

# Climate Change and Its Effect on Pests in Food Production

**Florencia García Segura\***

*Autonomous University of Puebla, Mexico*

**\*Corresponding author:** Florencia García Segura, Autonomous University of Puebla, Mexico

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## SUMMARY

Climate change is the result of energy demand and atmospheric emissions derived from fuel combustion, forest burning, greenhouse gases, among other anthropogenic causes. In Mexico, more than 90% of the energy generated is from polluting sources. The great challenge for universities is to train students in a multidisciplinary way to integrate knowledge and technology to be benign to climate change. This change is produced by humans, and it is they who can generate solutions and correct it.

## Introduction

FAO has warned that climate change is raising doubts about the availability of food, which could lead to an increase in hunger and poverty in the world in the future if urgent measures are not taken. The director general of the UN Food and Agriculture Organization (FAO), explained at a press conference that "climate change brings uncertainty as it is no longer possible to be sure that the crops that have been planted will be harvested. This situation threatens to increase the number of hungry people and the volatility of staple food prices, which are already being paid by everyone, not just those who are suffering from droughts. According to various estimates, by 2030 there could be between 35 and 122 million more people living in poverty due to the impact of climate change compared to a future without climate change.

In addition, global food demand in 2050 is projected to increase by at least 60 percent above 2006 levels, mainly due to population growth and rapid urbanization. FAO's biennial report on the state of food and agriculture warns that a decline in agricultural production would lead to food shortages, affecting even more exposed regions such as sub-Saharan Africa and South Asia. Da Silva called for the

introduction of climate change adaptation and mitigation measures in the primary sector, bearing in mind that the most affected in poor countries cannot afford to pay the cost, and therefore called for more public policies and resources to help them in the fight against global warming. There are about 475 million low-income smallholder farmers in the world who often face obstacles such as limited access to markets, credit, weather information, risk management tools and social protection.

Particular difficulties are faced by women, who make up 43% of the agricultural workforce in developing countries, according to the report. In September 2019, at the Climate Action Summit, 65 countries and major subnational economies, such as California, committed to reduce greenhouse gas emissions to net zero by 2050, while 70 countries announced that they will increase the ambition of their national action plans by 2020 or have begun the process to do so. After almost all the signatory countries of the Paris Agreement have committed to act against climate change in agriculture, the FAO director general insisted that policy makers must better target and coordinate their efforts in favor of sustainable production. More than 100 business leaders took concrete actions to align with the goals of the

Paris Agreement and accelerate the transition from the gray to the green economy, including asset owners with more than \$2 billion in assets and leading companies with a combined value of more than \$2 billion. He believes that there are now many technologies that can be applied to diversify the incomes of rural households with activities within and outside the primary sector so that they are able to better manage risks.

Twenty-one percent of global greenhouse gas emissions are caused by deforestation, livestock and soil and nutrient management. To cut these emissions, sustainable practices such as integrating crops, livestock and trees, using nitrogen-efficient and heat-tolerant varieties, or planting directly without plowing can be employed. Curbing forest deforestation is another priority action, as well as reducing food losses and waste and polluting gases during the production, transport, processing and sale of these products. The study warns that the adoption of these practices is still very limited, as it is hampered by policies-such as those that subsidize chemicals-that encourage environmentally unsustainable production instead of promoting efficiency in the use of natural resources and their conservation. For extreme climate changes we must take care of their impact on ecosystems, change land use, avoid deforestation by using a variety of crops, avoid fires, improve feed for large and small ruminants, make better use of waste generated in animal production by managing ecosystem services, reduce land use changes, and use conservation agriculture and agroforestry systems.

The World Meteorological Organization on Wednesday released its annual to decadal Global Climate Update, a report warning that there is a 66% chance that the annual average near-surface temperature between 2023 and 2027 will exceed pre-industrial levels by more than 1.5°C for at least one year. In addition, there is a 98% chance that at least one of the next five years, and the five-year period as a whole, will be the warmest on record (<https://news.un.org/es/story/2023/05/1521047>) [1]. Farmers and the rural population will suffer the greatest effect caused by extreme climate change, with repercussions on national and global food security, because they cause the loss of more than 40 percent of the world's food supply, causing an increase in malnourished people, due to the loss of crops, livestock, marine products, aquaculture, plants, etc. This shortage will lead to an increase in food prices. This shortage will lead to an increase in food prices, as a consequence, the population affected in the short term will be the most vulnerable due to the low purchasing power they have, putting food security at risk, there will also be new pests and diseases for plants and animals favored by high temperatures and increased humidity.

Pests are insects, pathogens and weeds that damage agricultural and food production. Fruit flies, their damage to fruit and vegetable production are the cause of heavy losses, increasing their number with global temperatures, and cover more land area, carrying the virus that transmits cyanotic tongue, temperatures have also allowed

new species of insects, more abundant, transmit this disease, whose spread has increased, their combat with pesticides, lead to present side effects on human health and the environment, particularly in the rural poor and food safety; because the increase in rainfall, temperature and humidity are environmental factors that favor food contamination: peanuts, wheat, corn, rice and coffee with fungi having mycotoxins, some of them highly carcinogenic. Combating them requires global participation for plant pests and transboundary animal diseases, accompanied by more localized or regionalized strategies to be effective with coordinated research, climate change and food security programs of the Consultative Group on International Agricultural Research, to increase the range of options available to countries. International trade and transit spread transboundary animal and plant pests and diseases, as well as aquatic invasive alien species; The development of new agricultural practices, different crops and animal varieties, as well as the development of integrated pest management principles to help curb the spread of pests through the introduction of biological agents to combat pests or the use of pest- and disease-resistant crops and livestock varieties to strengthen national animal and plant health services, linking taxonomy, modeling, population ecology and epidemiology. Governments should seek the best way to unify and organize their national animal and plant health services.

#### Other Factors Include

1. Globalization.
2. Population growth.
3. Ecosystem diversity, functions and resilience.
4. Chemical pollution from industry and agriculture.
5. Land use, water storage and irrigation.
6. The composition of the atmosphere.
7. The interaction of species with their hosts, predators and competing species.

#### The movement of commerce and people.

The generation of conditions conducive to the development of pests and diseases could affect between 12 and 13% of yields in the eight most important crops for food and industry, which occupy more than half of the world's cultivated area (Quiroga IA, et al. [2]). The increase in concentrations of greenhouse gases (GHG) such as CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub> in the atmosphere generates an increase in air and ocean temperatures, which is the cause of global warming; the agricultural sector is one of the most impacted by this phenomenon, due to the generation of conditions conducive to the development of pests and diseases. This could affect between 12 and 13% of yields in the eight most important crops for food and industry, which occupy more than half of the world's cultivated area.

A report by the UN weather agency indicates that global temperatures will reach record levels driven by greenhouse gases and the natural phenomenon of El Niño, which will have repercussions

on health, food security and the environment. They also warn of a warming Arctic and changing global precipitation patterns. Climate change causes the modification of temperatures, humidity and gases in the atmosphere, especially the accumulation of GHG (greenhouse gases), which can favor the growth of fungi and insects, altering the interaction of the disease triangle (host - pathogen - environment) and therefore reducing their production. The global average temperature in 2022 was about 1.15°C higher than the 1850-1900 average. The cooling influence of La Niña conditions for much of the past three years temporarily slowed the long-term warming trend. But La Niña ended in March 2023 and El Niño is expected to develop in the coming months. Normally, El Niño increases global temperatures in the year following its occurrence, which in this case would be 2024.

Between 2023 and 2027, the annual average global near-surface temperature is projected to be between 1.1°C and 1.8°C higher than

the 1850-1900 average. This is used as a baseline because it predates the emission of greenhouse gases from human and industrial activities. Arctic warming is disproportionately high. Compared to the 1991-2020 average, the temperature anomaly is projected to be more than three times the global average anomaly when averaged over the next five prolonged northern hemisphere winters. Precipitation patterns projected for the May-September 2023-2027 mean, compared to the 1991-2020 mean, suggest increased precipitation in the Sahel, northern Europe, Alaska, and northern Siberia, and reduced precipitation for this season in the Amazon and parts of Australia. Several investigations have demonstrated the fluctuation in the incidence of pests in both temperate and tropical zones, associated with drought period events and combination of drought and high relative humidity. Under extreme weather conditions, the National Institute of Agricultural Sciences (INCA) of Cuba identified the following phytosanitary problems (Table1) [3-8].

**Table 1.**

Climate Change	New pests at regional level
	Weeds, spontaneous plants, spontaneous plants, weeds
	Changes in pest life cycles
	Reduction of natural regulators (beneficial organisms)
	Reduced effectiveness of control methods
	Fallen coffee fruits
	Increase in corn rootworm and soybean aphid ( <i>Apis glycinis</i> ) pests (Karuppaiah, et al. [3]).
	Increased wheat recipitation leads to the development of fusarium (IDB, [4]).
	In oats <i>Phytophthora</i> is more prevalent with higher humidity (Pautasso, et al. [5]).
	Mediterranean fruit fly ( <i>Ceratitis capitata</i> ) and pink nutsedge ( <i>Maconellicococcus hirsutus</i> ) (Servin, [6]).
	Lemon suffers in drought seasons the development of HLB disease by the battery <i>Candidatus</i>
	<i>Liberibater asiaticus</i> (Grageda,[7]).
	Researchers from IRRI (International Rice Research Institute), CIMMYT (The International Maize and Wheat Improvement Center) and CIP (International Potato Center) indicate that diseases such as rice brown spot ( <i>Helminthosporium oryzae</i> ), Rice Tungro (RTBV virus), Potato late blight ( <i>Phytophthora infestans</i> ), Wheat blotch ( <i>Cochliobolus sativus</i> ), will show an increase in disease category (from chronic to emergence) due to alterations in weather patterns ( <a href="http://apsjournals.apsnet.org">http://apsjournals.apsnet.org</a> ) [8].

Precipitation and winds on the insect population influence population dynamics, reproduction and survival rate, the plants suffer mechanical damage to their organs making them susceptible to damage by pathogens and pests, weeds, weeds and spontaneous plants, within the cultivated, redistribution in their hosts and migrate towards cultivated plants; originating redistribution of payments with wind and water (Crispin, et al. [9]). Drought and high temperatures affect the oviposition or food of insects, generating selection of the insect population on crops (invasive pests); such as the hemiptera and thysanoptera genus because the rise in temperature favors the reproduction of these insects, by favoring the dispersion of exotic insects and pests that alter the population of beneficial insects (Hamada, et al. [9,10]) [11-13].

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Florencia García Segura. Biomed J Sci & Tech Res



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