Food Impacts due to Climate Change

A compilation of some of the available information as at April 2019

In alphabetical order by source, not all used in preceding pages

Introduction

This document presents some available information on near-term impacts to global food systems due to Climate Change. Following an outline of the main points is a list of the references used and suggestions for further reading. Many of the sources note that not enough research has been done in this area, despite the alarming indicators for global food shortages due to climate change. References used in this paper and further reading can be found on the last page.

Climate Change

The IPCC, NASA and UK sources, the Tyndall Centre and the MET Office, concur that detrimental human influence on the climate system is clear. Emissions of greenhouse gases are now the highest in history. The atmosphere and oceans have warmed, sea level has risen, snow and ice quantities have diminished, with the absence of reflection in an ice-free artic summer projected to increase warming by 50%. 1983 to 2012 was likely the warmest 30-year period of the last 1400 years in the Northern Hemisphere. 17 of the 18 warmest years on record have occurred since 2001. Climate related disasters account for more than 80% of all major globally reported disasters.

Several authors (Bendell a, Brown et al, Haberkorn, Steffen et al) believe that a rise of much more than 2 degrees sooner than 2050 is possible due to feedback systems and a lack of action by the world's governments. Tobias Haberkorn reports that in 2018 "the US Department of Transportation canceled an Obama-approved emissions cut for the US auto industry on the grounds that the earth would heat up by 3 to 4 degrees anyway."

A major impact of accelerating climate change is disruption to food production and distribution. A model funded Lloyds of London and prepared by a Foreign Office task force on Resilience and Anglia Ruskin University showed societal collapse by 2040 due to food supply issues if there is no change in current trends. Lloyd's release of this report concludes:

"A global production shock of the kind set out in this scenario would be expected to generate major economic and political impacts that could affect clients across a very wide spectrum of insurance classes."

Impacts on Food Systems - overview

The global food system is vulnerable to shocks caused by extreme weather, and data suggests that the risk of a 1-in-100 year shock is likely to increase to 1-in-30 or more by 2040. Floods, droughts and tropical storms affect food production the most. Drought causes more than 80 percent of the total damage and loss. A study published in 2019 (Cotrell, et al) shows over 50% of shocks to crop and livestock production are climate-change related and shocks are occurring with increasing frequency. Impacts are often further aggravated by geo-political issues. It concludes that import-dependent countries should build domestic food reserves to counter effects of trade partners reducing exports during production shocks and that trade policies should disincentivise hoarding and export bans by larger food producing countries such as the US, India and China.

The UN Food and Agricultural Organisation defines food crisis as where 20% or more of households have significant food consumption gaps and acute malnutrition levels are high. In 2017, almost 124 million people across 51 countries faced crisis levels of acute food insecurity or worse. In 2015 and 2016, 80 and 108 million people, respectively, faced crisis levels. Countries affected are mainly in Africa, Central and South America, but also include Bangladesh, Pakistan, and Afghanistan. IPCC projections show that a rise in global warming from 1.5°C to 2°C could increase the number of people exposed to climate-related risks and susceptible to poverty by up to *several hundred million by 2050*.

Cereal Crops: Warming of 1.5C - 2°C is projected to result in reductions in yields of maize, rice, wheat, and potentially other cereal crops, particularly in sub-Saharan Africa, Southeast Asia, and Central and South

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America, and reductions in the nutritional quality of rice and wheat and lower food availability in the Sahel, southern Africa, **the Mediterranean, central Europe,** and the Amazon. A 2018 European Commission short term outlook reports the impact to cereal production of continuous high temperatures in northern Europe in the summer of 2018 and severe impacts to the wheat harvest in particular: harvests were down in Germany (-18 %) and Poland (-14 %), and also in Latvia (-33 %) and Lithuania (-29 %).

Fish and livestock: The literature shows that fish stocks and livestock production are already being impacted and will continue to be impacted. One study showed the Northeast Atlantic temperature has increased rapidly in recent decades causing an increase of fish species in the north while decreases in abundance have occurred in the south. Livestock production is projected to be adversely affected with rising temperatures, due to changes in feed quality, spread of diseases, and water resource availability. Another study shows declines in fish stock often create more demand for livestock, transferring the stress.

Insects and disease: Changes in climate are expected to affect the geographic range of specific species of insects and diseases. Migratory insects could colonize crops over a larger range as temperature increases, with subsequent reductions in yield. Climate change may also be a factor in extending the northward migration of invasive weeds. A study of the insect-borne blue-tongue ruminant virus concluded that climate changes have facilitated the recent and rapid spread of the virus into Europe. Ticks that carry diseases that can be transferred from animals to humans have changed distribution as a consequence of climate trends.

Food quality: Climate change will have adverse impacts on food quality by altering carbon and nutrient uptake and biochemical processes during grain development and maturation. This in turn could impact human and livestock health by altering nutritional intake. Increased CO_2 alters the mineral content in plants. Studies have generally found decreases in zinc, sulfur, phosphorus, magnesium, and iron in wheat and barley grain; and increases in copper, molybdenum, and lead, for example.

Distribution: Climate change will increase the frequency and severity of extreme weather, leading to more regular closures of ports, maritime straits, and inland transport routes and greater wear and tear on infrastructure. Rising sea levels will threaten the integrity of port operations and coastal storage infrastructure, and will increase their vulnerability to storm surges. For example, if a hurricane comparable in ferocity to Hurricane Katrina in 2005 were to shut down US exports from the Gulf of Mexico at the same time as extreme rainfall rendered Brazil's roads impassable (as in 2013), up to 50 per cent of global soybean exports could be affected. If this in turn occurred in conjunction with a Black Sea heatwave (as in in 2010), around 51% of global soybean shipments, together with 41% and 18% of global maize and wheat exports, could be halted or delayed.

Nearly 25% of food and freshwater resources are imported; many countries are dependent on imports to meet the food needs of their population. Some areas are the sole suppliers of commodities to other nations. E.g., Thailand currently provides over 96% of rice imports to a number of West African countries. The high dependence on just a handful of producers by many countries highlights future vulnerability.

Fresh water: About 80% of the world's population already suffers serious threats to its water security. An increase in warming from 1.5°C to 2°C may increase the proportion of the world population exposed to a climate change-induced increase in water stress by up to 50%, although there is considerable variability between regions. Water resources are projected to decrease in many mid-latitude and dry subtropical regions, and to increase at high latitudes and in many humid mid-latitude regions. Even where increases are projected, there can be short-term shortages due to rainfall variability and reduced snow and ice storage. Warming may cause impacts on water quality; for instance, the quality of lake water supply could be impaired by algae producing toxins.

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Compiled by Pamela Candea April 2019

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