfall patterns, and sea level rise, and extreme weather events, and ocean acidification. Particularly in vulnerable parts of the world, these effects can cause crop yields to decline, food prices to rise, and food security to decline. Examining literature can help us better understand how changing climate is affecting the world's food systems.

Crop Yields: Via several processes, changing climate is altering crop production. Increased crop respiration, decreased photosynthesis, and shortened growing seasons are all effects of rising temperatures that can lower crop production. By increasing water stress, causing soil erosion, and raising the danger of pests and diseases, changes in rainfall patterns can also lower crop yields. Increased carbon dioxide levels can boost agricultural yields in some areas, but this effect is likely to be countered by other elements, such as increased water stress and temperature extremes. The effect of changing climate on crop yields has been examined in several research. **(Lobell et al. 2011)** Analysis was done and found that a global dataset of maize, wheat, and rice yields and discovered that the adverse effects of changing climate on yields outnumbered any favorable benefits of elevated carbon dioxide concentrations. **(Schlenker and Roberts 2009)** Climate change decreased American maize and soybean yields by 30% and 20%, respectively.

Food Prices: Its effects on crop yields and food demand, climate change can also affect food prices. Food costs may rise as a result of decreased agricultural yields, especially in areas which are dependent on imports for meeting their food requirements. Extreme weather conditions, such as droughts and floods, can also interfere with the flow of food, driving up prices and creating a lack of it. Several studies have evaluated how climate change would affect food costs. Particularly in underdeveloped nations, these price rises may have a severe influence on food security.

Food Security: Access to food is impacted by changing climate, which affects food security. Food supply may be impacted by lower agricultural yields and higher food prices, especially in areas where there is already a food crisis. Extreme weather conditions can also wreak havoc on food supply systems and infrastructure, resulting in shortages of food and an increase in price. Moreover, changing climate has the potential to worsen already existing social and economic disparities, increasing food insecurity. Many studies have evaluated how climate change would affect food availability. The number of malnourished children in sub-Saharan Africa could rise by 20% **(Lobell et al. 2013).** Changing climate may cause a 20% increase in the count of hungry people in growing countries. Particularly in economically and health-vulnerable parts of the world, these effects could have serious negative effects **(Wheeler and von Braun 2013)**.

Nutrition: Because fewer and lower-quality foods are available, changing climate has an impact on nutrition as well. Crops become less nutrient-dense as a result of rising temperatures and shifting rainfall patterns. For instance, elevated levels of carbon dioxide in the environment may result in lower protein content in crops like rice and wheat **(Myers et al., 2014).** The health and

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welfare of the people whose primary source of food comes from these crops may be significantly impacted by this. Foods high in nutrients, like fruits, vegetables, and seafood, are less readily available because of changing climate. The distribution of these items and their production may be impacted by warming temperatures and shifting rainfall patterns, which could result in shortages and higher pricing. Malnutrition may be made worse by this, especially in low-income nations where certain foods would be out of reach.

Adaptation Strategies and Mitigation: To lessen the effects of changing climate on the world's food systems, mitigation and adaptation measures are crucial. Reducing greenhouse gas emissions, changing agricultural methods, and utilizing more renewable energy sources are all examples of mitigation strategies **(Smith et al., 2014).** Research has demonstrated that sustainable agricultural methods, such as integrated crop-livestock systems, agroforestry, and conservation agriculture, can improve soil health, increase soil carbon absorption, and reduce greenhouse gas emissions **(Pretty et al., 2018).** Crops that are resistant to climate change are being developed, water management is being improved, and initial warning systems for extreme weather events are being created as adaptation methods **(Lobell et al., 2011).** According to a study, creating crops that can withstand heat and drought, for instance, could lessen the effects of changing climate on food production **(Hoffmann et al., 2017).** Enhancing water management may also assist farmers in adjusting to shifting precipitation patterns and minimizing the effects of droughts and floods **(Gornall et al., 2010).** To lessen the effect of changing climate on food systems, another strategy is to minimize greenhouse gas emissions. This might be accomplished by taking steps to stop deforestation, increase energy efficiency, and support renewable energy sources. Lowering greenhouse gas emissions could aid in lessening the effects of 'climate change' on crop yields and food security.

Objective:

To measure the impact of climate change on global food systems

Methodology:

This study is descriptive in nature in which the data were obtained from the 200 respondents to find the impact of climate change on global food systems. Different verticals that are covered in this study are production, distribution, and consumption patterns. A checklist question was used to analyze and interpret the data. In a checklist question respondents choose "Yes" or "No" for all the questions.

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Data Analysis and Interpretations:

Table 1 Impact of Climate Change on Global Food Systems

SL No.	Impact of Climate Change on Global Food Systems	Yes	% Yes	No	% No	Total
1	Effects on rising of temperatures that can lower crop production	173	86.50	27	13.50	200
2	Climate change decreased American maize and soybean yields	168	84.00	32	16.00	200
3	Food prices rise due to climate change	179	89.50	21	10.50	200
4	Climate change can cause droughts and floods	181	90.50	19	9.50	200
5	Food supply affected due to climate change	163	81.50	37	18.50	200
6	Increase food insecurity	184	92.00	16	8.00	200
7	Climate change can reduce nutritional content in the food	175	87.50	25	12.50	200
8	Affects shifting of rainfall patterns	187	93.50	13	6.50	200
9.	Impact on distribution and production of food	177	88.50	23	11.50	200

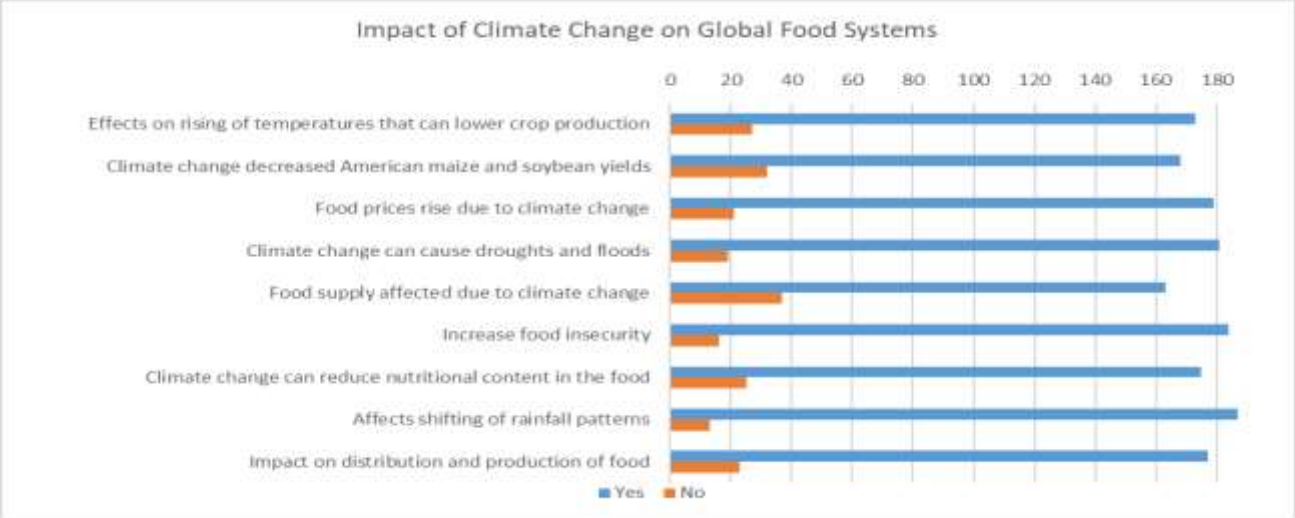

Figure 1 Impact of Climate Change on Global Food Systems

Table 1 and Figure 1 show the impact of climate change on global food systems. It was found that around 92.0% respondents accept that climate change affects shifting of rainfall patterns, Increase food insecurity (95.0%), Climate change can cause droughts and floods (90.5%), Food prices rise due to climate change (89.5%), Impact on distribution and production of food (88.5%), Climate change can reduce nutritional content in the food (87.5%), Effects on rising of temperatures that can lower crop production (86.5%), Climate change decreased American maize and soybean yields (84.0%) and Food supply affected due to climate change (81.5%).

Conclusion:

Most urgent issues of today are changing climate, which has a tremendous effect on food systems around the world. It already has an impact on food access, distribution, and production, which causes widespread hunger, malnutrition, and instability of food. The impact changing climate on food systems is expected to worsen in the upcoming years, especially in developing nations where the majority of people rely on agriculture for their livelihoods. Floods, droughts, heat waves, and storms are just a few of the unpredictable weather patterns brought on by changing climate that have an impact on crop yields and quality. Severe weather occurrences have significantly reduced crop yields, which has resulted in food shortages and price increases. In arid and semi-arid regions where many crops depend on a consistent supply of water, the effects of climate change on water supplies have made food insecurity worse. The effects of changing climate on the world's food systems go beyond just crop production. Aquaculture, fisheries, and livestock output have all been impacted. The decline in fish populations resulting from rising ocean temperatures, ocean acidification, and overfishing has a negative impact on the livelihoods of lots of people.

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