

Article 6

Impact Of Climate Change on The Global Food Resources

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Climate change phenomenon:

The climate change is simply refers to the long-term shifts in weather patterns and temperatures (<https://www.un.org>). The temperature increase described as global warming, Intergovernmental Panel on Climate Change (IPCC) in its Sixth Assessment Report (AR6) (IPCC 2023) reported that “ the temperature is predictable or very predictable to exceed the 1.5°C limit before 2040 and the available pathways that avoid this are very limited (Bustamante et al., 2023). Where the estimated remaining CO2 budget for 1.5°C is 250 Gt (Forster et al., 2023), accordingly the 1.5°C will go above shortly after 2030 (Meinshausen et al., 2022). Additionally, to 2100 the climatic scenarios assuming that the continuation of current policies inducing the temperature increase of 1.9-3.7°C (Meinshausen et al., 2022) and 2.1-2.4°C (van der Ven et al., 2023).

The Impact of climate change:

The consequences of climate change induced several impacts (Figure 1) namely: 1- Global warming, 2- Extreme droughts, 3- Water scarcity, 4- Decrease the access to clean water, 5- Increase in wildfires, 6-Sea level rise, 7- Flooding, 8- Melting of the polar ice, 9- More frequent and intense of the extreme weather events, 10- Unreliable crop yields, 11- Physical and mental health impacts for the human and other living species, 12- Increased conflicts over natural resources, 13- Mass displacement, and 14- Widespread hunger (<https://ecotoronto.org> and <https://www.un.org>). NASA (<https://climate.nasa.gov>) reported likewise, that the natural processes can also contribute to climate change, involving internal variability among them cyclical ocean patterns (e.g. El Niño, La Niña and the Pacific Decadal Oscillation) and external forcings as changes in the following items: output of the Sun’s energy, volcanic activity, and Earth’s orbit.

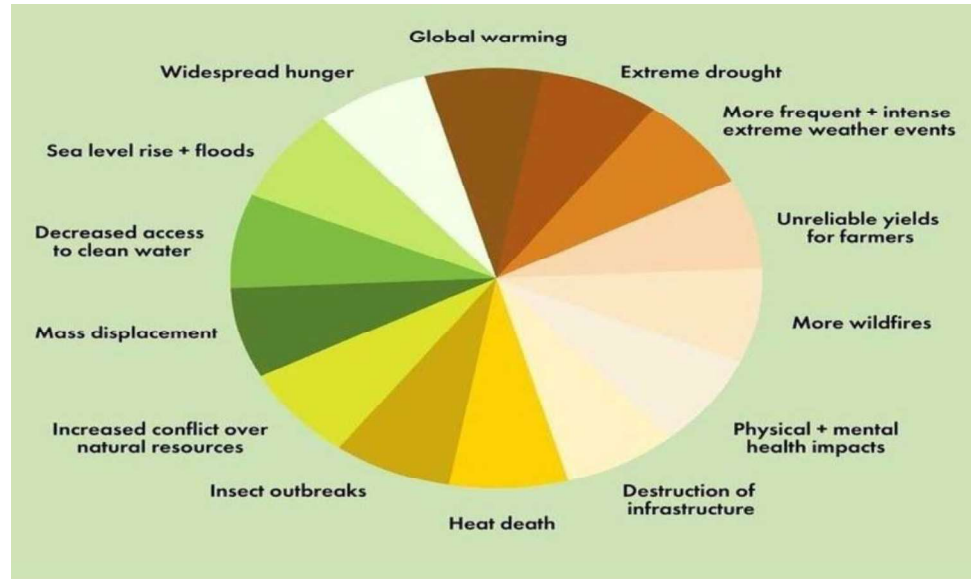


Figure (1). The major events induced by the climate change
(source: <https://ecotoronto.org/tag/climate-action/>)

The impact of climate change including and not limited to the above items (1,2,3,5,8,9,11& 13), these items induce a wide range of negative impacts on biodiversity starting from shifting of timing of its biological/physiological processes (Parmesan 2007), shifts in the distributions of various species towards the poles and to higher altitudes (Parmesan and Yohe 2003; Franco et al., 2006; Arneith et al., 2020; Amer et al., 2021), change in the global vegetation in terms of distribution, development, densities and relative abundance (Scholtze et al., 2006; Amer et al., 2021), changes in species and communities (Parmesan 2007; Pounds et al., 1999; Amer et al., 2021), Cornell university 2019 (<https://news.cornell.edu>) reported about the loss of billion/s of the avifauna population in every biome across the U.S. & Canadian continent.

The climate change adds more pressure on the global food resources:

The impact of climate change on the global food resources will be affected by the above events (1-11) inducing the conflicts over natural resources (event 12), mass displacement (event 13), and hunger (event 14). The climate change catastrophe is its negative impact biodiversity and food production, both will leading to high social and political vulnerability, where the human health and social/population stability are of intimate connection. Heavy rain, cyclones, tropical storms, drought, flooding, and climate variability are the extreme weather phenomena possess the significant drivers of food insecurity (World Bank 2023).

The world food demand looks worthy, where the current global food status is not satisfactory. The acute food insecurity reached 345 millions in 82 countries during 2022 compared to 135 million in 2019 (<https://www.worldbank.org>). In addition to, 2 billion person suffering from malnutrition, more pressure was added to secure global food demand for the 10 billion person to 2050, where the food resources should increase

with 60% (<https://www.preventionweb.net/>). The global inflation tsunami threatens the rest of the population, where the domestic food price inflation affected almost all the countries, although the most affected countries are in Africa, Latin America, N. America, Europe, S. & C. Asia. The food inflation was greater than 5% in 70.6 %, 81.4 % of and 84.0 % of the low, lower-middle and upper-middle income countries; respectively (Work Bank 2023).

Contrary, the Food and Agriculture Organization (FAO) claimed that by 2050, the available land for food production will be diminished to 0.18 ha/person compared to of its current value of 0.242 ha per/person (Alexandratos and Bruinsma 2012). And theyield projection by 2050, refers to insufficient to double global crop production to be crop-yield to 2.4% instead of its 1.7% current ratio (Ray et al., 2013).

Although, both of the global overpopulation and the climate change affect the available and expected food production negatively. The world is struggling to achieve the seventeen global sustainable development goals 2030 (SDGs), from them the food shortage is situated in the second position after zero poverty (Goal 1), followed by the good health (Goal 3), responsible consumption and production (Goal 12) are the major goals directly-linked to the food security (<https://sdgs.un.org/goals>). In the main time the world sustainable development report 2023 (<https://unstats.un.org/sdgs/report/2023/>) warns about the lack of progress in achieving the SDGs at the global scale (Figure 2) and related this to the impact of climate change crises, weak global economy, the war in Ukraine. Figure (2), indicating the low achievement in the Goal 2, where the under nourishment, and low food security, malnutrition, low agriculture investment, and increase in food price comprising the keystone items hinder the progress in this goal at the global level. This report highlights that the poor and most vulnerable countries are facing the worst effect of the global change.

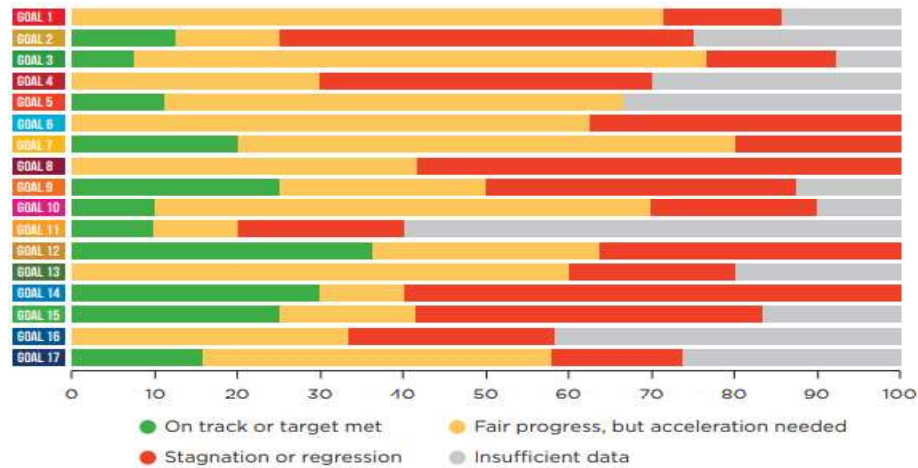


Figure (2). The progress in achieving the SDGs during 2023 at the global level (source: <https://sdgs.un.org/goals>).

Prospectives to secure the global food resources:

The world still so far to secure the amount of food requested to feed the 10 billion person in 2050. To overcome the food shortage three intervening gaps should be closed explicitly. Two gaps 56% of the food (Gap 1) and **593 million-hectare of agriculture land (Gap 2) should added globally**, and the third Gap 3: **is to cut off the 11-gigaton GHG to hold the global warming below 2°C** (Ranganathan et al., 2018).

The World Research Institute (<https://www.wri.org>), published an article entitled "How to create a sustainable food future?". This report identified 22 solutions that need to be concurrently applied to close these three gaps and secure the future food demand. The 22 solutions (Ranganathan et al., 2018) are grouped under five-topics each included from 2-7 subtopics as numerated here:

Topic 1: Reduce growth in demand of food and agricultural products (with 4 subtopics: 1. Reduce food loss and waste., 2. Shift to healthier, more sustainable diets., 3. Avoid competition from bioenergy for food crops and land. and 4. Achieve replacement-level fertility rates.).

Topic 2: Increase food production without expanding agricultural land (with 5 subtopics: 5. Increase livestock and pasture productivity., 6. Improve crop breeding., 7. Improve soil and water management., 8. Plant existing cropland more frequently. And 9. Adapt to climate change.).

Topic 3: Protect and restore natural ecosystems (with 4 subtopics: 10. Link productivity gains with protection of natural ecosystems., 11. Limit inevitable cropland expansion to lands with low environmental opportunity costs., 12. Reforest agricultural lands with little intensification potential. And 13. Conserve and restore peatlands.).

Topic 4: Increase fish supply (with 2 subtopics: 14. Improve wild fisheries management. And 15. Improve productivity and environmental performance of aquaculture.).

Topic 5: Reduce GHG emissions from agricultural production (with 7 subtopics: 16. Reduce enteric fermentation through new technologies., 17. Reduce emissions through improved manure management., 18. Reduce emissions from manure left on pasture., 19. Reduce emissions from fertilizers by increasing nitrogen use efficiency., 20. Adopt emissions-reducing rice management and varieties., 21. Increase agricultural energy efficiency and shift to non-fossil energy sources. And 22. Implement realistic options to sequester carbon in soils.).

Conclusion:

The challenge of feeding 10 billion people sustainably by 2050 is much harder than people realize. The decision makers, environmentalists and leaders should work together with the related national and international organizations to save our planet and to secure the future food demands. Effort should also express to empower people around the globe to do something and everything to conserve the environment directly by planting trees; reduce the use of fossil fuel; protect the wetland ecosystems

and forests; use a wide diversity of food resources; domesticate the wild crop relatives and the underutilized food species; reduce the birth rate; and conserve the natural resources in and off shore. The problem now is clear and the steps to overcome it become obvious and the implementation plan should started now and not tomorrow.

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