FOOD INSECURITY AND GLOBAL WARMING: A TIME SENSITIVE ISSUE

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EXAMINATION OF INCREASING GLOBAL TEMPERATURE AND FOOD PRODUCTION THROUGH TIME.

Food insecurity is rarely reported as a result of climate change. Oftentimes, food security is immediately related to state and governmental malfunction and poverty. Research shows that the increase in global mean temperature and extreme weather events influences biogeographic range shift that results in the movement of crops poleward. It also shows that there is a positive correlation between the alteration of latitudinal range of crops and pest distribution. The biogeographic range shift of crops can lead to trait shift and increase in biogeographic range of pests that eventually enable them to thrive in a wide range of environmental conditions. The proliferation of pests threatens food security by decreasing food production and food accessibility accordingly. These variables are vital in understanding the biological implications of climate change and understanding other factors of food insecurity.

United Nations Food and Agriculture Organization estimates that about 795 million people of the 7.3 billion people in the world were suffering from chronic undernourishment in 2014-2016. Almost all the hungry people, 780 million, live in developing countries, representing one in eight of the population of developing countries.[1]

Global food security is threatened by the spread of pests and disease pathogens and climate change plays a significant role in the biological aspect of this problem. Research shows that the top four crops—maize, rice, wheat, and soybean—that currently produce nearly two-thirds of global agricultural calories are increasing at a rate of 1.6%, 1.0%, 0.9%, and 1.3% respectively. However, this increase in production is not enough to reach the required rate of 2.4% yield to meet the demands of increasing population in the year 2050.[2] In relation to that, most of the people who are at risk and are currently affected by food insecurity are living in developing countries.[3] These countries also have the lowest income and are the hardest hit by climate change.

HUMAN INTERFERENCE WITH THE CLIMATE SYSTEM IS OCCURRING FROM THE EMISSIONS OF GREENHOUSE GASES, PRIMARILY FROM BURNING FOSSIL FUELS. THE RESULTING CLIMATE CHANGE POSES RISKS FOR HUMAN AND NATURAL SYSTEMS.

The overall effect is increased global mean temperature, which has already risen, by roughly 0.13 °C per decade since the 1950s, resulting in an overall rise of just under 1 °C today, in comparison to pre-industrial norms. Future emissions, even under best-case scenarios, are predicted to add 1°C in the next three decades. Along with mean temperature changes, there has been an increase in the occurrence of warm temperature extremes and a simultaneous reduction in cold extremes.[4] Climate change also includes stronger and more frequent extreme weather events and changes in the lengths of growing season of crops. It is also shown to induce biological changes in weeds and pests.

The inflation of food prices and decrease in food production can be attributed to many different factors, but the strongest correlations point to climate change. Increasing temperature can induce stress to crops that can make it more favorable for pests and weeds to thrive. Climate change can cause biogeographic range shifts to plants in order to adapt and compensate for long summers and early wintertime—both of which are related to food production. Biogeographic range shift is the expansion or contraction of a species' area through the movement or disappearance of individuals. Climate change can cause biogeographic range shifts by inducing interspecific interactions, short-term climate extremes, and

change can cause biogeographic range shifts by inducing interspecific interactions, short-term climate extremes, and changes in temperature and precipitation.[5] eptiam, aliquatia doluptae niet rae cus aut experro corat aut dipsapiet et fugitae

IMPACT OF CLIMATE CHANGE

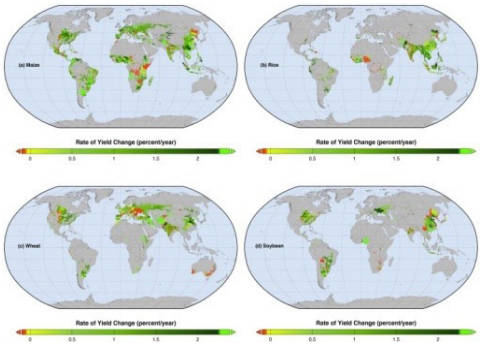
The most critical time for many pests is winter because low-temperature extremes can significantly increase mortality, thereby reducing population levels in the following season. The warming temperature caused by climate change enables insects to increase fecundity and faster generation time.[6] In addition to that, the increase in generation per year can accelerate species evolution. The increase in generation time and insect evolution can affect the severity of insect herbivory among crops that has a detrimental impact to crops and food production.

Low food supply, accessibility, and malnutrition

The increase in fecundity and rate of generation per year of pests can result in increased pest herbivory. Better-adapted pests can move to expand their biogeographic ranges together with the hosts shift as a result of climate change. Elevated temperature can increase the hosts-crop's system susceptibility to certain pathogens that are not normally pathogenic in the absence of increasing temperature. Further, an increase in biomass of pests can pose a risk to young and developing crops. The uncontrolled growth of these pests could also cause a new outbreak that can damage growing and existing crops. In relation to that, insects are often migratory which makes them better adapted to exploit new territories and resources. This behavior together with the expansion of biogeographic range of their host expand its ability to cause pest outbreak and herbivory. The increasing temperature would also increase the probability of better breeding areas and more resources.[7] For example, Sambaraju et al. (2012) has demonstrated that the warming temperature caused the increase in out break of bark beetle infestations in forests in California and Nevada. Between 1997 and 2010, more than 5 million hectares of pine trees died due to the infestation of bark beetles in the western US, most notably by mountain beetles (D. ponderosae) and spruce beetle (D. rufipennis), more than the trees killed by forest fires. This study suggests that warming summer and winter temperatures are the main cause of this outbreak.

Low Food Supply, Accessibility, and Malnutrition

The increasing temperature may result to the re-emergence of pathogens, introduction of new pests to a new biogeographic range, and pest adaptation. These may cause low crop yield and low food production. The production yield for the top three crops decreases as the mean average global temperature increases.[8] It is also projected that the average crop yield will continue to decline. For the major crops (wheat, rice, and maize) in tropical and temperate regions, climate change without adaptation (such as sustainable soil management and irrigation access) will negatively impact production for local temperature increases of 2 °C or more above late-20th-century levels, although individual locations may benefit.[9]



Maps of observed rates of percent yield changes per year. Global map of current percentage rates of changes in (a) maize, (b) rice, (c) wheat, and (d) soybean yields. Red areas show where yields are declining whereas the fluorescent green areas show where rates of yield increase – if sustained – would double production by 2050.

Food prices are expected to continue to rise as global food production declines and as the world struggles to keep pace with the rising demand and increasing population. Climate change has contributed in the inconsistencies and changes in agriculture by inducing biological changes to crops and pests. If these changes are not mitigated or actions to slow down the effects of climate change are not taken seriously, food prices will continue to increase.[10]

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