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Food and Agriculture Organization (FAO)

#BACKGROUND GUIDE

Food and Agriculture Organization

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HISTORY OF THE COMMITTEE

The first international cooperation regarding agriculture was the establishment of the International Institute of Agriculture, founded in 1905. This organization, made up of 40 countries, mainly collected and published statistics on agricultural output, plant diseases, and other relevant information. The Food and Agriculture Organization was formed in 1945 by Franklin Delano Roosevelt, then President of the United States, and 43 other UN representatives. The FAO, beyond simply collecting statistics, was committed to achieving, "the goal of freedom from want of food, suitable and adequate for the health and strength of all peoples."[1] After World War II, the International Institute of Agriculture was dissolved and transferred to the FAO. Since then the FAO has been involved in development projects to end hunger around the world.

The FAO currently has 197 members and has created many sub-programs to address specific areas of food production and agriculture. Some notable programs are the World Food Summit– a global summit in which 112 world government officials committed to halving the number of hungry people by 2015, the FAO-EU partnership where the FAO created programs to help small farmers in countries with rising food prices, and the Alliance Against Hunger and Malnutrition (AAHM) which connects hunger initiatives from NGOs, UN organizations and national governments to create unified fronts against malnutrition. The FAO has also published 10 annual "State of the World" reports which give information on the condition of forests, markets, fisheries and other areas of agriculture world-wide.[2]

1 Constitution of the Food and Agriculture Organization of the United Nations, 1945., p.3.-p.23; Constitution was modified at Rome on 11/27/1991 in order to allow European Community accession.

2 "About FAO," Food and Agriculture Organization of the United Nations, accessed October 13, 2018, http://www.fao.org/about/en/.

TOPIC A: CLIMATE CHANGE AND AGRICULTURE

Statement of the Problem

Introduction to Climate Change

Our current way of life has impacted our environment in many ways, but arguably the most far-reaching and disastrous effect of human activity is climate change. **Climate change** refers to a change in overall weather patterns that lasts for an extended period of time. Typically, climate change can be observed in four main areas: increases in average global temperature, changes in cloud cover and rainfall, melting of glaciers and ice caps, and increases in ocean temperatures and ocean acidity.[3] While climate change can and has occurred naturally via plate tectonics, volcanic eruptions and other natural phenomena, recent human activities have caused and exacerbated climate change.[4] The Food and Agriculture Organization must address this topic, as agriculture and climate change are interconnected. Unsustainable agricultural practices have contributed to the climate change we currently experience, and this climate change will impact our agricultural output and our ability to produce enough food to sustain the world's population. It is vital that this committee discuss how to change global agricultural practices to create a food system that not only prevents worsening climate change, but also is resilient to the changing climate we currently experience.

Often, when climate change is discussed, it is talked about like some concerning but distant future problem. However, the truth is that our actions have already begun to have a noticeable effect on our environment. Global weather statistics show that we are currently experiencing measurable climate change. During the 20th century, sea levels rose by 0.17 meters.[5] This rise is due to increased ocean temperatures which causes **thermal expansion**, the expanding of water when heated, of the ocean and melting ice sheets due to global warming.[6] The global average temperature has already risen by 0.6 °C and is expected to continue rising at an even faster rate.[7] While 0.6 °C may not seem like very much, it is important to keep in mind that this is the global average temperature. An increase in global average temperature of even 1-2 °C can have harmful impacts on agriculture, weather patterns and rainfall.[8] These changes have been directly correlated with carbon emissions, which produce **greenhouse gases**. Greenhouse gases are gases like carbon dioxide, methane and ozone that can absorb and emit energy from

3 United Nations Framework Convention on Climate Change, ***The Paris Agreement***, 12, Dec. 2015.
4 Jessica Eise and Kenneth A. Foster, ***How to Feed the World***, Island Press, 2018.
5 United Nations Framework Convention on Climate Change, ***Climate Change: Impacts, Vulnerabilities and Adaptations in Developing Countries***, 2007.
6 Ibid
7 J. T. Houghton et al***, Climate Change 2001: The Science of Climate Change***, New York: Cambridge Univ. Press 2001.
8 UNFCCC, 2007.

the sun, leading to global warming in high amounts.[9] Since 1996, global CO_2 emissions have increased by 12 billion metric tons per year, and they continue to rise.[10] Clearly, climate change is an issue that should be addressed by many different groups, but this committee must pay special attention to how our changing climate affects and is affected by our global agricultural practices.

The Impact of Climate Change on Plant Growth

Climate change will impact agricultural output because plant growth is greatly tied to the environment that the plant is growing in. Exposure to higher temperatures can cause plants to grow poorly.[11] This is because plants have pores called **stoma** that regulate gas exchange by opening and closing.[12] This gas exchange is vital for the growth of the plant, but it can cause the plant to lose water when the stoma is open.[13] For this reason, plants will close their stoma during periods of high temperature to avoid too much water loss.[14] Frequent high temperatures - like those caused by global warming - mean that the stoma will be closed more often and vital gas exchange will occur less frequently.[15] Overall, this means that higher temperatures will lead to poor plant growth. Already, delayed plant growth has been observed in many areas, from tropical forests to grasslands, due to our recent rising global temperatures.[16] Agricultural output specifically has been shown to be impacted by higher-than-normal temperatures.[17] If the trend continues, we are sure to see an even greater effect on plant growth. This means that farmers will need to use more resources to produce the same output, and our ability to produce enough food will be jeopardized.

Not only is plant growth affected by climate change, but plant nutrition as well. Rising temperatures affect the nutrition of agricultural plants, as does carbon dioxide. This may seem counterintuitive, as plants require carbon dioxide for growth and have even been shown to grow better with more atmospheric carbon dioxide, all other factors being equal.[18] However, there are two reasons why more atmospheric carbon dioxide will not be good for agricultural output in the long run. First of all, while plant growth is helped by carbon dioxide, it is hindered by increased temperatures, as discussed above. The effect of the carbon dioxide will not outweigh the effect of the heat, and

9 Houghton et al, 2001.
10 Global Carbon Project, "Global Co2 Emissions from 1996 to 2016 (in Billion Metric Tons)," Statista - The Statistics Portal, Statista, www.statista.com/statistics/276629/global-co2-emissions/, Accessed 6 May 2018.
11 Jeff Dukes and Thomas W Hertel, "Our Changing Climate," ***How to Feed the World***, edited by Jessica Eise and Kenneth A Foster, Island Press, 2018, pp. 59–76.
12 Ibid.
13 Ibid.
14 Ibid.
15 Ibid.
16 Andrew Richardson et al, "Climate Change, Phenology, and Phenological Control of Vegetation Feedbacks to the Climate System," ***Agricultural and Forest Meteorology***, vol. 169, 15 Feb. 2013, pp. 156–173, ***ScienceDirect***.
17 Lobell, D. B., G. L. Hammer, G. McLean, C. Messina, M. J. Roberts, and W. Schlenker, "The critical role of extreme heat for maize production in the United States," ***Nature Climate Change***, vol. 3, 2013, 497-501.
18 Alayna DeMartini, "Higher Carbon Dioxide Levels Prompt More Plant Growth, But Fewer Nutrients," ***Ohio State University: College of Food, Agricultural and Environmental Sciences***, 3 Apr. 2018, cfaes.osu.edu/news/articles/higher-carbon-dioxide-levels-prompt-more-plant-growth-fewer-nutrients.

the increased temperatures are inextricably linked to increased carbon emissions.[19] Second of all, increased atmospheric carbon dioxide leads to poorer plant nutrition.[20] Too much carbon dioxide lowers the amount of iron, zinc and vitamin C present in plants.[21] Studies have even shown that the amount of protein present in wheat and rice decreases with greater exposure to atmospheric carbon dioxide.[22] This is particularly troubling as these crops are staples in the diets of people around the world who rely on these foods for their daily nutrition.[23] If these plants continue to lose nutrients due to global warming, people with limited access to food will become more at-risk for dietary deficiencies that can impact their health and threaten their lives.

Plant diseases also become more prevalent with increased temperature. One example of this is Sudden Oak Death. Sudden Oak Death is a disease caused by ***Pythium oligandrum*** - a fungi that attacks oak trees in Europe and the United States.[24] This pathogen, like many other plant diseases, thrives in warmer weather and under increased rainfall.[25] Climate change creates the ideal environment for this disease via increased temperatures and its impact on precipitation patterns.[26] Furthermore, as the plants are highly stressed by increased temperatures, they will be more susceptible to infection and have fewer defenses against the fungi.[27] In the recent years, an increase in Sudden Oak Death infections has been observed, and this increase was tied to climate change in the area.[28] Most plant diseases behave like ***Pythium oligandrum*** and will flourish in the environment created by global warming.[29] This stands to affect agricultural output and puts even some staple crops at risk of succumbing to disease.

Climate Change and Pests

Like plant diseases, pest populations will increase with climate change. Insect populations are extremely dependent on temperature. Because insects are cold-blooded, the temperature of their environment is one of the main factors determining their survival and proliferation.[30] Even a 2 °C increase in temperature can give insect populations up to five additional life cycles per season due to increased reproduction.[31] Given the global warming that we have already experienced

19 Hatfield, J., G. Takle, R. Grotjahn, P. Holden, R. C. Izaurralde, T. Mader, E. Marshall, and D. Liverman, 2014: ***Ch. 6: Agriculture. Climate Change Impacts in the United States: The Third National Climate Assessment***, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 150-174. 2014.
20 DeMartini, 2018.
21 Ibid.
22 Roddy Scheer and Doug Moss, "Does Global Warming Make Food Less Nutritious?" ***Scientific American***, www.scientificamerican.com/article/does-global-warming-make-food-less-nutritious/.
23 Ibid.
24 Marco Pautasso et al, "Impacts of Climate Change on Plant Diseases: Opinions and Trends," ***European Journal of Plant Pathology***, vol. 133, no. 1, 2012, pp. 295–313., doi:10.1007/s10658-012-9936-1.
25 Ibid.
26 Houghton, 2001.
27 Pautasso, 2012.
28 Ibid.
29 Ibid.
30 Chris Petzoldt and Abby Seaman, "Climate Change Effects on Insects and Pathogens," ***Climate Change and Agriculture: Promoting Practical and Profitable Responses***, 2005.
31 K. Yamamura and K. Kiritani, A simple method to estimate the potential increase in the number of generations under global warming in temperate zones, ***Applied Entomology and Zoology***. 33:289-298. 1998.

and the expected trend in the coming years, a 2 °C increase in global average temperature is well within the realm of possibility. Not only will insect populations increase, but insect migratory patterns will change with increased temperature as well.[32] Thus, farmers will have more insects to deal with and a greater diversity of insect species. This will force farmers to increase their pesticide use. In fact, climate change can decrease the efficacy of pesticides in a few ways. Pest populations might become more tolerant to these pesticides in more favorable climates.[33] Furthermore, climate change can reduce pesticide coverage through changes in precipitation.[34]

This greater need for pesticide use increases the financial burden on the farmer and will ultimately lead to increasing food prices.[35] Increased pesticide use will have environmental as well as economic impacts. Pesticides can easily spread into groundwater, air and other areas of land through what is known as **pesticide drift**.[36] This spread of pesticides into other areas causes ill effects to the plants, animals and people in those areas.[37] There is even evidence that global warming will exacerbate the environmental impact of pesticides. High temperatures can cause pesticides to vaporize, which exacerbates pesticide drift.[38] Ultimately, the combination of increased pesticide use and greater pesticide drift will lead to more air and water pollution.

Effect of Climate Change on Precipitation

Aside from temperature increase, the changes in precipitation brought about by climate change will also have a pronounced effect on agriculture. Climate change can increase the risk of floods and droughts in certain areas.[39] It may seem strange that climate change could have such contradictory effects, but the science is fairly simple: warm air holds more water vapor, so as the climate gets warmer, the air becomes more filled with moisture, and heavy rainfall is more likely.[40] However, warm weather also makes water evaporate more quickly, which leads to drought when there is no precipitation.[41] Essentially, climate change makes flooding and droughts more likely and intermediate precipitation less likely. These changes in precipitation will alter plant diseases and insect populations just as changes in temperature do.[42] [43]

Clearly, floods and droughts can have a severe impact on plant growth and can lead to decreased harvests. Perhaps less obviously, floods and droughts can also impact the transportation of

32 Petzoldt and Seaman, 2005.
33 L. Ziska, et al, ***Ch. 7: Food Safety, Nutrition, and Distribution,*** "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. U.S. Global Change Research Program," Washington, DC, 189–216. 2016.
34 Ibid.
35 Ibid.
36 A.J. Hewitt, "Spray drift: impact of requirements to protect the environment," ***Crop Protection*** 19:623-627. 2000.
37 Houghton, 2001.
38 Hewitt, 2000.
39 L. Ziska et al, 2016.
40 John Abraham, "Global Warming Is Increasing Rainfall Rates," ***The Guardian***, Guardian News and Media, 22 Mar. 2017, www.theguardian.com/environment/climate-consensus-97-per-cent/2017/mar/22/global-warming-is-increasing-rainfall-rates.
41 Ibid.
42 Pautasso, 2012.
43 Petzoldt and Seaman, 2005.

food. Flooding can make certain roads impassable, making food transportation more difficult and potentially preventing certain populations from accessing food.[44] A large proportion of food transportation is done over water, so both floods and droughts can impact this transportation. For example, in 2012, the Midwestern United States was hit with a severe drought that reduced the size of the Mississippi Watershed, a vital agricultural shipping route.[45] This drought caused an enormous reduction in food transportation and major economic losses for Midwestern farmers.[46] As is frequently the case, this drought was followed later that year by flooding which further impacted agricultural transportation.[47]

Floods and droughts will also lead to soil erosion and degradation. Normally, agricultural **topsoil** is renewed as quickly as degradation occurs, meaning that there is a constant layer of nutritious soil for plants to take root in.[48] However, conditions of drought can cause soil to become dry and dusty, and thus easily carried by the wind.[49] This increases the rate of soil degradation. Erosion can also be caused by flooding, as increased rainfall will carry away soil and deplete the vital layer of topsoil.[50] Furthermore, the decrease in plant growth due to increased temperatures also has the capacity to increase erosion. Topsoil is held in place by the network of roots of the plants that inhabit it.[51] Fewer of these plants mean that the topsoil is less secure and more likely to be swept away by wind or rain.[52] It has been estimated that soil erosion rates in areas like the Midwestern United States could increase by as much as 55% by the year 2050 if current climate trends continue.[53] Depletion of this nutrient-rich soil would lead to a greater reduction in plant growth. This vicious cycle of decreased plant growth and increased soil erosion would be disastrous for agricultural output.

The Impact of Agriculture on Climate Change

Climate change has a severe impact on agriculture, but it is just as necessary for this committee to recognize the impact that agriculture has on climate change. Many of the current agricultural practices used around the world contribute to and exacerbate the issue of climate change. As we discuss how to protect global agriculture from the effects of climate change, it will be necessary to consider how to create more sustainable agricultural systems that are not only resilient to climate change but also have a diminished environmental impact. There are three main ways

44 Eise and Foster, 2018.
45 L. Ziska et al, 2016.
46 Ibid.
47 Ibid.
48 Anne Williams et al, "Indirect Impacts of Climate Change That Affect Agricultural Production: Soil Erosion," ***Effects of Climate Change and Variability on Agricultural Production Systems***, 2002, pp. 249–264., doi:10.1007/978-1-4615-0969-1_12.
49 Ibid.
50 MA Nearing et al, " Expected Climate Change Impacts on Soil Erosion Rates: A Review," ***Journal of Soil and Water Conservation***, vol. 59, 2004, pp. 43–50.
51 Ibid.
52 Ibid.
53 Williams, 2002.

that agriculture affects climate change that this committee must recognize: greenhouse gas emissions, deforestation and overgrazing.

The agricultural sector is one of the main contributors of greenhouse gases, responsible for 13% of total greenhouse gas emissions.[54] The only sector with a greater contribution to greenhouse gas emissions is the energy sector, which contributes 25% of total greenhouse gas emissions.[55] The greenhouse gas emissions from the agricultural sector come from a variety of sources. One of the main sources is methane emissions from livestock. Methane production - also called enteric fermentation - is a natural part of the digestive process but is particularly high in livestock animals such as cows and pigs.[56] These emissions can increase when these animals are not fed properly, as often occurs in factory farms and low-income farms.[57] These methane emissions account for 65% of the agricultural sector's greenhouse gas emissions.[58]

Most of the remaining emissions come from the application of synthetic fertilizers that contain nitrous oxide (NO_2). Nitrogen is naturally present in most fertile soils as these soils contain "nitrogen-fixing" bacteria that take atmospheric nitrogen and convert it into "fixed" nitrogen that can be taken up by plants.[59] Nitrogen is an important nutrient for plants - and while they can typically get sufficient nitrogen from these bacteria, many farmers choose to supplement this with fertilizers that contain nitrogen.[60] Plants can only absorb so much nitrogen, however, and any excess nitrogen that is not taken up becomes nitrous oxide and is released into the atmosphere.[61] Often, the amount of fertilizer applied to agricultural fields is far too high for the amount of nitrogen that the plants could reasonably absorb, which creates a lot of excess nitrogen that can become NO_2.[62] Most agricultural NO_2 emissions occur this way, but there are other ways that agriculture can cause these emissions. For example, rice paddies are natural sources of NO_2, and while certain chemicals applied to these paddies can increase NO_2 emissions, there is a baseline level of NO_2 emitted from rice paddies that is unavoidable.[63]

While these are the main sources of agricultural greenhouse gas emissions, there are many other aspects of agriculture that also contribute. These include field burning (especially in areas that use slash-and-burn farming), fuel use, manure management, and methane emissions from

54 Russel, Stephen. "Everything You Need to Know About Agricultural Emissions." ***WRI***, World Resources Institute, 29 May 2014, www.wri.org/blog/2014/05/everything-you-need-know-about-agricultural-emissions.
55 Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.) ***Fifth Assessment Report of the Intergovernmental Panel on Climate Change.*** Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 2014.
56 "Key Facts and Findings." ***Food and Agriculture Organization***, FAO of the UN, www.fao.org/news/story/en/item/197623/icode/.
57 Ibid.
58 Ibid.
59 Neville Millar, Julie Doll and G. Robertson, "Management of Nitrogen Fertilizer to Reduce Nitrous Oxide (NO2) Emissions from Field Crops," ***MSU Extension Bulletin***, Nov, 2014.
60 Ibid.
61 Russel, 2014.
62 Millar et al, 2014.
63 Eise and Foster, 2018.

rice paddies.[64,65] It is vital that the committee consider solutions that address these factors in addition to those that make up the majority of greenhouse gas emissions.

Land Use

Another way that climate change can have an enormous impact on the environment is through deforestation. More than 20,000 square miles of forests are cleared every year and one major cause of this deforestation is agriculture.[66] These forests are cleared to make room for more agricultural fields as well as to create more grazing land for cattle and other livestock.[67] This is a problem because forests are one of the biggest carbon sinks in our natural environment. A **carbon sink** is a natural or artificial reservoir that can absorb carbon dioxide and sequester it, preventing it from entering the atmosphere and contributing to global warming.[68] Forests accomplish this because trees and other plants absorb carbon dioxide from the atmosphere to be used in photosynthesis.[69] This carbon is stored in the plant and is released as CO_2 when the plant or tree dies.[70] This means that a normal healthy forest will help mitigate the effects of climate change. However, deforestation removes these carbon sinks and creates more dead plants that will release CO_2 into the atmosphere.

64 Russel, 2014.
65 "Agriculture's Greenhouse Gas Emissions on the Rise," ***Fao.org***, FAO of the UN, 11 Apr. 2014, www.fao.org/news/story/en/item/216137/icode/.
66 "Deforestation and Its Effect on the Planet," ***National Geographic***, National Geographic, 25 July 2017, www.nationalgeographic.com/environment/global-warming/deforestation/.
67 Ibid.
68 Melanie Friedel, "Forests as Carbon Sinks," ***American Forests***, 18 July 2017, www.americanforests.org/blog/forests-carbon-sinks/.
69 Ibid.
70 Ibid.

Increased deforestation stands to have massive effects on the environment. Besides increased CO_2 in the atmosphere, decreasing forest coverage has been shown to increase the surface temperature of deforested areas and decrease the rates of **evapotranspiration**, a sum of water lost from the ground and from plants, as well as precipitation in those areas.[71] Areas adjacent to the deforested areas are affected as well, meaning that the impacts of deforestation radiate outwards.[72] It is important to note that these effects were observed when the deforested areas were replaced with grassland pastures used for livestock grazing. Although these pastures still have plants that can absorb CO_2, these grasses and shrubs are not nearly massive enough to absorb CO_2 at the level of a forest.[73] This is not the only impact that grazing has on the environment.

Overgrazing is the practice of allowing livestock to feed on a certain area of land for an excessive amount of time.[74] It can have lasting effects on the grazing land, even after grazing stops. Grazing can change the vegetative structure of a pasture. Certain plants will be selected for or against based on the preference of the grazing animal, which will alter the abundance of plants in that area.[75] The physical structure of plants is also impacted by grazing. Grazing animals cause physical damage to plants that can result in decreased height and canopy cover in those areas.[76] Additional physical damage is done by trampling. Trampling breaks down vegetation in grazing areas and causes damage to plant structure. Trampling can also compact the soil in grazing areas, which can damage plant roots and cause these roots to only be able to occupy shallow depths of soil, preventing them from acquiring sufficient nutrients.[77] All of these effects reduce vegetative cover in those areas, which decreases the carbon-absorbing abilities of the area and exacerbates climate change.

It is important to note, however, that grazing can have positive impacts on the environment as well. Grazing animals can encourage the spread of vegetation by carrying seeds on their coats.[78] Soil erosion can be combated by the deposition of waste by these animals, and the nitrogen in this waste can encourage plant growth (although too much waste deposition can cause NO_2 release as discussed above).[79][80] Controlled grazing can even help prevent forest fires,

71 J. Shukla et al, "Amazon Deforestation and Climate Change," ***Science***, vol. 247, no. 4948, 1990, pp. 1322–1325., doi:10.1126/science.247.4948.1322.
72 Ibid.
73 Ibid.
74 Jenny Ericson, "Impacts of Grazing," ***FWS***, US Fish and Wildlife Service, 18 Feb. 2009, www.fws.gov/invasives/staffTrainingModule/methods/grazing/impacts.html.
75 RC Szaro, "Riparian forest and shrubland community types of Arizona and New Mexico," ***Desert Plants.*** 9:69-138. 1989.
76 N. Huntly, "Herbivores and the dynamics of communities and ecosystems," ***Annual Review of Ecology and Systematics***. 22:477-503. 1991.
77 JF Dormaar and WD Willms, 1998. Effect of forty-four years of grazing on fescue grassland soils, Journal of Range Management 52:122-126.
78 JR Lacey, R Wallander and K Olson-Rutz, "Recovery, germinability, and viability of leafy spurge ***(Euphorbia esula)*** seeds ingested by sheep and goats," ***Weed Technology*** 6:599-602. 1992.
79 RK Hubbard, GL Newton and GM Mill, "Water quality and the grazing animal," ***Journal of Animal Science*** 82:E255-E263. 2004.
80 EA Holland, WJ Parton, JK Detling and DL Coppock, "Physiological responses of plant populations to herbivory and other consequences of ecosystem nutrient flow," ***American Naturalist*** 140:685-706. 1992.

as extremely flammable brush is removed from the environment.[81] Preventing overgrazing from impacting the environment is not a matter of eliminating grazing, but finding ways to cultivate grazing practices that help, rather than harm, the environment.

As we have seen, the relationship between climate change and agriculture is very complicated, but its repercussions threaten our current global food system. As this committee begins to explore solutions, it is vital to consider solutions that not only protect our agriculture from climate change but also those that protect our environment from harmful agricultural practices.

81 MJ DiTomaso and DW Johnson, "The Use of Fire as a Tool for Controlling Invasive Plants," Cal-IPC Publication-01, Berkeley (CA): California Invasive Plant Council, 2006, p. 56.

History of the Problem

The Industrial Revolution

Humans have been impacting their environment for as long as civilizations have existed, but our impact on our climate largely began with the Industrial Revolution. The Industrial Revolution was a period in Western Europe during the 18th and 19th centuries where technological advances made the production of things like food and textiles much faster and more efficient.[82] This allowed for mass production of consumer goods that previously all had to be made by hand much more slowly. These changes quickly spread from Britain where they had begun to the rest of Europe and, eventually, to most of the world.[83] From this revolution came the advent of factories, national businesses and modern urban structure.[84] More relevant to this committee, the Industrial Revolution created significant air and water pollution, and the practices born from this revolution still create pollution to this day.

Much of this pollution came from the new sources of power used by factories and households in that time. One of these major power sources was coal.[85] Coal has been used as a fuel source since at least the 13th century as it releases a lot of energy upon burning.[86] Because of the large coal deposits in Britain, coal was heavily exploited during the Industrial Revolution in order to power new factories.[87] However, the burning of coal creates toxic smoke that can enter the atmosphere and pollute the air.[88] During the time of the Industrial Revolution, the air was often filled with a thick, sooty smog.[89] This smog darkened the sky, caused numerous health problems for the people of London and even corroded metal.[90] As we will see, efforts have since been made to reduce air pollution by businesses and move towards more sustainable fuel sources, but many places around the world – developing and developed countries alike – are still heavily reliant on coal as a fuel source.[91] This is one of the legacies of the Industrial Revolution.

As the practices put in place by the Industrial Revolution spread globally - so did their environmental impact. One salient example is the rapid industrialization of China by Mao Zedong during the "Great Leap Forward". Over two five-year spans, hundreds of factories and steel mills were built in an effort to bring China to the forefront of global manufacturing.[92] Like previously industrialized

82 Joseph A Montagna, "The Industrial Revolution," ***New Haven Teachers Institute***, Yale, 1981, teachersinstitute.yale.edu/curriculum/units/1981/2/81.02.06.x.html.
83 Ibid.
84 Ibid.
85 Elizabeth Healy, ***Industrialization, Pollution and Policies: Comparing England and China,*** 2015.
86 Gregory Clark and David Jacks, "Coal and the Industrial Revolution, 1700–1869," ***European Review of Economic History***, vol. 11, no. 1, 26 Mar. 2007, pp. 39–72.
87 Ibid.
88 Michael Parfit, "Future Power: Where Will the World Get Its Next Energy Fix?" ***National Geographic***, www.nationalgeographic.com/environment/global-warming/powering-the-future/.
89 Healy, 2015.
90 Ibid.
91 Parfit, 2014.
92 Healy, 2015.

countries, this industrialization was powered by coal.[93] And like those other countries, this led to air and water pollution on a massive scale.[94] Industry in China is still heavily dependent on coal power, and attempts at regulation by the central government have been largely ineffective.[95] Because of this, China is the world's largest emitter of greenhouse gases and has higher levels of air pollution than any other country.[96] The increase in greenhouse gas emissions brought about by industrialization began a period of severe human impact on the environment. However, it would take some time before people became fully aware of the impact that human action was having on the environment and climate.

A Growing Awareness of Global Warming

The first evidence that greenhouse gas emissions can impact the climate came from 19th century physicist John Tyndall. In the late 1850's, Tyndall began investigating the "radiant energy" of different atmospheric gases.[97] This led him to investigate how well different gases absorb heat.[98] Through his investigation, he discovered that certain atmospheric gases are able to absorb energy from the sun and increase ambient temperature.[99] This so-called "Greenhouse Effect" had been suspected by scientists before Tyndall, but he was the first to prove its existence.[100] While we now understand the repercussions of the Greenhouse Effect, society in Tyndall's time was relatively unbothered by his discovery. In fact, some people thought that the Greenhouse Effect was a good thing. Swedish chemist Svante Arrhenius concluded that coal-burning would enhance the natural greenhouse effect and predicted an increase in global temperature quite close to the actual increase in global temperature that has occurred since his time.[101] He thought that this temperature increase would be beneficial for future generations as it would prevent Earth from entering another ice age and possibly boost crop yield, allowing agriculture to keep up with the growing population.[102]

Further proof of climate change came in the 20th century. In the 1930's, Guy Callendar, a steam engineer, began collecting data on carbon emissions and global temperature. In his spare time, he used data from over 140 weather stations around the world to explore the relationship between carbon emissions and global temperature.[103] He unequivocally demonstrated that

93 Ibid.
94 "China Wakes Up To Dangers of Industrial Pollution," ***The New York Times,*** April 6, 1980.
95 Healy, 2015.
96 Jianguo Liu and Jared Diamond, "Science and Government. Revolutionizing China's Environmental Protection," ***Science*** 319:31, 58-59 Jan, 2008.
97 U. Deyoung, ***Vision of Modern Science: John Tyndall and the Role of the Scientist in Victorian Culture***, Palgrave Macmillan, 2016.
98 Ibid.
99 Rudy M. Baum, Sr., "Future Calculations: The first climate change believer," ***Distillations***, 2 (2): 38–39. 2016.
100 Ibid.
101 Ibid.
102 Svante Arrhenius, ***Das Werden der Welten*** (Worlds in the making; the evolution of the universe), Leipzig: Academic Publishing House, 1908.
103 G. S. Callendar, "The artificial production of carbon dioxide and its influence on temperature," ***Quarterly Journal of the Royal Meteorological Society***, 1938.

global temperature had risen in the previous one-hundred years and showed that global CO_2 emissions had similarly increased, suggesting a relationship between the two.[104] Despite the importance of this discovery, it went relatively unnoticed in Callendar's time.[105] Even Callendar himself did not understand the full magnitude of his discovery. Like Arrhenius, he thought that this change in global temperatures was a good thing, as it would prevent the return of the "deadly glaciers" and boost crop yields.[106] It would take more than thirty years until the negative repercussions of climate change would come to be fully appreciated.

In 1972, the UN held its first environmental conference in Stockholm, Sweden.[107] At this point, the potential dangers of climate change were becoming apparent, but conversation at this conference was dominated by issues like chemical pollution, whaling and atomic bomb testing.[108] While climate change was on the agenda, it received very little attention and no real committee-wide consensus was reached on the issue.[109] Fifteen years later, the Intergovernmental Panel on Climate Change (IPCC) was formed with the directive of investigating evidence of climate change.[110] The panel produced a report in 1990 demonstrating that global temperatures had risen by 0.6 °C in the previous century and were expected the continue rising.[111] Their second report, published in 1995, provided strong evidence that human activity was directly responsible for the changing climate.[112] These findings urged national governments to act, and in 1997, the Kyoto Protocol was agreed upon - in which participating nations pledged to reduce their carbon emissions.[113] A similar agreement was made 20 years later, albeit on a wider scale, with the Paris Agreement.[114] Both the Kyoto Protocol and the Paris Agreement will be discussed in further detail in a later section. While promising developments, these international agreements have not been enough to undo decades of unchecked greenhouse gas emissions. Global temperature continues to rise and threaten our way of life.

The Industrialization of Agriculture

Just as human innovation has changed our climate, it has also changed the way we cultivate food. The industrialization of agriculture made it possible for farmers to significantly increase their output, allowing food production to match our growing population, but it also significantly increased the impact that farming has on the environment. The industrialization of agriculture

104 Ibid.
105 Zoe Applegate, "Guy Stewart Callendar: Global Warming Discovery Marked," ***BBC News***, BBC, 26 Apr. 2013, www.bbc.com/news/uk-england-norfolk-22283372.
106 Callendar, 1938.
107 Anthony Astrachan, "Goals for Environment Talks Listed," ***The Washington Post, Times Herald***, p. A20. 17 March, 1972.
108 Ibid.
109 Ibid.
110 Spencer Weart, "International Cooperation: Democracy and Policy Advice (1980s)," ***The Discovery of Global Warming,*** American Institute of Physics. 2011.
111 IPCC, ***Climate Change: The IPCC Scientific Assessment***, Cambridge University Press, 1990.
112 IPCC, ***Climate Change 1995: Second Assessment Report***, Cambridge University Press, 1996.
113 United Nations, ***7. a Kyoto Protocol to the United Nations Framework Convention on Climate Change,*** Kyoto, Japan, 11 Dec. 1997.
114 United Nations, ***7. D Paris Agreement***, Paris, France. 12 Dec. 2015.

began slightly earlier than the Industrial Revolution. The development of new machines made harvesting easier and much more efficient. In 1796, the threshing machine was invented.[115] This machine threshes grains like wheat by removing the seeds from the stalks and husks.[116] Previously, farmers did this by hand much more slowly.[117] The introduction of the thresher allowed farmers to substantially increase their harvesting capacity while also cut down on labor costs.[118] Another key development in the mechanization of farm labor was the invention of the combine harvester. This machine also aids in grain harvesting but the combine harvester is able to harvest a variety of crops including soybeans, corn and oats.[119] Prototypes of the combine harvester were introduced in the early 1800's but the final design was not perfected until 1860.[120] Like the thresher, the combine harvester greatly improved the efficiency of agricultural labor and encouraged farmers to seek more ways to mechanize.[121] All of these early machines were horse-drawn and hand-powered, but eventually these machines were designed to run on diesel or to be pulled by tractors that run on diesel.[122] While this innovation improved the performance of these machines, it also caused these machines to emit carbon. This has only worsened global greenhouse gas emissions.

Another outcome of the industrialization of agriculture was the rise of **monoculture**. Monoculture is the practice of growing a single crop on a large scale.[123] Because of the development of harvesting machines, it made economic sense for farmers to devote acres and acres of land to one crop like soybeans, rather than growing multiple crops.[124] However, large swaths of one crop

115 Gregory Clark, ***A Farewell to Alms: A Brief Economic History of the World,*** Princeton University Press, 2007.
116 Ibid.
117 Ibid.
118 George Constable and Bob Somerville, "Chapter 7, Agricultural Mechanization," ***A Century of Innovation: Twenty Engineering Achievements That Transformed Our Lives***, Washington, DC: Joseph Henry Press, 2003.
119 Lance Day and Ian McNeil, ***Biographical Dictionary of the History of Technology,*** London, UK: Routledge, 2011.
120 Ibid.
121 Constable and Somerville, 2003.
122 "Product History - Combine Harvesters," ***CLAAS Group***, CLAAS. http://www.claas-group.com/the-group/history/product-history/combine-harvesters
123 "Industrial Agriculture," ***UCSUSA***, Union of Concerned Scientists, www.ucsusa.org/our-work/food-agriculture/our-failing-food-system/industrial-agriculture.
124 Ibid.

are very attractive to insects and other pests.[125] Farmers had been using organic pesticides since agricultural practices first began, but monoculture required a more efficient pesticide.[126] Post-World War II, scientists began developing synthetic pesticides that quickly gained popularity as they were cheaper and easier to apply than traditional, organic pesticides.[127] However, as we have seen, pesticides can have very negative environmental impacts. The development of better pesticides and the necessity for pesticides caused by monoculture dramatically increased the use of pesticides and the impact of these substances on the environment.

Another problem with monoculture is that different crops require different nutrients, so growing a single crop causes soil to become depleted of the necessary nutrients for that crop rather quickly.[128] As farmers began practicing monoculture more and more frequently, this necessitated the development of **synthetic fertilizers**.[129] In 1903, the first synthetic fertilizer, calcium nitrate, was developed.[130] From here, many other more effective fertilizers were developed.[131] The introduction of these fertilizers allowed farmers to put nutrients that their crops were depleting back into the soil. Unfortunately, these fertilizers cause the emission of nitrogen and other greenhouse gases as previously discussed. As the use of synthetic fertilizer became more widespread, so did these emissions.

125 Ibid.
126 John Unsworth, "History of Pesticide Use," ***IUPAC***, 10 May 2010, agrochemicals.iupac.org/index.php?option=com_sobi2&sobi2Task=sobi2Details&catid=3&sobi2Id=31.
127 Ibid.
128 "Industrial Agriculture," ***USCUSA***
129 Darrell A. Russel and Gerald G. Williams, "History of Chemical Fertilizer Development," ***Soil Science Society of America Journal***, vol. 41, no. 2, 1977, p. 260., doi:10.2136/sssaj1977.03615995004100020020x.
130 Ibid.
131 Ibid.

Past Actions

The Stockholm Declaration

Humans first laid the seeds for climate change in the 18th century, but it was not until more than 150 years later that we realized the extent of the impact our actions had on our environment and tried to come together to create a solution.

The First UN Environment Conference in 1972 was the first time that climate change was discussed on the international level.[132] As was mentioned above, climate change received very little attention at the conference as there were many other issues that the committee believed to be more pressing. At that time, while climate change was largely recognized as real and man-made, its dangers were not fully appreciated by the global community.[133] Political issues also inhibited the productivity of the committee. The Soviet Union and other Warsaw Pact nations boycotted the committee because of their refusal to recognize East Germany as a sovereign nation.[134] Because of this, the hostility between China and the US dominated the committee proceedings and much of the conference was spent with each nation condemning the other's actions.[135]

Following the conference, the committee published the Stockholm Declaration, a collection of 26 principles that the participating countries pledged to uphold.[136] The principles centered around reducing human impact on the environment and alleviating poverty, which Indian Prime Minister Indira Gandhi argued for as a crucial strategy for environmental protection.[137] [138] However, none of the 26 principles directly address climate change.[139] Furthermore, the principles allow each state to set its own principles and exploit its own resources as much as it wishes as long as "activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."[140] Later, the global community would come to appreciate that greenhouse gas emissions can have impacts that reach far beyond the border of any state and stricter provisions would become necessary.

132 Astrachan, 1972.
133 Applegate, 2013.
134 Astrachan, 1972.
135 Claire Sterling, "Chinese Rip U.S. At Parley," ***The Washington Post, Times Herald***, June 10, 1972.
136 United Nations General Assembly, "Declaration of the United Nations Conference on the Human Environment," ***Report of the United Nations Conference on the Human Environment***, Stockholm, June 1972.
137 Ibid.
138 Venkat Vidya, "Indira Gandhi, the environmentalist," ***The Hindu***. May 21, 2017.
139 United Nations General Assembly, 1972.
140 Ibid.

The Kyoto Protocol

Following the Intergovernmental Panel on Climate Change's investigations, which demonstrated that climate change was happening and that a large portion of it was due to human actions, the Kyoto Protocol was agreed upon. The Kyoto Protocol was an extension of the United Nations Framework Convention on Climate Change which was published following the UN Conference on the Environment and Development in 1992.[141] The Kyoto Protocol, published in 1997, calls for developed nations to reduce their carbon emissions before 2008, and reduce them further by 2012.[142] The Kyoto Protocol also called for developed nations to donate money and lend support to the development of climate-related studies and technologies. Participating countries had their domestic greenhouse gas emissions monitored over the commitment period. Failure to sufficiently reduce greenhouse gas emissions by 2008 would result in the country being required to cut their emissions even more severely by 2012. Furthermore, non-compliant countries would be barred from participating in **emissions trading**, where countries can purchase the ability to emit more greenhouse gasses from countries who have cut their emissions below the required amount.[143] [144]

The Kyoto Protocol was ratified by 191 countries.[145] Notably, the United States did not ratify the Kyoto Protocol, and Canada withdrew from the agreement in 2012. The complaint made by then-president George Bush, which many other developed nations shared, was that the Protocol was too harsh on countries with well-established economies.[146] The philosophy of the Kyoto Protocol was that the countries who played the greatest role in creating climate change should be the ones responsible for addressing the problem. However, this exempted countries with emerging economies, like India and China, who now have very high carbon emissions. Many countries felt that the Kyoto Protocol was playing a "blame game" by not requiring emission cuts from countries with currently high greenhouse gas emissions. Some also complained that the Kyoto Protocol offered very little financial support to developing countries looking to reduce their emissions.[147] Another complaint was that indigenous people were not able to participate in the conventions leading up to the Kyoto Protocol despite the fact that indigenous people are highly vulnerable to the effects of climate change.[148] Ultimately, the Kyoto Protocol was not very successful. Since its negotiation in 1997, global carbon emissions have increased by 24%.[149]

141 United Nations, *7. a Kyoto Protocol to the United Nations Framework Convention on Climate Change,* Kyoto, Japan, 11 Dec. 1997.
142 United Nations Framework Convention on Climate Change (UNFCCC), ***Kyoto Protocol***, UNFCCC, 2011.
143 Ibid.
144 "What is Emissions Trading?" ***EPA***, US Environmental Protection Agency, https://www.epa.gov/emissions-trading-resources/what-emissions-trading.
145 UNFCCC, 2011.
146 S. Dessai, *Tyndall Centre Working Paper 12: The climate regime from The Hague to Marrakech: Saving or sinking the Kyoto Protocol?*, Norwich, UK: Tyndall Centre, 2001.
147 World Bank, ***5. Integrating development into a global climate regime***, p 246. 2010.
148 Bruce E Johansen, *Indigenous peoples and environmental issues : an encyclopedia,* Greenwood Press, pp. 115–116, 2001.
149 World Bank, 2010.

The Paris Agreement

The Paris Agreement is another agreement made within the UNFCCC. It was adopted in 2015 and, as of 2018, has been ratified by 178 countries.[150] Under the Paris Agreement, industrialized nations pledge to reduce their carbon emissions with the goal of keeping the increase in global temperature within 2 °C of pre-industrial levels.[151] Each country sets their own goal for emission reduction, and there is no mechanism to force a country to set a specific goal or to coerce a country to comply with its own goal.[152] There is no consequence for nations that fail to meet their emissions goals. The Paris Agreement also affirms developed countries' commitment to providing funds for climate change adaptation and mitigation in Least Developed Countries and Small Island States, which are most vulnerable to flooding and extreme weather events caused by climate change.[153]

The lack of any sort of enforcement mechanism has many parties concerned for the efficacy of the Paris Agreement. Some climate change experts argue that some sort of tax on CO_2 emissions is necessary to coerce countries into complying with the emission cuts and that the Paris Agreement only represents a promise that can easily be broken.[154] So far, all major industrialized nations participating in the Paris Agreement have failed to meet the standards that they have set for themselves, and many have not even enacted the policies that they pledged to enact in order to reduce their greenhouse gas emissions.[155] Even if all the countries comply, multiple studies have shown that the pledged emission cuts will be insufficient to keep global temperatures within the 2 °C deviation from pre-industrial levels that the Paris Agreement is aiming for.[156] [157] Furthermore, some feel that the Paris Agreement places too much emphasis on the governmental role in climate change and that the private sector is the main driver of carbon emissions.[158]

FAO Actions

The Food and Agriculture Organization has also implemented many policies in regard to the issue of climate change. These policies differ from policies like the Kyoto Protocol and the Paris Agreement in two important ways. First, these policies are much more specific, not only because they focus on the relationship between climate change and agriculture but also because they

150 United Nations Framework Convention on Climate Change, ***The Paris Agreement***, 12, Dec. 2015.
151 Ibid,
152 Ibid.
153 Ibid.
154 Oliver Milman, "James Hansen, father of climate change awareness, calls Paris talks 'a fraud,'" ***The Guardian***, London, England, Dec 12, 2015.
155 David Victor et al, "Prove Paris was more than paper promises," ***Nature Magazine***, August 1, 2017.
156 Joeri Rogelj et al, "Paris Agreement climate proposals need a boost to keep warming well below 2C," ***Nature***, 534(7609): 631–39. 2016
157 Fiona Harvey, "World on track for 3 °C of warming under current global climate pledges, warns UN," ***The Guardian***, November 3, 2016.
158 MN Firzli, "Investment Governance: The Real Fight against Emissions is Being Waged by Markets," ***Dow Jones Financial News***, January 25, 2016.

highlight practical solutions for specific regions rather than broad, overarching goals for the entire world. Second, because the FAO lacks the authority that other committees might have to punish non-compliance, these policies are focused on creating beneficial programs that a country will adopt because it is in its own best interest to do so. While there is only so much these programs can do to combat climate change overall, they can create more sustainable farming practices that will reduce the burden of climate change on global food systems.

It would be difficult to list every program that the FAO has implemented in response to climate change, but they generally fall into two categories: programs that reduce agricultural contributions to climate change and programs that protect agriculture from the negative impacts of climate change.[159] One of the main ways that the FAO has endeavored to reduce agricultural emissions is by combatting methane emissions from **ruminant animals** (cows, sheep, goats) in areas like Latin America, Sub-Saharan Africa and South Asia where agricultural methane emissions are particularly high.[160] The strategies that the FAO has chosen to focus on are improving feed quality, increasing animal lifespan and developing more efficient breeding strategies.[161] These low-cost methods of reducing methane emissions are important because they can be adopted in poorer areas without any major sacrifice on the part of the farmers.[162] Another strategy by the FAO to reduce agricultural contribution to climate change is the development of the Economics and Policy Innovations for Climate-Smart Agriculture (EPIC) program. This program works from a policy perspective to aid national governments in creating more effective agriculture systems that are less harmful to the environment.[163] Currently, EPIC is working with the governments of Malawi, Viet Nam and Zambia to strengthen **capacity building** to help them develop and promote "Climate-Smart Agriculture."[164]

Beyond changing agriculture to reduce contributions to climate change, the FAO has also worked to change agriculture to protect food systems against the weather impacts that climate change has brought. One program that does this is the Adapting Irrigation to Climate Change (AICCA) project.[165] This project is centered in the West and Central Africa region where water resources are unevenly distributed and farmers are already impacted by weather variability like droughts and floods as a result of climate change.[166] It is vital that more sustainable irrigation systems be implemented in this region. The AICCA project seeks to address this problem by

159 "Programmes and Projects | Climate Change," ***FAO***, Food and Agriculture Organization of the United Nations, www.fao.org/climate-change/programmes-and-projects/en/.
160 "Reducing Enteric Methane for improving food security and livelihoods," Food and Agriculture Organization of the United Nations, ***FAO***, http://www.fao.org/in-action/enteric-methane/en/.
161 Ibid.
162 Ibid.
163 "FAO: Economics and Policy Innovations for Climate-Smart Agriculture," Food and Agriculture Organization of the United Nations, ***FAO,*** http://www.fao.org/climatechange/epic/home/en/
164 Ibid.
165 "Adapting Irrigation to Climate Change," Food and Agriculture Organization of the United Nations, ***FAO***, http://www.fao.org/in-action/aicca/en/.
166 Ibid.

carrying out surveys of the resilience of farmer households to climate change.[167] After identifying gaps in the household's water management, the program helps farmers develop small-scale irrigation systems that will give them a steady supply of water regardless of changes in weather patterns.[168] The FAO has many other programs that do similar things, but because every region faces unique challenges, each program must be specially tailored to the needs of that region.

167 Ibid.
168 Ibid.

Possible Solutions

Sustainable Agriculture

One of the most important ways to address the issues that climate change causes for agriculture is by creating more sustainable farming practices. Not only does sustainable agriculture contribute less to climate change, but it is also more resilient to extreme weather events caused by climate change.[169] Creating a sustainable agricultural system means creating farming practices that, "meet the needs of the present without compromising the ability of future generations to meet their own needs."[170] This means that farmers should put back into the earth as much as they take out and ensure that their farming practices do not harm the soil or water quality of their farmland. There are many ways farmers can change their practices to be more sustainable. Making use of **crop rotation**, where different crops are planted after the harvest of another, can allow the soil to replenish its nutrients.[171] Greater crop diversity will have a similar effect as different crops have different nutritional needs.[172] This will reduce the need for synthetic fertilizers that can contribute to greenhouse gas emissions. The use of cleaner energy sources for farm work (biofuels, solar and wind power, hydroelectricity, etc.) as opposed to coal or diesel will also help farmers limit carbon emissions.[173] Farmers should also strive to be more efficient with their land use to limit deforestation. More efficiently-managed grazing practices should be used to allow grazing pastures to recover so that they can be reused for grazing.[174] This will limit the amount of deforestation that occurs for grazing animals.

More efficient pest-management strategies should be employed as pest populations could increase with global warming. **Targeted spraying**, where low volumes of pesticide are deployed to target one particular pest, is much more efficient than more broad pesticide applications.[175] This strategy limits the amount of pesticide that is released into the environment and will help prevent an increase in pesticide needs lead to an increase in environmental pollution. Creating better water management solutions will help give farmers a steady source of water and prevent extreme weather events from ruining an entire harvest.[176] For some areas, this will mean building robust irrigation systems that will bring water to fields in times of drought. Other areas are more prone to flooding so flood management techniques like **levees,** which are embankments preventing river overflow, should be implemented.

169 Eise and Foster, 2018.
170 Brundtland Commission, ***Report of the World Commission on Environment and Development,***United Nations, 1987.
171 Institut de Recherche Pour le Développement, "New Plant-bacterial Symbiotic Mechanism Promising For Crop Applications," ***ScienceDaily***, June 6, 2007.
172 "Industrial Agriculture," ***USCUSA***.
173 "Renewable Energy Production on Farms," ***Center for Agriculture, Food and the Environment***, University of Massachusetts, April 14, 2017, ag.umass.edu/crops-dairy-livestock-equine/fact-sheets/renewable-energy-production-on-farms.
174 Ericson, 2009.
175 G.A. Matthews and E.W. Thornhill, ***Pesticide Application Equipment for use in Agriculture***, FAO, Rome, 1994,
176 "Adapting Irrigation to Climate Change," ***FAO.***

One of the most effective ways to reduce agricultural greenhouse gas emissions is by reducing enteric methane emissions, as enteric methane makes up 65% of agricultural greenhouse gas emissions.[177] As mentioned previously, the FAO has already endeavored to do this by encouraging farmers to change feeding practices and increase the lifespan of their livestock. Some technologies have been developed that have the potential to reduce enteric methane emissions even more. **Biogas systems** are systems that ferment manure (which contains methane) to create biogas and slurry.[178] Biogas is a mixture of organic gases, and slurry is the remaining solid.[179] Not only does processing the manure prevent methane from being released into the atmosphere, but the resulting products are very useful. Biogas can be combusted just like natural gas and can be used as a clean energy source while slurry is an excellent organic fertilizer.[180] [181] Biogas systems have been used in agriculture for a while but recent technological developments have made it an option even in low-income areas. A biogas system can be installed for less than 1500 USD and can create gas with minimal maintenance for 15-20 years.[182]

From a Policy Perspective

The FAO should encourage these and other sustainable agricultural practices, but it is important that this committee recognize the barriers that prevent farmers from implementing these strategies. While most of these practices are very cost-effective in the long run, they can have some very high up-front costs.[183] For low-income farmers, this can make it impossible for them to implement these strategies. The international community must lend support to these projects to help farmers create more sustainable systems without sacrificing their income. Furthermore, it is vital to recognize that different regions have different needs.[184] Rather than creating blanket solutions, this committee must create strategies for assessing the needs of various regions, creating specific solutions and finding ways to build-up successful programs in areas with similar needs.

This committee must also recognize that significant agricultural development, while beneficial in the long-term, will likely increase food prices in the short-term.[185] This will occur as the result of any major costs associated with the development being passed on to the consumer, as well as decreased productivity as the farm acclimates to the new technology. Although these price increases will be transient, they can still be disastrous for vulnerable and low-income people.[186]

177 "Key Facts and Findings," ***FAO.***
178 State Energy Conservation Office (Texas), "Biomass Energy: Manure for Fuel," 23 April 2009.
179 Ibid.
180 "Biomethane fueled vehicles the carbon neutral option," Claverton Energy Conference Bath, UK, October 24, 2009.
181 Hynek Roubík et al, "Addressing problems at small-scale biogas plants: a case study from central Vietnam," ***Journal of Cleaner Production***, 112(4): 2784–2792, 2016.
182 Prakash C Ghimire, "SNV supported domestic biogas programmes in Asia and Africa," ***Renewable Energy,*** Selected papers from World Renewable Energy Congress – XI. 49: 90–94, 2013.
183 "Renewable Energy Production on Farms," 2017.
184 "Programmes and Projects | Climate Change," ***FAO***
185 Eise and Foster, 2018.
186 Ibid.

Therefore, the economic impact of any project should be carefully studied. If any food price increase is predicted, especially in low-income areas, then the project should be balanced with safety-net policies to ensure that access to food is not inhibited by the project. Once food prices return to normal levels, these policies can be removed.

Finally, national governments must recognize the relationship between climate change and agriculture. Provisions for agriculture should be incorporated into national climate change policies and all countries should commit to reducing greenhouse gas emissions from agriculture. Data collection programs for climate change should be built up and integrated with data collection programs from other countries so that robust studies on the impact that climate change and agriculture have on each other can be carried out.[187] There are other, more specific policies that countries can enact to address this issue. For example, the criminalization of deforestation in areas like Brazil where deforestation is a major problem can help create more efficient land use and greater carbon sinks.[188] As different countries contribute to climate change in different ways, these policies must be tailored to individual countries with support from the international community. Delegates should consider how best to encourage the creation of these policies and whether a system of rewards or punishments would be appropriate or feasible. By working with local farmers, large companies and international governments, we may be able to undo or at the very least mitigate the environmental effects of climate change.

187 Food and Agriculture Organization of the United Nations, 2017.
188 Eise and Foster, 2018.

Bloc Positions

Bloc 1: Countries with Stably-Developed Economies

Members: Canada, France, Germany, Greece, Italy, Japan, New Zealand, Portugal, Sweden, United Kingdom, United States

This bloc is made up of primarily high-income countries with well-established industries. These countries have contributed greatly to greenhouse gas emissions in the past and have been the most targeted by agreements like the Paris Agreement and Kyoto Accords. As these countries are highly developed, they may be willing to offer aid and development support to improve agricultural practices in other countries. They can also afford to reduce their greenhouse gas emissions and may be more willing to "go green". They may be open to stricter emission regulations and more oversight from the United Nations. However, these countries may also push for more inclusive agreements that target more than just historically large contributors to climate change. They could argue that countries with emerging industries should be more heavily monitored as these countries are now large contributors to climate change. Their larger international influence may make them more open to international oversight on carbon emissions and environmental practices. Overall, countries with stably-developed economies will be interested in broad solutions that address the causes of the issue.

Bloc 2: Countries with Emerging/Fragile Economies

Members: Algeria, Bangladesh, Brazil, Chile, China, Costa Rica, Dominican Republic, Ecuador, Egypt, Guatemala, Hungary, India, Indonesia, Iraq, Israel, Kazakhstan, Kenya, Kuwait, Lebanon, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, Romania, Russian Federation, Saudi Arabia, South Africa, South Korea, Sri Lanka, Thailand, Turkey, Venezuela, Vietnam

These countries do not have historically large industries and have not been targeted by official UN climate change agreements in the past. However, these countries have developed their economies considerably and may currently make significant contributions to climate change. Many of these countries have industry that is largely unregulated or insufficiently regulated on a national scale. Because their industries may be less stable than those in Bloc 1 countries, these countries may be less in favor of any resolution that could impact their industrial output. They may find solutions such as emission caps or measures against deforestation unsavory. Many of these countries likely have some form of agriculture though, and still have motivation to address the issue. They may encourage the committee to focus on solutions that do not stand to impact industrial output. They will likely be more in favor of programs that protect agriculture against climate change, such as programs to create more sustainable agricultural systems, than those that seek to reduce emissions. These countries will likely be open to solutions that provide aid but may be less willing to provide this aid than Bloc 1 countries.

Bloc 3: Agriculture-Dependent and Small-Island Countries

Members: Afghanistan, Barbados, Belize, Bolivia, Botswana, Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Guinea, Haiti, Honduras, Jamaica, Jordan, Libya, Mongolia, Mali, Philippines, Rwanda, Samoa, Senegal, Sierra Leone, Swaziland, Sudan, Syria, Tanzania, Turkmenistan, Uganda, Zimbabwe

These countries are the most at risk when it comes to climate change and its impact on agriculture. Countries that are very reliant on agriculture, particularly countries with mainly independent or **subsistence farming**, stand to lose a lot of economic activity if agricultural output is diminished. Small-island nations are also more vulnerable to the unpredictable weather patterns caused by climate change because of their proximity to large bodies of water. These countries will be very in favor of strong, action-oriented resolutions and will urge the committee to avoid empty promises and unrealistic goals. They will likely be in support of solutions that hold countries accountable for their emissions and create programs to improve agricultural practices. They will also likely favor programs that offer international aid to help with development. Because many of these countries are already experiencing the negative effects of climate change, they will likely focus on finding more immediate solutions. However, they may also recognize the need to create long-lasting solutions that do not just put a bandage on the issue. With that in mind, it is imperative for these vulnerable nations to both push for immediate action and look towards the long-term big picture.

Glossary

Biogas systems: Technology that processes manure to produce biogas, which can be used like natural gas as a source of energy, and a slurry that can be used as fertilizer. This prevents the methane that the manure emits from entering the atmosphere.

Capacity building: The process of increasing work efficiency for individuals and organizations by acquiring new skills and tools.

Carbon sink: A natural or artificial reservoir such as a forest that can store carbon-containing compounds for an indefinite period.

Climate change: A long-term change in global weather patterns such as average global temperature and rainfall.

Crop rotation: The practice of planting different crops in one plot of land in order to allow the soil to naturally replenish nutrients.

Emissions trading: The practice of buying and selling the right to emit more greenhouse gases. Emissions trading makes reducing emissions profitable and is often used to encourage businesses and countries to reduce their carbon emissions.

Greenhouse gases: A gas in the atmosphere like carbon dioxide, methane or nitrous oxide that can absorb and emit heat. The accumulation of greenhouse gases in the atmosphere causes global warming.

Levees: A naturally occurring ridge or artificial wall constructed to control water levels and prevent flooding.

Monoculture: The practice of planting large volumes of a single crop as opposed to cultivating a diverse collection of crops.

Overgrazing: Allowing livestock animals to graze on land excessively, often to the point where the land cannot recover.

Pesticide drift: The entry of pesticides applied to agricultural fields into the water and air, causing ill effects beyond the area where they were sprayed.

Ruminant animals: Animals that ferment food in their stomach, allowing them to absorb nutrients from plant-based foods that are inedible to other animals. Ruminant animals produce large quantities of methane during digestion.

Stoma: A pore found on plants' leaves and stems that can open and close to regulate gas exchange.

Subsistence farming: A farming practice where the majority of food grown is used to feed the farmer and his or her immediate family, with little of the harvest being sold.

Synthetic fertilizer: Man-made, inorganic fertilizers that tend to be made up of a combination of nitrogen, phosphorus, potassium, and sulfur.

Targeted spraying: The practice of spraying low volumes of pesticide to more efficiently target pests and mitigate pesticide drift.

Thermal expansion: The rise in sea levels observed with warmer global temperatures due to the fact that water expands when heated.

Topsoil: The upper layer of soil which contains plant roots, where plants get nutrients from.

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TOPIC B: FOOD SECURITY IN POLITICAL CONFLICTS

Statement of the Problem

What is Food Insecurity?

The Food and Agriculture Organization strives above all to defeat hunger and ensure that people across the globe are able to live happy and healthy lives. This goal can only be reached if people are given access to quality food, but unfortunately, not every community around the world has the same ability to access the food they need to prosper. **Food security** describes how easily an individual is able to access and utilize food. There are many reasons why this access may be blocked that stem from the four pillars of food security: availability, access, utilization and stability.[189] Clearly, if there is some sort of food shortage in an area, food availability is low and food insecurity will occur. However, even areas with a lot of available food can still experience food insecurity through phenomena like high prices or natural disasters which restrict access to this available food. Furthermore, for food security, food must have a positive impact, so areas with poor drinking water or poor nutrition can also be said to be food insecure even if they have plenty of access to food. This committee will focus specifically on how political conflicts such as war, revolution and oppressive regimes can damage **food systems** and restrict access to food, resulting in food insecurity for affected people.

It is important to note that food insecurity is different from hunger. While hunger can and does often occur with food insecurity, it is possible to have food insecurity without hunger. The United States Department of Agriculture recognizes four ranges of food security. The first is High Food Security, where people have no problem accessing or utilizing food.[190] The second range is Marginal Food Security. Here, there is no significant limit to accessing food but there are anxieties present about food shortages.[191] The third range is Low Food Security, previously called Food Insecurity without Hunger.[192] In this range, individuals experience a decrease in food quality, variety or nutrition but no significant decrease in food amount. These people may not be experiencing hunger but their access to varied, nutritious food has been impacted in some way. The final range is Very Low Food Security or Food Insecurity with Hunger.[193] In this range, individuals show disrupted eating patterns and reduced food intake. When we think of food insecurity we often only think of Very Low Food Security, but it is important to consider the other

189 World Food Program, "What is food insecurity?" ***World Food Program,*** https://www.wfp.org/node/359289
190 USDA Economic Research Service, "Definitions of Food Security," ***United States Department of Agriculture,*** https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security.aspx
191 Ibid.
192 Ibid.
193 Ibid.

two ranges as they also constitute food insecurity and individuals often drift between these ranges. Currently, there are more than one billion people in the world who experience hunger or poverty.[194] Furthermore, people who live in war-torn countries are twice as likely to suffer from **malnutrition** and die in infancy than people in other developing countries.[195]

Food insecurity has a number of negative impacts on affected people. Poor nutrition can lead to stunted growth and swollen limbs in children.[196] All people who suffer from hunger are more susceptible to illness.[197] Even in situations without hunger, the mental toll of food insecurity can lead to emotional distress and poor school performance for children.[198] As a committee, we must consider the ways in which political conflict restricts access to and utilization of food and decide how the Food and Agriculture Organization can enact policies to address this. Remember that this committee deals solely with food and agriculture. We cannot stop political conflicts, but we can determine how to change global food systems to be more resilient against political conflicts.

The Impact of Political Conflict

There is a strong link between political conflict and food insecurity. Political conflict can restrict food access in a number of ways, and food insecurity can also exacerbate certain kinds of political conflicts, such as protests or uprisings. One of the ways that political conflict leads to food insecurity is when food is used as a political weapon. This practice is an ancient one, but one that is still used today. A salient example is the 1983-85 famine that occurred in Ethiopia during the Ethiopian Civil War. During this **famine**, Ethiopia received food aid that was delivered through the government.[199] The government directed the majority of this food aid to urban populations that were poised to start rioting, ignoring the more rural populations to the north.[200] This satiated the urban populations which held more political power and worked to starve out the rebels who were based in the northern provinces of Ethiopia.[201] As a result of this strategy, impoverished people in rural areas starved.[202] Developed nations have also adopted this strategy. During the Cold War, the United States delivered food aid to countries with ideologies similar to its own, withholding aid from countries aligned with pro-Marxist ideologies.[203] These strategies

194 "Declaration of the World Summit on Food Security," Rome, Italy, 18 Nov, 2009.
195 World Food Program, "World Hunger Series: Hunger and Markets," 2009.
196 FAO, IFAD, UNICEF, WFP and WHO, ***The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security,*** Rome, FAO, 2017.
197 Ibid.
198 Ibid.
199 Alex de Waal, ***Evil Days: Thirty Years of War and Famine in Ethiopia***, New York & London: Human Rights Watch, 1991.
200 Ibid.
201 Ibid.
202 Gebru Tareke, ***The Ethiopian Revolution: War in the Horn of Africa***, New Haven: Yale University Press, ISBN 978-0-300-14163-4. 2009.
203 Denise M. Bostdorff, ***Proclaiming the Truman Doctrine: The Cold War Call to Arms.*** College Station, Texas: Texas A&M University Press, 2008.

are powerful political tools, but they disproportionately impact poor, vulnerable people who, ironically, often hold the least amount of political power.

Even when not done purposefully, political insecurity can still have impacts on food systems. Firstly, political insecurity can limit food availability by impacting agriculture. This is because many conflicts are fought in rural areas that are heavily dominated by agriculture.[204] Land and livestock can both be impacted by violence in these areas, leading to poorer agricultural output for an entire region.[205] A second way that political conflict leads to food insecurity is through damage done to food system **infrastructure**. Beyond agricultural infrastructure, public infrastructure such as roads and stores or marketplaces can be damaged due to political conflict.[206] When this happens, people become unable to access food, regardless of how much is available. All of these can also play a role in food prices as well. During times of political instability, food prices can be just as unstable, and damage done to agricultural and public infrastructure will drive up food prices.[207] Furthermore, political conflict limits the amount of market activity. This can be due to decreased output, displaced people who cannot fully participate in the market, and reduced trade activity.[208] Limited market activity also drives up food prices. This means that even people who do not face a physical barrier to food access may still face a financial one.

Although it is typically the case that political instability leads to food insecurity, in some cases, food insecurity can exacerbate political instability, especially when the food insecurity is caused by high food prices. Global bodies have observed that rising food prices increases the risk of democratic breakdown, protests, riots and civil conflict. For example, in 2007 and 2008 there were riots in 48 countries as a result of record high food prices.[209] In Haiti, the riots became violent enough to send people to the hospital and ended with the prime minister being kicked out of office.[210] Riots in Egypt in 2008 led to people burning cars and breaking windows as

204 José Graziano da Silva and Shenggen Fan, ***Conflict, migration and food security: the role of agriculture and rural development***, Food and Agriculture Organization and International Food Policy Research Institute Joint Brief, 2017.
205 Ibid.
206 Clemens Breisinger et al, "Food Security Policies for Building Resilience to Conflict," ***Building Resilience to Conflict through Food-Security Policies and Programs: An Overview***, International Food Policy Research Institute, 2014, pp. 37–44.
207 Hank-Jan Brinkman and Cullen C Hendrix, "Food Insecurity and Violent Conflict: Causes, Consequences, and Addressing the Challenge," ***World Food Program***, 2011.
208 Clemens Breisinger et al, "Conflict and Food Insecurity: How Do We Break the Links?" ***2014-15 Global Food Policy Report***, pp. 52–59.
209 Brinkman and Cullen, 2011.
210 "Riots, instability spread as food prices skyrocket," ***CNN***. 14 Apr. 2008. http://edition.cnn.com/2008/WORLD/americas/04/14/world.food.crisis/

police in riot gear tried to quell the protest.[211] While this kind of food-related political insecurity can occur in any nation, typically developing nations with greater overall food insecurity are the most at risk.[212]

New Issues and Vulnerable Groups

Food insecurity caused by political conflict is not a new problem, but recent changes in the way wars are fought have changed the way we need to think about food insecurity. Globally, we are seeing fewer state vs state wars and more of what are referred to as "new wars": civil wars fought by loosely organized **militias** and **paramilitaries**.[213] These wars are altogether less lethal than traditional wars but bring new problems.[214] They are typically nearly patternless, difficult to predict and tend to spillover and have a greater impact on innocent civilians.[215] They also bring unique challenges for aid delivery. In traditional state vs state wars, the government plays a very clear role in aid delivery: it either supports aid delivery and protects aid workers or it outright prevents it.[216] In these more loosely organized civil wars, the government does not have this kind of control.[217] Instead, aid workers must navigate the chaotic political climate themselves, which makes aid delivery difficult and very dangerous for aid workers. For example, in 2017, eight Red Cross workers in Afghanistan were ambushed by militants.[218] Six were killed and two went missing after the attack.[219] Violence like this both directly impacts the delivery of aid and makes nations less willing to send aid and put their workers at risk.

As mentioned previously, politically-charged food insecurity can happen anywhere but there are certain areas that are more at risk and certain kinds of people who are more vulnerable to the negative impacts of food insecurity. Developing and unstable nations are the most likely to experience food insecurity during political conflict and people in these nations tend to suffer the most. These nations tend to be highly reliant on **imports** for their food supply. Areas that rely on imports for the majority of their food are the most at risk because these imports can easily be affected by natural disasters, violence or even **tariffs**, leaving the people who are dependent on these imports with no other alternative for food.[220] These nations also tend to have poor agricultural and economic infrastructure, meaning that political conflict can easily disrupt their food systems.[221]

211 Ibid.
212 Brinkman and Cullen, 2011.
213 Mary Kaldor, ***New and Old Wars: Organized Violence in a Global Era.*** Stanford, CA: Stanford University Press, 1999.
214 Human Security Report Project, ***Human Security Report 2009***, 2009.
215 Kaldor, 1999.
216 Alex de Waal, ***Armed Conflict and the Challenge of Hunger: Is an End in Sight?*** Global Health Index, 2015, pp. 23–29.
217 Ibid.
218 Sune Engal Rasmussen, "Six Red Cross workers in Afghanistan killed in ambush," ***The Guardian***, 8 Feb. 2017.
219 Ibid.
220 Brinkman and Cullen, 2011.
221 Ibid.

One group of people generally more vulnerable to food insecurity is women and children. Women and young girls represent 60% of undernourished people, which means that they are hit especially hard by food shortages and lack of access to food.[222] Furthermore, malnourishment in women is associated with poor birth outcomes including stillbirths and birth defects. During the Bangladesh Famine of 1974, researchers found that children who were in utero during the famine were 32% more likely to die within one month of birth than children who were not in utero during the famine.[223] There was also a higher number of stillbirths during the famine than in pre- or post-famine years.[224]

Another group of vulnerable people is displaced people. Especially given our current global refugee crisis, we must consider how these people are impacted by food insecurity. Firstly, food insecurity often triggers forced migrations, as refugees must leave their homes in search of safety and ready access to food.[225] Once they leave, however, refugees often face other obstacles to food access. Displaced people often face poverty, with the majority of refugees living under the poverty line.[226] Furthermore, these people are highly dependent on food **vouchers** and other programs for their daily food needs so that when these programs are reduced, as the World Food Program did with its voucher program in 2015, these people have no other options for food.[227] Large influxes of refugees can also trigger new political conflict as socioeconomic changes can heighten tensions between refugees and the other people in those areas.[228] This conflict, in turn, can affect local food systems, leading to a vicious cycle of political instability and decreased access to food.[229]

A third vulnerable group is the rural poor. Firstly, impoverished rural areas tend to have poor infrastructure, making them especially vulnerable to any kind of political instability.[230] Second, political conflicts tend to occur in rural areas and often target agricultural assets, meaning that the people living in these areas will be disproportionately affected by the violence.[231] A third danger these people face is distance from resources. It is often difficult for these areas to access basic resources and receive aid, especially when these areas are cut off from surrounding areas by political conflict.[232] Current aid work is often insufficient to target these individuals and ensure

222 World Food Program, 2009.
223 Rey Hernandez-Julian et al, "The Effects of Intrauterine Malnutrition on Birth and Fertility Outcomes: Evidence From the 1974 Bangladesh Famine," ***Demography***, vol. 51, no. 5, 2014, pp. 1775–1796., doi:10.1007/s13524-014-0326-5.
224 Ibid.
225 Graziano and Fan, 2017.
226 "Food insecurity among Syrian refugees increases as food assistance decreases," ***REACH Initiative***, 8 Jul. 2015, http://www.reach-initiative.org/food-insecurity-among-syrian-refugees-increases-as-food-assistance-decreases
227 Ibid.
228 Graziano and Fan, 2017.
229 Ibid.
230 Bresinger, 2014-15.
231 Graziano and Fan, 2017.
232 Ibid.

their proper access to resources.[233] For this reason, it is vital for this committee to consider the shortcomings in aid delivery and support of local food systems and find ways to improve them.

233 Ibid.

History of the Problem

The relationship between food insecurity and political conflict is as old as political conflict itself. For this reason, rather than detail the entire history of political food insecurity, it will be more helpful to explore specific examples where war, civil unrest and political regimes impacted people's ability to access food. Through these case studies, we can understand how these situations arise and how people are impacted by them.

The Nazi Hunger Plan

During World War II, high-ranking Nazi German officials created a plan to systematically starve the people of Poland and Soviet Russia.[234] At the time, Nazi Germany had invaded much of these areas and planned to use food as a weapon. The Hunger Plan, also called the Starvation Plan or the Backe-Plan, named after Herbert Backe who advocated for the plan, was carried out on four fronts.[235] The first was in occupied Poland. The Germans seized much of the agricultural output in these areas and sought to control the delivery of food to occupied Poles.[236] The **rations** supplied to occupied people was not enough to survive on, although some people were able to supplement their rations by growing their own food in secret or buying food on the black market.[237] The second front of the Hunger Plan was in the Jewish **ghettos**. People in the ghettos were also supplied meager rations, even less livable than those supplied to non-Jewish Poles.[238] Furthermore, the ghettos were under tight control, so bringing in additional food was almost impossible.[239] The third front was in POW camps. The policy in these Nazi camps was that any prisoner of war unable to work should be starved.[240] Even those who did work barely received enough food to survive.[241] The final area where the Hunger Plan was to be carried out was in Soviet Russia. The Nazis were pushing further into Soviet Russia at the time and planned to destroy Soviet infrastructure and starve the Soviet people once they gained control.[242]

Although presented as a means towards winning the war, the truth is that the motivations behind the Hunger Plan were not based on strategy but on racism. In fact, the Hunger Plan was detrimental to the Nazi war effort because it killed and weakened much of the labor force that Nazi Germany was reliant on.[243] Many of the starved people worked in war industries and

234 Steven R Welch, "The Annihilation of Superfluous Eaters: Nazi Plans for and Use of Famine in Eastern Europe," ***MacMillan Center Genocide Studies***, No 17. 2001.
235 Ibid.
236 Jan Tomasz Gross, ***Polish Society Under German Occupation***, Princeton, NJ: Princeton University Press, 1979.
237 Ibid.
238 Raul Hilberg, ***The Destruction of the European Jews***, New York City, NY: Franklin Watts, 1973.
239 Ibid.
240 Timothy Snyder, "The Reich's Forgotten Atrocity," ***The Guardian***, Guardian News and Media, 21 Oct. 2010, www.theguardian.com/commentisfree/cifamerica/2010/oct/21/secondworldwar-russia.
241 Ibid.
242 Joseph Poprzeczny, ***Odilo Globocnik: Hitler's Man in the East***. Jefferson, NC: McFarland, 2004.
243 Welch, 2001.

their systematic starvation led to labor shortages that actually impeded the war effort.[244] The true motivation behind the Hunger Plan was the desire to wipe out the Jewish and Slavic races, which were seen as "less-than" by the central ideology of the Nazi Party.[245]

Fortunately, the Hunger Plan was never carried to fruition, although many people did starve under Nazi policy. Despite the efforts of Nazi Germany, much of Poland was able to survive the starvation by supplementing their rations with illegally-obtained food and Allied assistance.[246] The Nazis were also never able to gain enough control in Soviet Russia to carry out their mass starvations plans there either.[247] However, the prisoner of war camps were extraordinarily deadly. More than 3.1 million Soviet prisoners of war died in POW camps. About 500,000 were executed and the rest died of starvation.[248] While these numbers are very high, they are a far cry from the close to 30 million people that would have been starved had the Hunger Plan been carried out to fruition.[249]

244 Ibid.
245 Alex J. Kay, ***Exploitation, Resettlement, Mass Murder: Political and Economic Planning for German Occupation Policy in the Soviet Union, 1940-1941***, New York City, NY: Berghahn Books, 2011.
246 Gross, 1979.
247 Kay, 2011.
248 Snyder, 2010.
249 Ibid.

Past Actions

Past FAO Projects

The Food and Agriculture Organization has implemented many projects that address food insecurity, most of them focused on alleviating short-term crises and increasing self-sufficiency for affected people. The FAO often uses a system of vouchers and coupons to give people access to food for free or at very low prices.[271] Similar programs are also used to distribute seeds and other agricultural necessities for impacted farmers.[272] Another important role of the FAO is to monitor food security around the world and flag situations in which food security is decreasing rapidly, altering other humanitarian organization to the situation.[273] Recently, the FAO has placed more of a focus on monitoring areas fraught with civil conflict. Beginning in June 2017, the FAO is monitoring the food security situation in those countries currently monitored by the UN Security Council.[274] By monitoring these countries closely, the FAO hopes to mitigate the impact that these conflicts have on people's access to food. The FAO also has many programs that work on creating more resilient food systems in response to damage to infrastructure.[275] However, these programs are highly localized and tend to be more responsive than proactive.[276]

The Food and Agriculture Organization has worked towards ending food insecurity since it was founded, but it was not until recently that food insecurity from political conflict was recognized as a distinct form of food insecurity. Although food insecurity from a drought has very similar effects to food insecurity from conflict, the differences in their causes mean that different solutions are called for. The 2017 State of Food Security, published by the FAO, addresses this topic in detail. In this publication, the FAO recognizes the need for policies that directly address conflict-based food insecurity.[277] Particularly because violent conflict has increased since 2010 and is now at an all-time high.[278] In that time, more research has been done highlighting the relationship between political conflict and food insecurity, which has also spurred the FAO to take specific action against this form of food insecurity.[279] While the 2017 State of Food Security offers little in the form of practical solutions, it is promising to see that this committee plans to address this issue properly.

271 FAO, WFP and IFAD, ***The State of Food Insecurity in the World 2012***, "Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition," Rome, FAO, 2012.
272 Ibid.
273 FAO, ***Peace and Food Security***, "Investing in resilience to sustain rural livelihoods amidst conflict," Rome, FAO, 2016.
274 FAO and WFP, ***Monitoring food security in countries with conflict situations,*** Rome, FAO, 2017.
275 FAO, 2016.
276 "World Food Summit: 10 years of empty promises. Time for food sovereignty!" ***La Via Campesina***, 22 Sep. 2006.
277 FAO, IFAD, UNICEF, WFP and WHO, ***The State of Food Security and Nutrition in the World 2017***,

"Building resilience for peace and food security," Rome, FAO, 2017.
278 E Melander, T Petterson and L. Themnér, "Organized violence, 1989–2015," Version 5.0-2015, ***Journal of Peace Research***, 53(5): 727–742, 2016.
279 FAO, IFAD, UNICEF, WFP and WHO, 2017.

Possible Solutions

When discussing solutions to an issue as broad as food security, it is important to strike a precise balance between short-term and long-term solutions. Short-term solutions will directly address the needs of impacted people at that time and will alleviate the immediate burden of food insecurity. However, these short-term solutions must be accompanied by long-term changes to the food system of the area. Otherwise, there arises a risk of the situation reverting back to where it was or becoming even worse once the immediate aid is gone. In this section we will explore many different short-term and long-term solutions, but delegates must decide how best to balance them.

Short-Term Solutions

Immediate aid in the form of vouchers, subsidies and direct transfers are often used during humanitarian interventions. In a voucher system, people are given tickets that they can exchange for food in designated areas.[280] Subsidies and direct transfers involve the transfer of cash that people can use to meet the basic needs of their households.[281] These can be further divided into conditional and unconditional transfers. Conditional transfers are dependent on the receiver fulfilling some requirement such as working or attending school while unconditional transfers are given freely.[282] These forms of aid are generally thought to be better than aid that directly gives food because it allows the beneficiary to make their own decisions rather than have the decision made by the aid organization.[283] This allows them to maintain dignity and fulfill their own individual needs. [284]

Although these forms of immediate aid are useful, they are not always sufficient. Especially during political conflict, the cause of food insecurity is often not a lack of money but an inability to exchange that money for food.[285] If there is no way to access a marketplace where one can redeem their vouchers or spend their cash, then these forms of aid become useless. One way to preserve these areas and people's access to them is by increasing the peacekeeping presence in that area if there is one.[286] While the FAO is not authorized to send peacekeeping forces anywhere, this committee can certainly call on other committees with the power to do so. Conversely, partnering with the local or national government in the affected area could help protect these areas. However, if the government is involved in the political conflict, directly or indirectly, then this partnership could do more harm than good. Another issue is

280 Directorate-General for Humanitarian Aid and Civil Protection, ***The Use of Cash Vouchers in Humanitarian Crises,*** European Commission, 2013.
281 Ibid.
282 Ibid.
283 The Cash Learning Partnership, ***Cash Transfers and the Future of Humanitarian Assistance***, Swiss Confederation, 2013.
284 Ibid.
285 Bresinger, 2014-15.
286 FAO, IFAD, UNICEF, WFP and WHO, 2017.

that humanitarian actors often have a hard time accessing vulnerable people either because of safety concerns or a misunderstanding of where the need lies.[287] Again, a partnership with the local or national government could be helpful due to the access to military and police as well as a greater familiarity with the region but must be considered on a case-to-case basis. More robust investigation into the region and the situation would also help, although too much investigation could delay the delivery of aid.

In addition to direct aid, immediate aid can also be deployed to temporarily strengthen the local economy. One intervention that bridges the gap between direct aid and economic aid is Cash for Work programs. Cash for Work programs are a type of conditional cash transfer that provides temporary employment opportunities for affected people in post-conflict and disaster-affected areas.[288] While this employment is not permanent, and therefore not a long-term solution, Cash for Work programs allow for the delivery of aid in a way that preserves dignity and simultaneously promotes the rebuilding of infrastructure.[289] Cash for Work programs are relatively new, but the areas in which they have been implemented have seen major success. In 2014, the FAO implemented Cash for Work programs to help people affected by the conflict in Iraq, specifically targeting vulnerable households.[290] Through these programs, people repaired irrigation canals and farmland that had been damaged in the conflict, and the FAO completed 100% of their rehabilitation targets in that area by 2015. As effective as these programs are, they can often exclude people with disabilities and other people who may not be able to work, and so should not stand alone.[291]

Some more drastic economic measures can also be taken, although these typically fall to the national government of the affected area, not to aid organizations. Regardless, the FAO can urge national governments to take these actions when necessary and can provide assistance. These measures can include: lowering taxes, imposing export restrictions, lowering import **tariffs** and implementing price controls.[292] All of these measures lower food prices, which will increase food security if a major barrier to food is high prices.[293] However, these measures also tend to have other effects on the economy of the area and can hurt some groups of people while helping others.[294] It is often unclear whether these measures will do more harm than good. For example, the World Bank strongly urges against export restrictions and price controls as a response to economic trouble.[295] Yet, some countries that implemented these policies during the 2008

287 Brinkman and Cullen, 2011.
288 The Cash Learning Partnership, 2013.
289 Brinkman and Cullen, 2011.
290 "FAO in Iraq," Food and Agriculture Organization of the United Nations, ***FAO,*** http://www.fao.org/iraq/programmes-and-projects/success-stories/cash-for-work/en/.
291 Directorate-General for Humanitarian Aid and Civil Protection, 2013.
292 Brinkman and Cullen, 2011.
293 Ibid.
294 Ibid.
295 World Bank, ***Double Jeopardy: Responding to High Food and Fuel Prices***, Washington DC. 2008.

financial crisis, such as China, Indonesia and India, were largely able to shield their economies from severe financial disaster.[296] As with most interventions, it is necessary to consider the full impact on a case-by-case basis to determine whether it will improve the situation.

Different interventions are required to improve food security for refugees who, as mentioned above, are particularly vulnerable to food insecurity during political conflicts. Refugees are often dependent on external aid and have no other options if this aid becomes unavailable.[297] Furthermore, many refugee camps lack adequate food resources, leaving many refugees in these camps suffering from acute malnutrition.[298] One way to address this shortcoming is to provide more funding to refugee camps and programs like the World Food Program to ensure that refugees have constant access to these resources. Another solution is to give refugees more independence in their food. In 2016, the FAO donated agriculture inputs to refugee settlements in Uganda including goats, chickens and seeds.[299] Additionally, the FAO provided farming materials and a micro-irrigation system to keep the crops watered. Donations of agriculture inputs as opposed to food helps displaced people regain independence and reduce their reliance on external aid.

Long-Term Solutions

Direct aid is helpful and necessary during political conflict in order to minimize the immediate effects. However, it is also necessary to create more stable food systems, particularly in politically-unstable areas, in order to prevent future conflict from compromising food security. One concept that is useful to consider here is resilience. In the context of food systems, resilience refers to the ability of a system to provide adequate food despite disturbances and shocks.[300] This form of aid takes longer to implement and requires much more collaboration between international organizations, national governments and local farmers. It will be very important for this committee to consider how best to foster this collaboration during political conflict as there may be more barriers to cooperation.

In the agricultural sector, policies can be put in place to ensure that farmers' livelihoods are not jeopardized by political conflict. **Crop insurance** can be provided to farmers to protect them against any damage to their assets during a disaster.[301] This will minimize the vicious cycle of farmers not having enough income to plant more crops and thus not growing enough crops to generate income. Investment in rural infrastructure is another way to improve the resiliency of a

296 Brinkman and Cullen, 2011.
297 REACH Initiative, 2015.
298 Bart de Bruijn, "Human Development Research Paper 2009/25: The Living Conditions and Well-being of Refugees," ***United Nations Development Programme***, June, 2009.
299 "FAO in Uganda," Food and Agriculture Organization of the United Nations, ***FAO***, 15 Aug. 2016. http://www.fao.org/uganda/news/detail-events/en/c/434157/.
300 Tendall et al, "Food system resilience: defining the concept," ***Global Food Security***, 6:17-23, 2015.
301 Jessica Eise and Kenneth A. Foster, ***How to Feed the World***, Island Press, 2018.

food system.[302] However, these investments should require some oversight by the FAO, the degree of which should be discussed by this committee. On one side, the FAO has many resources at its disposal, including highly knowledgeable people whose input could be greatly helpful.[303] On the other side, the people in that region know more about their own food system than a large, international organization would and may be more able to make informed decisions about their own region.[304] Delegates should consider how closely the FAO and other organizations should be involved in the way their investments are spent.

Another possible solution is to build up urban agriculture. Particularly in developing countries, urban populations can be more vulnerable to food insecurity because they rely on rural areas for food.[305] During political conflict, when travel and transport are difficult, these populations have no alternative for food. Urban agriculture, where plants and animals are raised in or near cities, can give urban populations access to fresh food even in times of instability.[306] Currently, urban agriculture is growing worldwide but is typically not supported by national governments and is even illegal in some countries.[307] The FAO is currently working to transform urban agriculture into a recognized urban land use and economic activity by encouraging national and regional governments to adopt urban agriculture and by lending technical support to new urban agriculture programs.[308] An additional concern is the effect that pollution could have on the quality of the food, which should be considered if new urban agriculture programs are to be implemented.[309]

Finally, the diversification of income sources is a good way to create a more resilient economy, which will in turn increase food security. Investments in small businesses, either through subsidies or direct donations by the FAO, will give people more independence in their income

302 P Pingali, L Alinovi and J Sutton, "Food security in complex emergencies: enhancing food system resilience," ***Disasters***, 29:S5-S24, 2005.
303 Ibid.
304 The Cash Learning Partnership, 2013.
305 Claire Corbould, "Feeding the Cities: Is Urban Agriculture the Future of Food Security?" ***Future Directions International***, 1 Nov. 2013, http://www.futuredirections.org.au/publication/feeding-the-cities-is-urban-agriculture-the-future-of-food-security/.
306 "Urban Agriculture," Food and Agriculture Organization of the United Nations, ***FAO***, http://www.fao.org/urban-agriculture/en/.
307 Corbould, 2013.
308 "Urban Agriculture."
309 Ibid.

and make them less vulnerable to food insecurity.[310] In developing countries specifically, small businesses make up the majority of employers so building up these businesses will have the greatest impact on job creation.[311] Furthermore, economic support should also be provided to self-employed people. Currently, 48% of the workforce in vulnerable countries is made up of the self-employed, with most of these people being self-employed farmers.[312] As economic programs are implemented, they must provide support for self-employed people just as they do for companies, particularly because supporting self-employed farmers will protect this group from economic disaster during political conflict.

There are other steps that national governments can and should take to reduce their vulnerability to food insecurity. The first is creating food **reserves**. Through food reserves, a moderate amount of food is stored during times of good food security.[313] Typically, this food is purchased by the government from farmers. In situations where food security is threatened, this food can be distributed, thus lessening the impact of the disaster. National and regional governments should also build up safety net policies that support people whose income is affected by political conflict or other disasters. While international organizations like the FAO are able to provide similar support, government-backed programs will more easily reach people and will be much less transient than the programs that international organizations implement.[314] Governments should also be urged to vigilantly monitor food security in their country during times of political conflict to catch food crises before they become too serious.[315] Ultimately, national and regional governments must be held accountable for the food security of their region by the international community.

310 Bresinger, 2014.
311 Asli Demirgüç-Kunt, "Generating Jobs in Developing Countries: A Big Role for Small Firms," ***All About Finance***, The World Bank, 12 Jun. 2011, http://blogs.worldbank.org/allaboutfinance/generating-jobs-in-developing-countries-a-big-role-for-small-firms
312 "Employment strategies for developing countries," ***MSS Research***, http://www.mssresearch.org/?q=Employment_strategies_for_developing_countries
313 Bresinger, 2014-15.
314 Brinkman and Cullen, 2011.
315 Ibid.

Bloc Positions

Bloc 1: Countries with High Food Security[316] and High Political Stability[317]

Members: Barbados, Botswana, Brazil, Canada, Chile, Costa Rica, France, Germany, Greece, Hungary, Italy, Japan, Kuwait, Mexico, New Zealand, Panama, Peru, Portugal, Romania, Saudi Arabia, South Korea, Sweden, United Kingdom, United States

Countries in this bloc are very stable with most of their population able to easily access food. While they are likely still invested in this issue, it may be more from the standpoint of an aid donor. These countries may be more interested in how to reform aid and humanitarian interventions in order to reduce food insecurity during political conflict. They will likely also be interested in capacity building to improve the resilience of food systems in vulnerable countries and holding accountable those countries that fail to provide adequate access to food for their citizens.

Bloc 2: Countries with High Food Security and Low Political Security

Members: China, Israel, Jordan, Lebanon, Russian Federation, South Africa, Thailand, Turkey

While these countries may be engaged in civil and international wars or may have an unstable national government, this political conflict has not yet severely impacted food security. However, these countries' food systems may still be vulnerable to this conflict. For this reason, these countries will likely be very interested in increasing food system resilience and taking other preventive measures to avoid food insecurity. They may also encourage aid and support from high security countries, though not as much as other countries.

Bloc 3: Countries with Low Food Security and High Political Security

Members: Turkmenistan, Belize, Dominican Republic, India, Indonesia, Jamaica, Kazakhstan, Mongolia, Samoa, Vietnam

Countries in this bloc have a high amount of food insecurity, but it is not due to political conflict. Rather, it may be due to natural disasters or economic crisis. Because these countries do not have significant political conflicts, they may be less interested in food insecurity that arises from political conflict. They likely will not oppose resolutions on this issue but may encourage the committee to explore broader solutions that will address food insecurity overall and not solely focus on political instability as a cause.

316 Determined by "Global Food Security 2017" ***The Economist Intelligence Unit***, 2017.
317 Determined by "Fragile States Index 2018" ***The Fund for Peace***, 2018.

Bloc 4: Countries with Low Food Security and Low Political Security

Members: Afghanistan, Algeria, Bangladesh, Bolivia, Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Ecuador, Egypt, Guatemala, Guinea, Haití, Honduras, Iraq, Kenya, Libya, Mali, Morocco, Nigeria, North Korea, Pakistan, Philippines, Rwanda, Senegal, Sierra Leone, Sri Lanka, Sudan, Swaziland, Syria, Tanzania, Uganda, Venezuela, Zimbabwe

Countries in this bloc have very poor food security, a significant portion of which comes from the political conflicts occurring in their country. These countries are the most vulnerable to this issue and already suffer many of the effects of food insecurity. They will likely be most invested in solutions that specifically address food insecurity from political conflict, particularly those solutions with direct impact. These countries may push for immediate action but will likely also support resolutions that include long-term increases in food system resilience.

Glossary

Crop insurance: Insurance that protects farmers against lost revenue due to natural, political or economic disasters. It may be purchased by individual farmers or subsidized by the government.

Famine: A widespread food shortage.

Food security: The state of food availability and access in an area.

Food system: The network of processes and infrastructure that are involved in feeding a population including agriculture, markets, and households.

Ghetto: A section of a city predominantly inhabited by members of a particular ethnic group, often residing there due to political or socio-economic restrictions.

Imports: Goods that are brought into a country from another country.

Infrastructure: The fundamental facilities and systems necessary to maintain living conditions in a particular area.

Malnutrition: A condition due to a lack of vital nutrients or a severe imbalance in nutrients.

Militia: An army composed of non-professional soldiers or non-soldier citizens.

Paramilitary: A semi-militarized force that is composed like a national army but is not under the jurisdiction of the nation's formal armed forces.

Rations: Food allowances as determined by a governing force.

Reserves: Food supplies set aside by the government to be stored and used in times of poor food security.

Tariff: Fees imposed by the government on imported or exported goods.

Voucher: A coupon that can be redeemed for some good or service such as food or schooling.

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