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**Climate Change and its Risks on Food**  
**Security**

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## **Abstract**

*Hunger is an issue of justice and not of charity. When we talk about food insecurity, we talk of prices and poverty, and smoothly ignore the other side of the coin. What happened to the monsoon patterns? Why, in an agrarian country, malnutrition roars like a beast? The rise in global temperatures has made humanity witness increased floods, burning forests, weeping glaciers, etc., and it's the poorest of the poor and the marginalized that bear the weight of the worst implications. This paper attempts at drawing a bridge between the horrors that are climate change and food insecurity, using statistics and comparison of data sets of developing countries. Agriculture is the key that can be used to tackle food insecurity but it is also the sector that is directly impacted by climate change. Light on United Nations Sustainable Development Goals is also thrown while also analyzing some other associated risks of climate change such as biodiversity loss, poverty, climate refugees, etc.*

**Keywords:** *Climate Change, Food Security, Agriculture, Sustainable Development Goals, Climate Action*

## **1.0 Introduction**

The 17 Sustainable Development Goals adopted by the United Nations General Assembly in September 2015 aims to transform the world (UNDP, 2015), focus on Zero Hunger (SDG2) and Climate Action (SDG13).

Food security can be ensured when food is accessible, affordable and available to people at all times. Rising temperatures, changing precipitation patterns, flooding, droughts, biodiversity loss, population growth directly or indirectly affect agriculture and thus pose a threat to Global Food Security. *Climate change is the long-term alteration of temperature and typical weather patterns in a place. Climate change could refer to a particular location or the planet as a whole* (National Geographic Society, 2019). Global Climate Change is one of the biggest threats that the human race will have to face. The intensity of the threat is increasing along with rising global temperatures and increasing greenhouse gas emissions.

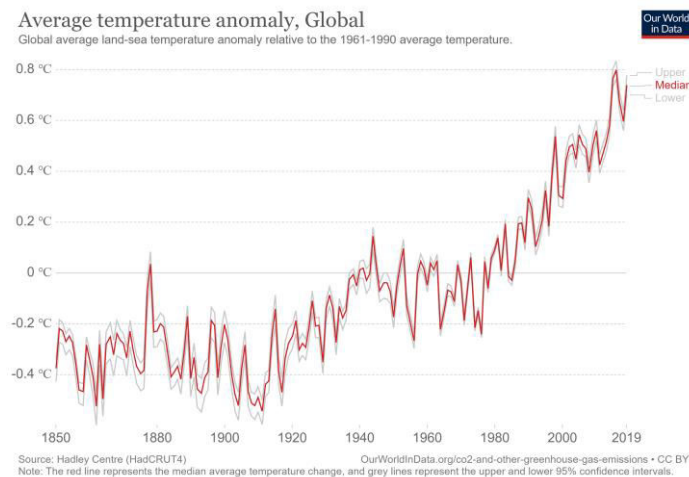


Figure no 1: Increase in global average temperature from 1850 to 2019.

*OurWorldInData.org*

The rise in global average temperatures has increased from 1 to 1.2 degrees celsius (Lombrana, 2020). The effects of the same include high-intensity floods, droughts, sea-level rise, forest fires, melting of glaciers and ice sheets, biodiversity loss and so on. *The World Food Summit of 1996 defined food security as existing when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet the dietary needs for a productive and healthy life* (Water and food security | International Decade for Action 'Water for Life' 2005-2015, 2020).<sup>[2]</sup>

It is important to tackle the challenges of Climate Change and Food insecurity on a global level and with a holistic and inclusive approach. The United States of America under Donald Trump administration backed out from the Paris Agreement, 2015 and now it is even more crucial that policies are formulated in such a manner that the most affected nations and communities can adapt and thrive while the global carbon emissions are to be decreased substantially. The United States is the 2nd largest emitter of Carbon dioxide (Union of Concerned Scientists, 2020). The nation also does not have an action plan to act on its pledge to reduce the emissions by 17 per cent (What Countries Are Doing To Tackle Climate Change, 2011). The USA is an important contender in limiting the greenhouse gas emissions and in ensuring that global warming doesn't cross the 1.5°C. This move might encourage other large emitters of greenhouse gases to roll back down on their efforts and commitments.

This paper tries to examine the relation between Climate Change and Food Security through quantitative data analysis collected using secondary research sources. The extent of food insecurity in developing countries is higher than that in the developed countries (*Global Food Security Index (GFSI)*, 2019), thus a comparison will be presented.

Since agriculture plays a vital role in ensuring food security, thus the effects of climate change on agriculture and food security will also be addressed. Land degradation leads to a fall in agricultural productivity and thus risks food security. Associated risks of Climate Change such as floods, droughts, biodiversity loss, poverty, social inequalities, population growth and climate refugees are also highlighted. The performance of various regions of the world concerning Climate Action (SDG13) and Zero Hunger (SDG2) is also emphasized upon.

## **2.0 Food Security- An Overview**

Almost 690 million people around the world went hungry in 2019 (Food and Agriculture Organization, n.d.). High costs and low affordability also mean billions cannot eat healthily or nutritiously (The state of food security and nutrition in the world 2020, 2020)<sup>[3]</sup>. Nearly half of India's small children are malnourished: one of the highest rates of underweight children in the world (The Economist, 2010). The hunger problem in India is serious, and the marginalised communities are the worst affected. Despite India's 50% increase in GDP since 1991, it has failed to address the Human Development Index, which is a grave concern for a developing country like ours (Meher, 2019). In India, the food insecurity amongst various groups such as children, women, marginalised communities is comparatively higher than other groups because of present social inequalities. The following sections present a comparison between three developing countries of Brazil, Sri Lanka and India on the basis of affordability, availability, overall score of food security and their vulnerability to climate change. Developing countries have relatively less economic growth, industrialisation and Human Development Index. Countries like India, Bangladesh, Sri Lanka and Nepal are Developing Nations (UNITED NATIONS DEVELOPMENT PROGRAMME, 2019). Climate Change will severely affect developing nations because of their geographical location and lower capability of adaptation to the changes.

## 2.1 Comparison: Brazil, India and Sri Lanka

The top countries in the Global Food Security Index rankings published by The Economist Intelligence Unit Limited are developed countries. It becomes imperative to focus on climate action and food security in developing countries since the Human Development Index score is lower for these countries. Brazil, India and Sri Lanka are developing countries with varied performances in non-economic indicators such as the Human Development Index, Global Hunger Index and so on. This comparison brings out the current scenario of food security and its attributes in these developing nations through quantitative analysis. Brazil performs better among the three countries with respect to food security. In terms of Climate action Brazil and India have performed insufficiently even though the three nations are vulnerable to Climate Change.

### 2.1.1 Global Hunger Index

The Global Hunger Index measures and tracks hunger at a regional, national and global level. It uses four criteria of undernourishment, child wasting, child stunting and child mortality. The score is between 0 to 100 (*Global Hunger Index Scores by 2020 GHI Rank*, n.d.).

**Table no 1: GHI Severity Scale**

<= 9.9	10.0 to 19.9	20.0 to 34.9	35 to 49.9	>= 50
Low	Moderate	Serious	Alarming	Extremely Alarming

Source: [globalhungerindex.org](http://globalhungerindex.org)

**Table no 2: Global Hunger Index 2020**

Sl No.	Country	Rank	2000	2006	2012	2020
1.	Brazil	1-17*	11.3	6.3	<5	<5
3.	Sri Lanka	64	21.9	19.5	20.1	16.3
4.	India	94	38.9	37.5	29.3	27.2

Source: [globalhungerindex.org](http://globalhungerindex.org)

Brazil has been performing well on the Global Hunger Index and has been placed amongst the top 17 nations which have low rates of hunger. Sri Lanka has been able to reduce the GHI severity score over the years and now has a GHI score of 16.3 which indicates moderate hunger rates in the country. India has shown improvement in terms of GHI score over two decades but the GHI score of 27.2 indicates that the current situation is serious.

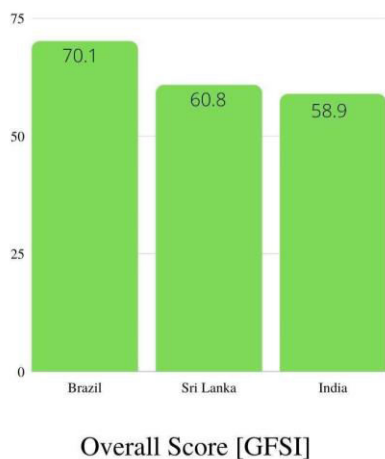
### 2.1.2 Global Food Security Index

The Global Food Security Index (GFSI) takes into consideration the important issues of affordability, availability and quality across various countries. The index uses 34 unique indicators to measure food security across developed and developing countries.

**Table no 3: Ranking of Global Food Security Index**

SI No.	Country	Rank (GFSI)
1.	Brazil	39 <sup>th</sup>
2.	Sri Lanka	66 <sup>th</sup>
3.	India	72 <sup>nd</sup>

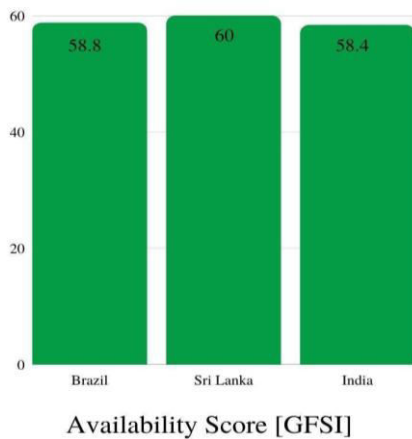
Source: (Global Food Security Index (GFSI), 2020)



The chart shows the overall performance of Brazil, Sri Lanka and India according to the 2020's Global Food Security Index. The score of Brazil, Sri Lanka and India is 70.1, 60.8 and 58.9 respectively.

Source of data: Global Food Security Index (GFSI), 2020

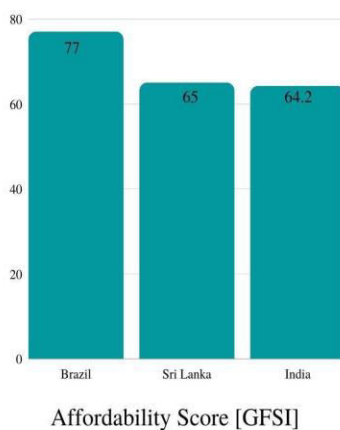
Figure no 2: According to the GFSI rankings and overall score, Brazil has performed better than Sri Lanka and India. Brazil's achievements in hunger and poverty reduction are widely considered to be the results of pro-poor policies introduced during the presidency of Luiz Inácio Lula da Silva, including Fome Zero (Zero Hunger), a national cross-sectoral strategy which was launched in 2003. (Fighting Hunger in Brazil' Oxfam Case Study, June 2010)



Source of data: Global Food Security Index (GFSI), 2020

The chart shows the Availability score in Brazil, Sri Lanka and India with scores of 58.8, 60 and 58.4 respectively.

Figure no 3: As the name suggests, Availability score determines the availability of food to the population of the nation. Sri Lanka shows better performance in terms of availability of food whereas Brazil and India have almost the same performance since the deviation is minimal.



Source of data: Global Food Security Index (GFSI), 2020

This chart shows the affordability of food in Brazil, Sri Lanka and India with the scores as 77, 65 and 64.2 respectively. The scores have been reported in the Global Food Security Index 2020.

Figure no 4: As the name suggests Affordability score measures whether the food is available at affordable prices. Brazil has performed better than India and Sri Lanka. One of the factors for this food safety net and the proportion of people below the poverty line.

Ranking 2018 (2017)	Country	CRi score	Death toll	Deaths per 100 000 inhabitants	Absolute losses (in million US\$ PPP)	Losses per unit GDP in %	Human Development Index 2018 Ranking
1 (30)	Japan	5.50	1 202	1.01	35 039.34	0.64	19
2 (20)	Philippines	11.17	455	0.43	4 947.27	0.48	113
3 (40)	Germany	13.83	1 246	1.50	5 038.62	0.12	5
4 (7)	Madagascar	15.83	72	0.27	568.10	1.32	161
5 (14)	India	18.17	2 001	0.16	37 807.82	0.36	130
6 (2)	Sri Lanka	19.00	38	0.18	3 626.72	1.24	76
7 (45)	Kenya	19.67	113	0.24	768.39	0.40	142
8 (87)	Rwanda	21.17	88	0.73	93.23	0.34	158
9 (42)	Canada	21.83	101	0.28	2 282.17	0.12	12
10 (56)	Fiji	22.50	8	0.90	118.61	1.14	92

The Global Climate Risk Index for 2018: the 10 most affected countries  
www.germanwatch.org/en/crri

### 2.1.3 Climate Risk Index

Figure no 5: The figure shows the top 10 countries affected by Climate Change (Eckstein et al., 2019, p. 6).

The Climate Risk Index Rankings according to the germanwatch.org for India and Sri Lanka are 5th and 6th respectively. Similarly, The impacts of climate change in Brazil, which harbours nearly 60% of the Amazon, vary significantly and are vast: higher temperatures may change the range and

distribution of temperature-sensitive species, increased severity of drought can greatly affect the Amazon's freshwater ecosystems and the people that rely on them (Climate Risk Profile: Brazil, 2020).

## **2.2 Climate Action**

Climate action globally will reduce Greenhouse Gas Emissions and is a crucial step towards combating climate change and its impacts. Various nations have taken steps to reduce their emissions but those steps seem to be inadequate.

India: India is the world's 3rd largest emitter of greenhouse gases (Each Country's Share of CO<sub>2</sub> Emissions, 2020), but since it is a developing country it is not required for the country to cut down on emissions under the Kyoto Protocol, 1997. Moreover, India's climate action plans have loopholes and lack accountability. The National Action Plan on Climate Change dates back to 2008 and was formed under the United Progressive Alliance Government, but The rushed manner in which NAPCC was formulated ensured that the document merely provided broad objectives and did not address strategy (Rattani et al., 2018). India is also dependent largely on fossil fuels and is encouraging coal mining in India.

Brazil: Brazil's Climate Action is rated as "insufficient" by Climate Action Tracker which is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aim of "holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C." The efforts of the country are thus inadequate and not stringent enough to achieve their fair share of limiting global warming to 1.5°C.

Sri Lanka: Any tangible progress in addressing climate change has been slow, particularly in the northern part of the country (USAID, n.d.). Various policy measures have been taken to tackle the issues of safe water and hygiene in the country such as WASH in Schools through the Ministry of Education (*Wash In Schools*, n.d.).

### **Vulnerabilities**

- India: India is a country with low Human Development Index value of 0.647 and with the rank 129 (UNDP, 2019). Along with this climate change poses a threat on agriculture, water resources and ecosystems (*Climate Risk Profile: India*, 2017). This would make impacts of food insecurity and climate change more severe.



- Brazil: Brazil's Human Development Index value is much better than that of India, the value and rank are 0.761 and 79 respectively (UNDP, 2019). Along with a lower value of HDI, Brazil's agriculture and tourism is at risk because of Climate Change (*Climate Risk Profile: Brazil*, 2018).
- Sri Lanka: Sri Lanka's Human Development Index value is comparatively better than that of Brazil and India. The value stands at 0.780 and the rank is 71 (UNDP, 2019). Sri Lanka's water resources, agriculture and food security are at risk due to the impact of climate change (*Climate Risk Profile: Sri Lanka*, 2018)

### **3.0 Climate Change and Associated Risks**

Climate change is increasing the frequency and intensity of extreme weather events such as heatwaves, droughts, floods and tropical cyclones, aggravating water management problems, reducing agricultural production and food security, increasing health risks, damaging critical infrastructure and interrupting the provision of basic services such water and sanitation, education, energy and transport (GOAL 13: Climate action, 2020).

It is important to analyze various other issues that are intertwined with Climate Change and pose a risk on food security. The following sections analyse natural calamities and their interrelatedness to food insecurity and how extreme weather events such as floods and droughts could lead to subacute food insecurity. The section also talks about how socio-economic issues affect food security and adaptation to climate change. Social inequalities along with poverty could add to the vulnerabilities of food insecurity and malnutrition.

### **3.1 Natural Calamities and Food Insecurity**

#### **3.1.1 Floods**

Floods are one of the most common natural disasters. An area is said to be affected by a flood when water is accumulated over the said area (usually dry land). Global Climate Change has led to an increase in the frequency and intensity of the floods. Extreme floods can be triggered by intense precipitation, longer duration, close repetition of precipitations or a combination of these (How climate change is making record-breaking floods the new normal, 2020)<sup>[5]</sup>. So far the numbers of very heavy rainfall events across India were 381 in June 2020, 457 in July and — more than double — 1,138 in August, totalling 1,976 over three months. The maximum such events in a single month were in MP (214 in August), followed by Gujarat (199, same month). Excessive rainfall has led to floods in 256 districts across 13 states in India (Sangomla and Amarnath, 2020). Floods lead to the loss of fertile land and

result in land degradation. Flood affected areas lose crops and agricultural land leading to chances of food insecurity in those areas.

### **3.1.2 Droughts**

A drought is a period when an area or region experiences below-normal precipitation. The lack of adequate precipitation, either rain or snow, can cause reduced soil moisture or groundwater, diminished streamflow, crop damage, and a general water shortage (Society, 2020). The rising global average temperature would result in more droughts since the precipitation cycle is disrupted and evaporation rates increase. This directly affects agricultural productivity of the land and might result in chronic or short-lived food insecurity amongst the population in the drought-affected areas. Droughts occur less frequently, but impact the highest number of people in the country (India), affecting 680 million people in the 20 years to 2017 (Singh, 2020).

## **3.2 Socio-economic Issues**

### **3.2.1 Poverty**

Poverty refers to the state when a person is unable to afford even basic necessities of life such as food, shelter, education etc. Across 107 developing countries, 1.3 billion people—22 per cent—live in multidimensional poverty (The 2020 Global Multidimensional Poverty Index (MPI) | Human Development Reports, 2020). Poverty, lack of awareness of government schemes, illiteracy, and poor accessibility of health care are the major obstacles in eliminating malnutrition among the marginalised communities (Meher, 2019). Poverty reduction is an essential aspect to ensure food security. Availability of food alone can not ensure food security since poverty affects affordability and accessibility of food. Moreover, climate change affects the poor more severely since they lack the resources to adapt to the changing climate. Extreme weather events might lead to loss of livelihood, housing and might induce the issue of climate refugees where people will have to migrate.

### **3.2.2 Social Inequalities**

Social inequalities exist in developed and developing nations where resources are distributed unevenly. Such inequalities exist based on gender, race, sexual orientation, caste, religion, migrant status, disability, ethnicity etc. In India, The level of malnutrition is consistently high among Scheduled castes, Scheduled Tribes and Other Backwards Classes, as compared to other castes and the general population (Meher, 2019). Social inequalities would mean greater risks to food security since lack of resources would affect availability, accessibility and affordability of safe and quality food. Thus, it is of prime importance that

policies that ensure food security revolve around climate action and existing social inequalities so that the food insecurity among marginalised groups and communities does not increase.

### **3.2.3 Climate Refugees**

Climate refugees or climate migrants are the people who have had to migrate either temporarily and permanently due to extreme weather events such as drought, floods, hurricanes and storms. Climate Migrants also includes people who were motivated to migrate due to the predicted future problems that might come along with climate change. According to the UN Food and Agriculture Organization, in 2015, there were 244 million international migrants, 40% more than in 2000. In the same year, over 19 million people were internally displaced because of natural disasters. Between 2008 and 2015, an average of 26 million people have been displaced annually by climate or weather-related disasters (Climate Change Is A Key Driver of Migration and Food Insecurity, 2017).

## **4.0 Agriculture and Climate Change**

Climate Change and Agriculture are closely interrelated. In 2010, agriculture, forestry and land-use change were estimated to contribute 20–25% of global annual emissions (Wikipedia contributors, 2020). Moreover, it is also the sector which will be affected by climate change because the sector is directly dependent on Nature and its various attributes such as precipitation, pollination, adequate temperatures, etc. Agriculture is also one of the sectors upon which a large mass of population depends for employment. In 2020, 41.49 per cent of the workforce in India were employed in agriculture (Statista, 2020). Worldwide, the livelihood of 2.5 billion people depend on agriculture. These small-scale farmers, herders, fishers and forest-dependent communities generate more than half of the global agricultural production and are particularly at risk from disasters that destroy or damage harvests, equipment, supplies, livestock, seeds, crops and stored food (FAO, n.d.). Thus, if proper measures to prevent the adverse effects of climate change are not adapted there will be a rise in loss of livelihood and food insecurity. It is also imperative to ensure that agricultural productivity increases and the impact of changing climate is minimal on the agricultural sector while also shifting to sustainable means of agriculture by investing in rural and urban agriculture and small farmers.

#### **4.1 Water Crisis**

With the changing global climate, our relationship with water is changing too. The sixth Sustainable Development Goal has set up targets to manage the global challenge of water scarcity. "Ensure availability and sustainable management of water and sanitation for all" is the official motto of the aforesaid SDG. Water scarcity has a huge impact on food production. Without water people do not have a means of watering their crops and, therefore, to provide food for the fast-growing population. According to the International Water Management Institute, agriculture, which accounts for about 70% of global water withdrawals, is constantly competing with domestic, industrial and environmental uses for a scarce water supply (Sentlinger, n.d.). Agriculture is largely dependent upon natural sources of water especially rainfall. Indian agriculture remains largely dependent on monsoon with around 52 per cent of the agricultural land non-irrigated (Kumari, 2020). Hence the change in precipitation patterns will directly affect agriculture and result in food insecurity because of less availability of food. This will also lead to increase in food prices since the demand for food will increase but the supply will decrease. Hence tackling the water crisis, climate crisis and food security must go hand in hand.

#### **4.2 Women in Agriculture**

Women's participation in agriculture is crucial in ensuring climate action and food security. According to the Food and Agricultural Organization (FAO, 2011), empowering women through land and ownership rights has the potential of raising total agricultural output in developing countries by 2.5 to 4 per cent and can reduce hunger across the world by 12-17 per cent (Pachauri, 2019).

In India, the Agriculture sector employs 80% of all economically active women which comprises 33% of the agricultural labour force and 48% of the self-employed farmers (Oxfam India, 2018). However, when it comes to owning the land, only 13% of women farmers have complete control over it (shah, 2020). In search of better income opportunities men often migrate out of rural areas thus leaving women to work on the agricultural land.

Thus, a direct effect on agriculture puts women in a position of income and food insecurity along with the risks of falling into the web of poverty. Contribution of indigenous women and communities has been vital in ensuring food security. The traditional practices can be adopted in the changing climate. Such practices often involve no usage of High Yielding Variety seeds, chemical fertilizer, etc. These practices ensure the quality and safety

of food while catering to vulnerable communities. Resource allocation and investment in traditional knowledge can pave a path for achieving the goal of zero hunger.

Thus, women are more prone to the effects of climate change due to the existing inequalities and are also more vulnerable to food insecurity while being the backbone of an essential sector that ensures nutrition and food security for all.

### **4.3 Food Security Across the Globe and the Way Forward**

The right to adequate food is a universal human right that is realized when all people have physical and economic access at all times to adequate food or the means for its procurement, without discrimination of any kind (Food security and the right to food | Sustainable Development Goals | Food and Agriculture Organization of the United Nations, n.d.). Across the globe, poverty reduction has been a crucial aspect of the process of tackling food insecurity. Through various systems established in different countries to ensure the availability of safe and affordable food. Singapore is a country which has been able to ensure food security through imports and has ranked First in the Global Food Security Index. The way forward is to ensure that goals of climate action and zero hunger are achieved through various policies where the governments adapt and work collectively. It is important to firstly identify who is the most marginalised and has to bear the brunt of the climate crisis, to evolve policies and laws that commit to the agendas of combating climate change and eradication of food insecurity and malnourishment and allocate enough resources so that action plans are implemented.

### **5.0 Conclusion**

Climate change is real and one of the biggest threats of the 21st century. The world is still tackling the covid-19 pandemic and it has become rather imperative for the countries to focus on a just and a sustainable recovery from the pandemic which includes stringent policies and resource allocation for tackling climate crisis and food insecurity. It is evident that people who are bound with less privileges will be severely affected by climate change and food insecurity. Countries like Brazil, Sri Lanka and India are comparatively more vulnerable to the risks of Climate Change. In the analysis performed it was evident that Brazil performs fairly with respect to food security. But Brazil's efforts to mitigate the effects remain insufficient whereas India performs fairly but is not fully consistent. Sri Lanka is one of the top 10 countries affected by climate change (Eckstein et al., 2019, p. 6). The climate crisis will have an enormous impact on food security because of the direct impact on agriculture and allied activities. The fragile relationship of the population employed in the

agricultural sector will become more fragile due to the climate crisis, leading to loss of livelihood. The fight against climate change and hunger is a global concern and must be tackled at the earliest to safeguard the global population and the future generations. “*There can be no separating climate action from the larger planetary picture. Everything is interlinked - the global commons and global well-being.*” - Antonio Guterres (UN Secretary-General)

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