



# Harvard Model Congress Boston 2023

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## CLIMATE CHANGE AND AGRICULTURE

*By Ella Wesson*

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### INTRODUCTION

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There is no question in the eyes of scientific experts that climate change is affecting our planet tremendously. NASA scientists have presented the following as evidence for this climate increase: a global temperature rise, warming oceans, shrinking ice sheets, glacial retreats, decreased snow cover, rising sea levels, declining arctic sea ice, extreme weather events, and ocean acidification (Climate Change: How Do We Know?, 2022).

So, it is clear that climate change is real. Why is it an important issue to discuss? Debate on climate change policies is vital due to the phenomenon's incredibly multifaceted impacts. The global warming of the planet will and already is affecting environments, economies, food production, human health, and infrastructure (Climate change impacts, 2021).

This briefing will focus on the impact of climate change on agriculture, specifically. It is predicted that an agricultural productivity decrease of between 2% and 15% will ensue by 2050 if climate change follows its current progression (Delincé et al., 2015). Decreased agricultural productivity will lead many new issues as a result, including the potential starvation of millions of people as the population of the Earth continues to grow and all our agricultural production struggles to meet the rising demand needed to feed everyone. However, this briefing will focus on the economic fallout, which is expected to be devastating with food prices predicted to rise between 1.3% and 56% by 2050 (Delincé et al., 2015). In centering on agriculture and its economics, this briefing aims to consider only some of the many devastating outcomes of climate change.



*Climate increases  
can lead to  
droughts, which are  
detrimental for  
most crops.*

*UCSUSA, 2019*

## EXPLANATION OF THE ISSUE

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### *Historical Development*

The words “climate change” are fitting in that the term refers to a significant change in climate over time; this change can include temperature, wind patterns, precipitation, humidity, and air pressure, among other measures (Agriculture and Climate, 2022).

The current period of climate change, which is also referred to as global warming due to the rise in average temperatures, is caused by human activity creating a buildup in **greenhouse gases**. Greenhouse gases are compounds that trap heat in the atmosphere. In releasing large amounts of carbon dioxide (one of these gases) into the atmosphere over the past few centuries through the burning of fossil fuels, humans have caused an increase in global temperatures by about 1°C since 1901 (Climate change impacts, 2021). All aspects of agriculture (crops, livestock, and seafood) depend on specific temperatures and weather patterns, which is why climate change is so important to consider in this context, as even a slight change in temperature could drastically decrease agricultural yields.

**Greenhouse gases**  
– gaseous compounds  
which trap heat in the  
atmosphere.

#### The Paris Agreement

Efforts have been made in the past to hinder the progression of climate change, namely the Paris Agreement, which was signed by most UN member states in 2016, pledging to cut greenhouse emissions by half by the year 2030. The overarching goal of this legally binding treaty was to limit the global temperature increase to well below 2°C, while ideally limiting it to a rise of 1.5°C. While the Paris Agreement had lots of buy-in from countries at the time of its ratification, many argue that it will not be effective in the long run (Maizland, 2021). This can be seen in the ability of countries to leave the agreement at will. Most famously, the United States left the agreement for about a year in 2020 under President Donald Trump, before rejoining under President Joe Biden, who is known to be more concerned about global warming and climate change as a whole.

### *Scope of the Problem*

The effect of climate change on agriculture can be broken up into the different sectors of food production, with each facing unique challenges due to the rise in temperatures and sea levels.

#### The Crop Industry

Crops, which can be as varied as grain and fruits and vegetables, are vital to the agricultural industry and the production of food on a global scale due to the large amounts that are consumed by global

*Humans have caused an increase in global temperatures by about 1°C since 1901*

populations annually. There are a few ways in which climate change is impacting the growth of crops, a reality that will only worsen without a solid resolution in place to mediate the phenomenon.

First, the global temperature increase is leading to a decrease in yields. This is because different crops flourish in various regions of the world in part due to the temperatures in those places. In much higher temperatures, crop yields would almost certainly decline (Climate Impacts on Agriculture and Food Supply, 2017). Additionally, the change in temperature may stunt the length of the growing season in areas where many crops are grown, leading to smaller crops which will not be able to feed as many people.

A second consideration is the increased level of carbon dioxide in the atmosphere. As stated earlier, burning fossil fuels emits carbon dioxide. With no specific policies to limit the combustion of fossil fuels, this and other greenhouse gases will continue to take up larger (and unnatural) percentages of the Earth's atmosphere. Experiments indicate that this could lead to decreases in yield in addition to quality of crops (Climate Impacts on Agriculture and Food Supply, 2017). This could be because of the delicate relationship between plants and their surrounding air.

Third, extreme weather events, which are made more common due to rapid climate change, can be incredibly detrimental to crop yields. Crops are heavily reliant on their optimal amount of watering, which is altered in the wake of a drought or a flood (Climate Impacts on Agriculture and Food Supply, 2017). Many nations, such as Chile and Sub-Saharan Africa, are already seeing decreases in crop yield due to the rapidly encroaching desert on agricultural fields, killing crops and limiting the amount of space that can be used.

Finally, even unrelated from climate change, crop yields are affected by pests and weeds. With increased temperatures and changes in humidity, however, these pests are predicted to grow in population, negatively affecting the yield of planted crops (Climate Impacts on Agriculture and Food Supply, 2017). This is particularly impactful in developing countries, where farmers cannot afford to buy industrial remedies to protect their crops from these pests. As a result, many of these farmers, who are primarily growing crops for their own subsistence, will see their livelihoods shrink, exacerbating the issue of famine in developing countries.

### The Livestock Industry

The livestock industry is another sector of agriculture that has the potential to be ravaged in the wake of climate change. In a direct sense, increases in temperature and heat waves impact livestock by making them more susceptible to disease, a scary reality for the industry. This is also exacerbated by the fact that as temperatures rise, livestock becomes dehydrated quicker, leading to



*Extreme weather events, including floods like this, can greatly impact the proper growth of crops.*

*Thelen, 2017*

other health problems for the animals. Additionally, studies show heat reduces fertility and milk production (if applicable) of livestock (Climate Impacts on Agriculture and Food Supply, 2017). This can also be explained by the thirst of these animals, as studies have shown that if an animal is having a difficult time surviving, such as by being constantly dehydrated, it will not be able to become pregnant or produce milk.

Indirectly, changes to the crops which are brought about by climate change, such as decreased yield and nutritional value as discussed earlier, can limit productive grazing by livestock, thereby affecting the population negatively (Climate Impacts on Agriculture and Food Supply, 2017).

As with crops, the increase in pests which can plague livestock is another consideration. However, using pesticides on livestock brings into question the safety of eating them. When passed through the food chain, these chemicals may harm any predator of the treated animal (Climate Impacts on Agriculture and Food Supply, 2017). This has been seen in the past with poisons such as dichloro-diphenyl-trichloroethane (**DDT**) undergoing biomagnification after leeching into fish, leading to massive population declines in all the species that eat fish, most famously the bald eagle.

***DDT** – a synthetic organic compound used as an insecticide*

It is important to note that some unsustainable livestock practices add to the problem of climate change. Methane, a greenhouse gas, is released from manure management by livestock farms, further adding to the issues stated above (Livestock Methane, 2022). In other words, the production of livestock, which then releases gas while grazing, is directly leading to an increase in the concentration of greenhouse gases in the atmosphere.

Furthermore, to create pastures for livestock, trees need to be cut down, leading to an epidemic of deforestation in Africa and South America. This contributes to the desertification of the region as trees are no longer able to keep the soil in place, ruining the soil and leading to even greater increases in global temperatures.

## The Fishing Industry

The final sector of the agriculture industry that will be touched on in this briefing is fishing. One of the clearest indicators of climate change is the rise in water temperatures. Unlike livestock, fish are often caught in the wild and therefore have the freedom to move from their locations when the water temperature becomes too high. As such, many species will move to an area of colder water, subsequently entering a new ecosystem which can have drastic effects on the populations of both the native and transplanted fish. Rising temperatures in the oceans, in parallel with on land, can lead to higher susceptibility to parasites and diseases (Climate Impacts on Agriculture and Food Supply, 2017).

Secondly, many aquatic species rely on the season to mate and migrate. This is indicated to these species by the temperature. As temperatures increase, the vital acts of reproduction and migration are impacted due to the fish not receiving the indicators that it is time to conduct these processes, which leads to a decrease in fish populations (Climate Impacts on Agriculture and Food Supply, 2017).

Finally, **ocean acidification** is a highly prevalent effect of climate change. Ocean acidification is the reduction in the ocean water's pH due to increased levels of carbon dioxide in the atmosphere. Acidic ocean water can weaken the shells of shellfish, having drastic impacts on the delicate ecosystems which exist in our oceans (Climate Impacts on Agriculture and Food Supply, 2017)

**Ocean acidification** – the reduction in the ocean water's pH due to increased levels of carbon dioxide in the atmosphere.

## *Group of 20 Action*

The Group of 20 (G-20), despite not being a legislative body, discusses the future of tackling climate change regularly, focusing on frameworks to put forth in their countries which will inspire action. To be clear, what is discussed in G-20 forums is not legally binding, though countries often make pledges which work toward achieving some type of goal.

At the 2021 G-20 summit in Rome, leaders made a resolution to stop financing coal power plants in countries that were not their own, referencing the Paris Agreement goal as a motivation for doing so (Rogers and Tankersley, 2021). However, this agreement was met with much criticism by climate activists, including Greenpeace International and Oxfam. This may have been because G-20 countries cause the majority of the emissions of greenhouse gases into the Earth's atmosphere. If these developed countries continue to fund their own coal plants, even without funding international ones, the net decrease in emissions may not be that drastic (Rogers and Tankersley, 2021).

*G-20 countries cause the majority of the emissions of greenhouse gases into the Earth's atmosphere*

Over the past twenty years, the G-20 has discussed tens of policies that aimed to reduce climate change. Some of these included incentives to remove greenhouse gases from the atmosphere, urban planning strategies and investments, coal and oil phase-outs, and carbon dioxide removal technology development. The number, scope, and ingenuity of these presented plans have increased a significant amount in recent years. However, as mentioned above, the forum nature of the G-20 summit makes action difficult for the group to achieve. In fact, about half of the policy options presented by the G-20 summit are not widely adopted by countries today, creating many gaps in climate change mitigation infrastructure (Nascimento et al., 2022).

## *Other Policy Action*

The United Nations Framework Convention on Climate Change (UNFCCC) is where most climate issues are discussed in the United Nations (UN), the two major policies in the past being the Kyoto Protocol of 1997 and the Paris Agreement, discussed earlier, in 2015 (Understanding the UN Climate Change Regime).

### The Kyoto Protocol

The Kyoto Protocol had a goal of limiting emissions of the following greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Each developed country was given a different cap on the allowed emissions of each gas based on the specific needs of the country (Kyoto Protocol, 2022).

However, the Kyoto Protocol was not met with much international support. The United States, Canada, and Russia did not agree to their assigned emissions targets, and because developing countries were not bound by the agreement, many industrial cities continued to emit many greenhouse gases. The goal of reducing emissions was not achieved, and the net amount of greenhouse gases emitted each year has increased since 1997 (National Geographic Society, 2022).

### The Paris Agreement

The Paris Agreement, as discussed earlier, aimed to limit the increase in temperature by global warming to 2°C. To achieve this goal, governments were required to make economic and social changes in their countries which slowed, and eventually stopped, the release of greenhouse gases into the atmosphere. Financial assistance was pledged by developed countries should it be necessary (The Paris Agreement, 2022). However, many argue that the Paris Agreement is not ambitious enough and will not achieve its goal of limiting global warming (Maizland, 2021).

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## IDEOLOGICAL VIEWPOINTS

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### *Cooperative View*

Countries with cooperative views are more likely to agree with policies that take a hard stance against climate change, holding ideals that by working together as one planet, we can stop anthropogenic climate change, hence the term “cooperative.”

Countries with cooperative ideologies are more willing to sacrifice the economic benefits of, say, the burning of fossil fuels

within their own country for the greater worldwide good of fighting climate change swiftly and efficiently.

To elaborate, countries with cooperative views are more interested in the furtherment of the globe as one entity than the furtherment of their own country. To these countries, the best interest of the entire world population is the best interest of the country; there is less of a “us vs. them” mentality in this viewpoint and rather a “let’s work together against this” thought process.

## *Individualist View*

Countries with individualist views are more likely to agree with policies that are more relaxed in their stances against climate change, holding ideals that the issue of climate change is not an incredibly pressing issue and that even small changes are helpful in the long run. As a result, these countries would be more willing to have every nation determine their own policies based on their wants and needs.

Countries with individualist views are not very willing to give up the economic benefits which come from the continuous burning of fossil fuels and using non-renewable energy and would thus be against any plan that would require them to spend an exorbitant amount of money to fight climate change.

As further explanation, countries with individualist views are truly interested in their own nation and the best interests of their population in contrast to the rest of the world’s, holding the belief that each country should be responsible for their own people and policies. Therefore, countries with individualist views are less likely to buy in to a policy that is worldwide, perhaps taking their own stance on climate change but not subscribing to a global initiative against it.

## AREAS OF DEBATE

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There is no magic bullet for climate change to suddenly stop affecting the agriculture industry. Rather, resolutions must be worked out that appeal to all countries at the table, both the cooperative-leaning and the individualistic-leaning ones. That said, the most agreeable resolution to this issue may not appeal strongly to either side of the spectrum, but rather fall in the middle of the pack.

### *Pledges to Decrease Greenhouse Gas Emissions on a Country-by-Country Basis*

This solution aims to solve the overarching issue of global warming. As stated earlier, higher greenhouse gas content in the

*In stopping the warming of the Earth at its origin, each of the sectors of the agriculture industry can benefit.*

atmosphere traps heat, warming the Earth which affects the crops, livestock, and fishing industries, as specified. In stopping the warming of the Earth at its origin, each of the sectors of the agriculture industry can benefit. If achieved quickly enough, global temperatures would ideally stop rising, and crops, livestock, and aquatic species could continue being produced in their optimal location based on climate.

This solution would look like the Kyoto Protocol or the Paris Agreement in that it encourages countries to make their own pledges about the reduction of greenhouse gas emissions. This solution would be implemented by the G-20 establishing figures (perhaps a limit on greenhouse gas emissions or a target for renewable energy plants) for specific countries to achieve.

The fact that this solution features specific targets for each country makes it desirable, as it would ensure that smaller countries with fewer resources would not have to reach the same number of renewable energy plants as more developed nations, and vice versa. With a collective goal, nations are more likely to make changes, even within their own countries, to work toward stopping climate change in its tracks.

However, this solution could fall into the same trap as the Kyoto Protocol where it just might not have enough buy-in from certain countries that lack incentive, likely more industrialized countries that rely on fossil fuel burning as an energy source.

Additionally, this solution might wind up like the Paris Agreement, with many critics arguing that small pledges by individual countries are simply not drastic enough to make any effective impact on the progression of climate change around the world.

### Political Perspectives on this Solution

Countries with a cooperative view would be highly likely to support this solution due to its nature of working toward a collective goal. Given that this solution leaves the exact numbers up to the discretion of the G-20, countries with a cooperative view would likely aim for high goals to truly accomplish the solution's purpose. With enough buy-in from every country, this solution could cause an effective change, though this is a strong contingency that may be too much of an idealistic view of today's world.

Countries with an individualist view have a chance of supporting this solution if the figures presented were not too ambitious. If countries with this ideology are still able to mostly continue their current plans for greenhouse emissions while still making some, though small, sacrifices, they might agree to it. However, if these figures appear too high for these countries, they may not choose to support it in their own economic best interest.



## *Integration of Crop-Livestock-Forestry Systems*

This solution aims to lessen the impacts of climate change on agriculture, which distinguishes it from the above solution as it targets the symptoms of climate change rather than the causes.

Integration of these systems is the combination of two or more sectors (crops, livestock, and forestry) to produce more than one product in each area. Why does this help? In addition to making agriculture more financially efficient, which is vital in a world where it is on the decline, integrating systems has proven adaptation benefits. Most importantly, they show a reduction in effects from extreme weather events on crops, and subsequently livestock, mitigation of greenhouse gases, and improvement of animal welfare (Calmon and Feltran-Barbieri, 2019).

This may be implemented by a pledge system by individual countries that agree. There is a lot of freedom in how exactly to implement this, for example, perhaps aiming to integrate a specified percentage of a country's farms.

This solution is desirable because it focuses on the impact climate change has on agriculture by changing agriculture itself. This allows farmers to come ahead with a profit due to more efficient farming practices, which helps to fight against the economic hardship that climate change is causing within the agriculture industry.

However, this solution, as mentioned, targets more of the symptoms of climate change rather than the causes. While there may be some environmental benefits that follow, this solution will not achieve the same level of carbon dioxide removal as decreasing fossil fuel burning would (What is "ICLFS"?).

### Political Perspectives on this Solution

Countries with a cooperative view would be likely to agree to this solution because it presents a clear way for the mitigation of the effects of climate change on agriculture through an international and cooperative effort. However, these countries would likely push for further change rather than just this, given that it does not target the cause of climate change.

Countries with an individualist view would be likely to agree to this solution because it creates a more efficient and economical framework for the agriculture industry, which would not be a financial burden. It is important to note, though, that this would require an initial investment to change the infrastructure, which some countries might be against even with the eventual return on investment years away.

## *Alternative Manure Management Pledges*

This solution aims toward lowering the content of greenhouse gases in the atmosphere. As mentioned earlier, the livestock industry adds to the causes of climate change through emissions of methane as a result of poor manure management practices. Therefore, this solution would target this cause of greenhouse gas emission through legislation that would require only “dry” management practices for manure.

This solution would be implemented through government pledges to transition farms to these more sustainable methods of manure management. As with the previously discussed method, this could be accomplished by establishing a percentage of farms to be transitioned over a specified amount of time to account for each country’s economic abilities.

For example, in California, United States, the implementation of **Anaerobic Digesters** (commonly called Methane Digesters) has allowed for a reduction in greenhouse gas emissions from manure by 4.14 million metric tons of carbon dioxide over ten years (California Department of Food and Agriculture, 2018). At the same time, these Anaerobic Digesters have allowed for the production of clean, renewable energy which can then be sold.

This solution is desirable because it does not require a major overhaul such as transitioning to all-renewable energy, but rather minor changes within farms. Additionally, this solution addresses a problem within the agriculture industry that adds to climate change, subsequently mitigating the impacts of climate change on agriculture (this is a bit convoluted but overall helpful).

However, this might be difficult to implement because countries are not willing to invest in changing farming practices that have been done in the past with no huge potential for economic benefit for doing so (Livestock Methane, 2022).

### Political Perspectives on this Solution

Countries with cooperative views would likely agree with this solution for the same reasons as stated for the other solutions: a cooperative effort made by countries around the world to effect meaningful change. Additionally, these countries would likely favor the fact that this reduces methane emissions, as methane is thirty to seventy times more potent as a greenhouse gas than carbon dioxide is.

Countries with individualist views would likely be more opposed to this policy as it would require infrastructure to transition the manure management processes to more sustainable ones which may not be the most economic for these countries.

**Anaerobic Digester**  
– a type of manure  
storage where  
bacteria break down  
material in the  
absence of oxygen.

The G-20 summit is a forum for developed and financially stable countries. There is no legislative action put into place by the G-20, but rather pledges made by each of its member countries. As such, the G-20 does not have a centralized monetary fund that can be used at the member's discretion.

Rather, G-20 resolutions tend to be pledges decided upon by the member nations where each member uses their own country's budget to achieve the outlined goal. These exact numbers may be different for each country, and smaller countries would not be expected to pay the same amount as a much larger country, but perhaps the same proportion of their gross domestic product (GDP).

G-20 countries make up 80% of the world's economy, indicating the financial ability of G-20 members to make effective changes with their own national budgets, as opposed to a G-20 fund (Murphy, 2020).

## CONCLUSION

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Climate change is one of our time's most contentious and significant issues. It requires not only small changes within each nation but international agreements to make effective change.

Countries will have to consider both their economic best interests and the best interests of the planet, with lots of overlap between these two spheres. In sacrificing our Earth's atmosphere and environment, we are putting the entire agriculture industry at risk, which has its own economic implications in addition to the major food production and access problems that can ensue.

There is no one right answer for a solution. Even policymakers from the G-20 countries have difficulty finding an agreement that suits every country's interests. So, it may be worth mixing several of these proposed solutions, in addition to other solutions you may have independently researched that were not covered in this briefing.

It is important to note that many solutions for climate change are based on science and technology which are extremely dynamic fields that are ever-changing, so new solutions appear every day.

## GUIDE TO FURTHER RESEARCH

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The G-20 website contains many of the documents from G-20 summits over the years. Performing effective research on the workings of the G-20 certainly begins here due to the purely informative nature of these documents. I would highly recommend delegates search the database for previous agreements and

discussions on climate change to gain an understanding of how the G-20 operates.

Additionally, looking at climate policies enacted within delegates' assigned countries may clarify how their country would react to potential G-20 agreements. Did their country support the Kyoto Protocol or the Paris Agreement? If so, did their country's government follow through on its pledges?

To find this information, delegates are encouraged to search reputable and nonpartisan sources to prevent any bias in gaining a complete understanding of the issue at hand.

## GLOSSARY

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**Anaerobic Digester** – a type of manure storage where bacteria break down the material in the absence of oxygen

**DDT** – a synthetic organic compound used as an insecticide

**Greenhouse gases** – gaseous compounds which trap heat in the atmosphere

**Ocean acidification** – the reduction in the ocean water's pH due to increased levels of carbon dioxide in the atmosphere

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