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Global Warming and Climate Change: A Threat to Environment

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Abstract

The issues of global warming and climate change are very important as its impacts are not limited to any geographical boundaries and affect all the countries whether developed or developing. Many factors varying from natural to human activities are responsible for this change. Rapidly growing population, deforestation, increasing use of chemical fertilizers, emissions from the vehicular traffic, industrialization, urban development and mining activities are some of them. Developed countries are major contributors to Green House Gasses- which is a main cause of global warming and climate change, however, its impact is seen all over the globe. In the recent years , it is felt that all the countries of the world should make some policies to handle this problem individually or collectively. In the present study an attempt has been made to identify major causes of global warming and climate change and their impacts on the human life such as issues of agriculture and food security, rising sea levels, human health, changing settlement patterns, natural hazards and disasters etc. As a whole it poses a great challenge on the part of developed as well as developing countries to reduce the emission of Green House Gasses and control this universal problem.

Keywords - Climate Change, Green House Gasses, Global Warming, Environment, Industrialization, Population.

Introduction

Climate – referred to as the average weather conditions (temperature and rainfall) over a geographical area for certain time period say 30 to 50 years. When these condition deviates from the normal to extreme, the phenomena is known as the climate change. The duration of climate change may vary from 5 years to hundreds and millions of years. Similarly its extent may vary from local to regional and global. Global warming is a phenomenon of increase in average temperature of the Earth, which is a contributing factor to climate change. The average temperature of the Earth has increased by more than 1º F since 1900 and this speed of warming is increasing rapidly day by

day. According to an estimate, the 21st century has witnessed an increase of 3º to 8º F in the global temperature. This occurs due to many reasons such as emission of greenhouse gases like carbon dioxide from the factories, vehicles, power plants, burning of forests, mining and construction activities etc. Global warming has a long –term impact on weather patterns that varies from place to place. In the present paper an attempt is made to study the major causes of global warming and its impact on the shifting patterns of climate. It also calls for need of proper and collective management of major environmental issues at the international level.

Review of Literature

The term 'Global Warming' was introduced for the first time by climatologist Wallace Broecker in his article "Climate Change: Are we on the Brink of pronounced Global warming?" Global warming is observable increase in the global temperature of earth (both land and water) and climate change is the effect brought about by the process of warming globally or in general, overall long-term change in our climate, including sea level rising, extreme weather, and ocean acidification. However, the term global warming and climate change are used interchangeably but there is difference in it, global warming is more sensitive and more diverging which results in less advocacy by some subpopulations (Benjamin, 2016). Further, (Krauss, 2021) clearly puts it in the context when he quotes Lorenz, "Climate is what you expect; weather is what you get." (p.158). Krauss argues that just because there is an anomalous cold day in Washington, DC does not mean that global warming is not happening. Likewise, just because there is an ultra-hot week in Washington, DC also does not validate global warming.

The solar radiation from the sun is balanced by the thermal radiations reflecting from the earth; this interaction balance determines the surface temperature of the earth. The incoming solar radiation from the sun is independent but the outgoing thermal radiations depend on the earth's surface temperature and the presence of greenhouse gases, which absorbs some of the thermal radiations. Greenhouse gases, such as carbon dioxide, methane, nitrous oxides, water vapors, ozone and chlorofluorocarbon (CFC) are responsible for trapping of heat. For instance, water vapor (40%) is responsible for absorbing majority of thermal radiation from earth, followed by carbon dioxide (30%), methane (20%) and other gases (5%) (Aizebeokhai, 2009). So, it indicates that outgoing thermal radiation is mostly absorbed by water vapors and carbon dioxide. Likewise, the change in composition of water vapor due to human activities are negligible, so it implies that the greenhouse gases produced by human activities are likely responsible for the most of the trapping of heat (Aggarwal, 2003; NAS, 2013).

However, some authors (Florides, 2019) argues that the heat trapping by the carbon dioxide is not significant and rather it is likely that sun radiations are responsible for the global temperature rise.

Herring (Herring, 2020) refuted the claim that likeliness of sun radiation as the cause of global warming might not be true. He argues that, it is possible that sun can warm the earth provided that the pattern of the solar intensity increases over the years. Likewise, the sunspot data do indicate that there was a small increase in the amount of sunlight from late 1800 to the mid-1900 which experts' estimates that it could have contributed at the most upto 1.0 C. Further, scientists rule out the significant role of sun in global warming due to the fact that if the sun energy output had intensified then it is logical to expect all layers of earth's atmosphere to be warmed, which is not the case that is been observed. In fact, lower layers of atmosphere (troposphere) get more heated while the upper layers (stratosphere) get cooling (Herring, 2020).

Burning of fossil fuels is the major source of global warming in the developing countries, which in turn, depends upon the high growth of population, increasing demand for fuels, need for economic growth and a high standard of living. Lack of political will power and institutional failure to make effective environmental policies have hampered action against global warming and reduction of the global warming gases (Aizebeokhai, 2009).

The Intergovernmental Panel on Climate Change (IPCC) which includes more than 1300 scientists from countries all over the world forecast a temperature rise of 2.5 to 10 degree F over the next century. Moreover, the IPCC predicts that increases in global temperature rise will produce beneficial impacts in some regions and harmful ones in others. Net annual costs will increase over time as global temperature increases (Jackson, 2019).

However, not everyone believes that the earth's surface temperature is increasing and even if global warming is there, not everyone agrees that human activities are responsible for global warming and climate change. As a result, critics and deniers of global warming and climate change do not see the need to take steps to delay or reverse these trends. USA disengaging from Kyoto protocol and Paris agreement on climate indicate the polarity of attitude of nations and people towards this issue (Johnsson, 2018).

A study conducted by Shapiro and Park (2015) showed that people responses to the global warming and climate change in social media are general and shows little or no concern about this issue, which indicates many people are not convinced about the reality of global warming and climate change. A study by Allen and McAleer (2018) suggests that the negative emotions or indifference to global warming might be due to lack of clear logical framework and confusion of short-term variations in local weather with the long-term global average climate change.

Despite the two school of thought on the urgency and status of global warming and climate change, the evidences from the surface temperature, sea level rise, sea surface temperature and borehole temperature profile indicate that the global warming is happening and it is going to be a major threat in the future, which will be discussed in the forthcoming sections of this paper.

Objective of the Study

The main objective of the present study is to identify the major sources of Global Warming, i.e. emission of greenhouse gases; to what extent this phenomenon affects the human life and ecological balance in the developing as well as developed countries. It also suggests the measures to deal with the situation of global warming and how its adverse effects can be minimized.

Methodology

For the present study descriptive and analytical methodology has been adopted. Data and information was collected from various sources such as govt. reports and publications, statistical abstracts and development plans. In addition, previous studies conducted by different scholars related with the theme were approached and studied. The data and information thus collected was analyzed by using different statistical and cartographic techniques. Besides this, observations during field studies were used to supplement the information.

Greenhouse Gases and Greenhouse Effect

The solar energy received by earth heats the earth's surface and the air coming in its contact. In turn, the earth radiates its energy back into the space (atmosphere). Some atmospheric gases such as carbon dioxide, water vapours and other gases interrupt this process and heat the environment beyond a certain limit. These gases are called greenhouse gases. These gases operate like a blanket and trap the energy radiated out by the earth and cause the rise in the average temperature of the earth's surface and atmosphere, which is known as the green house Effect.

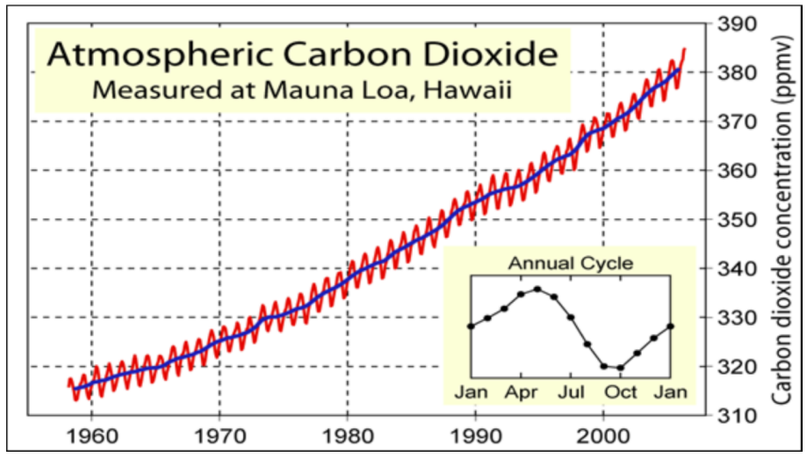
The major greenhouse gases are carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, per fluorocarbons and sulphur hexafluoride. To some extent water vapors are also considered as a greenhouse gas. Greenhouse gases are essential for the health of the planet earth, it can also deal with slightly increased level of such gases, but too much will affect the health of the whole planet adversely. The increased proportion of greenhouse gases in environment beyond a limit causes global warming and results in many adverse effects such as rise in the average sea level, frequent floods, droughts, cyclones, decline in the soil fertility, disturbed life cycle, depleting vegetation cover, changing climatic conditions etc.

Sources of Greenhouse Gases

1. Carbon dioxide is the major source of increase in the global temperature, which is released in huge quantities by the power plants, burning of fossil fuels, rising number of multi-storied buildings which require a lot of fuel to be burnt.

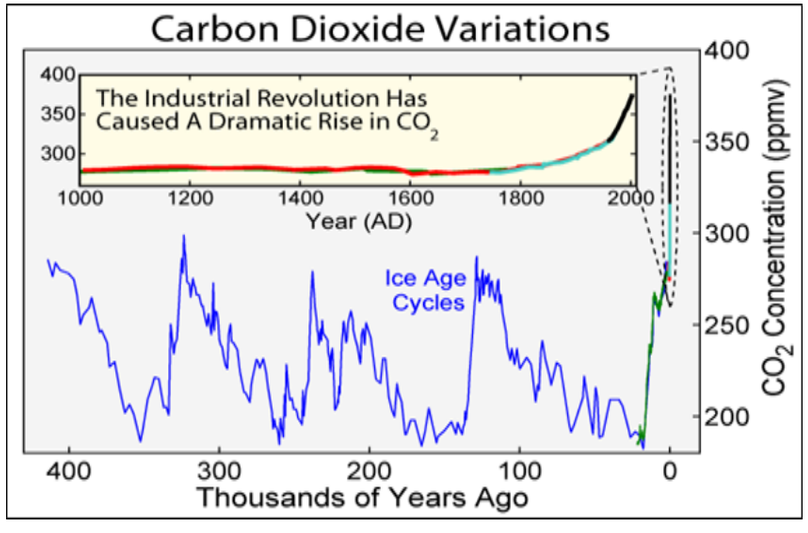
Fig 2 depicts that the atmospheric levels of the greenhouse gas carbon dioxide, have increased since pre-industrial times from 280 part per million (ppm) to 377.5 ppm a 34% increase. Carbon dioxide concentrations in the atmosphere are the highest. Carbon dioxide is a by-product of the burning of fossil fuels, such as gasoline in an automobile or coal in a power plant generating electricity of the UK Meteorological Office.

Fig 1- Average Concentration of Carbon Dioxide



Source: Jackson R (2019) The effects of climate change: vital signs of the planet.

Fig 2- Variation in Carbon Dioxide during the Past



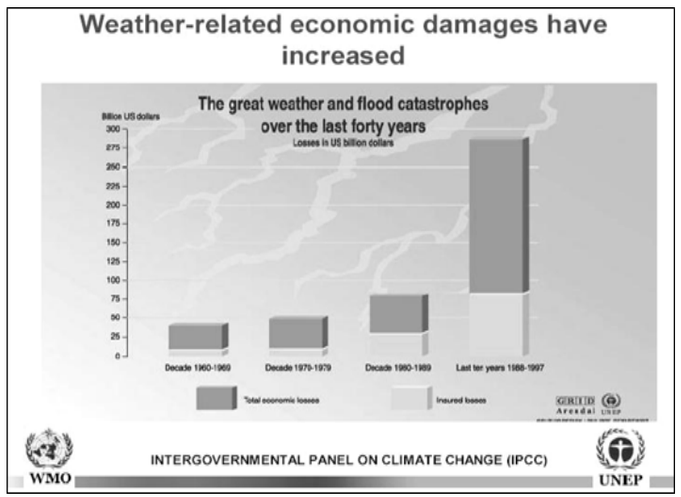
2. Methane is another source of heating the environment which is more than 20 times effectual than carbon dioxide. Methane is released from water logged paddy fields, manures and fossils. Decaying of the organic materials in the soil releases huge amounts of methane in to the atmosphere.
3. Nitrous oxide is another source of heat production which is produced by nylon and nitric acid production, cars with catalytic converters, the use of fertilizers in agriculture and burning of organic matters.
4. Another cause of global warming is deforestation caused by large scale cutting and burning of forests for clearing the land for other purposes.
5. The large scale growing population is also responsible for global temperature increase. At present about 9 billion human population is settled over this planet. This huge sized population requires houses, food and other civic amenities posing a great pressure on the urban infra structure and system already existing on the globe.

Global warming and Climatic Changes

The major climatic changes resulting from the Global warming are as following:

1. **Extreme weather conditions:** An increased temperature of the atmosphere would result in to extreme weather conditions such as frequent floods, droughts, intense heat and cold, spells of dry and rainy seasons etc. This would affect all the living habitats at this planet earth in the ray sun.

Fig 3- Impact of Extreme Weather Condition

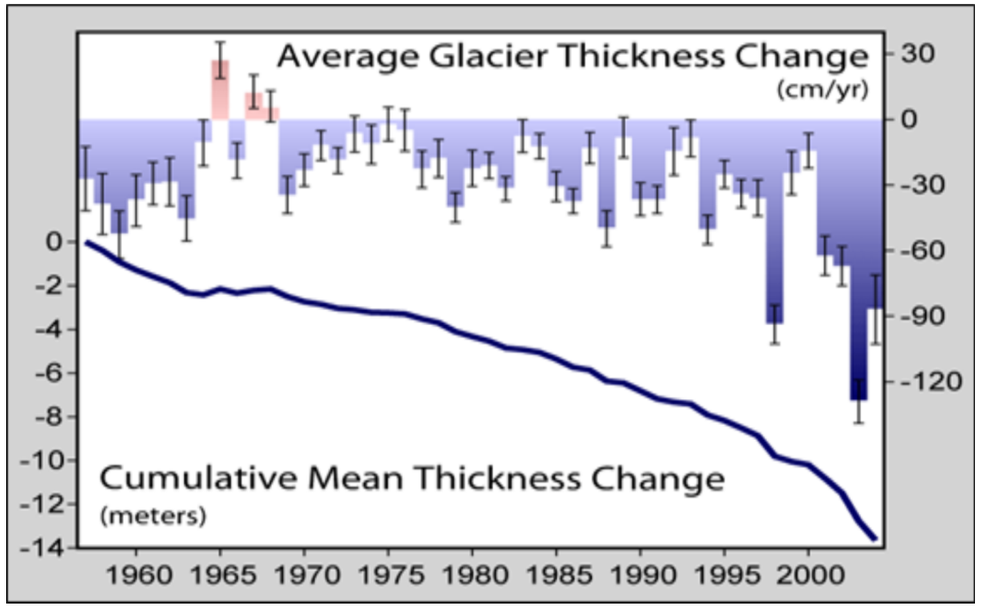


Source: Krauss L.M (2021)The physics of climate change, London. p 103

2. **Rise in the sea level:** An increase in the global environmental temperature would result in to melting of the ice caps and glaciers. This will affect the life on the mountains as well as in the coastal areas. On the one hand this would create a scarcity of fresh water in the high mountainous areas. At the same time, melting of glaciers and ice caps will suddenly increase the volume of water in the rivers and eventually rise in the sea level. This would result in the unexpected flooding in the coastal regions and submergence of the nearby areas.
3. **Melting glaciers:** Increasing temperature is one of the effects of melting of glaciers in the high altitude Himalayas. Mainly South Asian countries will be affected by worsening floods from the melting glaciers of the Himalayas. Heavy rainfall and uprising water level in the rivers will create floods like conditions and destroy many civilizations.

Ice is melting all over the planet. Glaciers are melting on six continents. If present warming trends continue, all glaciers in Glacier National Park could be gone by 2030. The park's Grinnell Glacier is already 90% gone. Because of global warming, the glaciers of the Ruwenzori range in Uganda are in massive retreat. The Bering Glacier, North America's largest glacier, has lost 7miles of its length, while losing 20-25% of parts of the glacier. In southern Peru the rate of melting of the Qori Kalis glacier during the last 8 year period was 10 times more than previous decade.

Fig 4- Average Melting of Glaciers due to Temperature Rise



Source: Krauss L.M (2021)The physics of climate change, London. p 195

Greenland's glaciers are moving more rapidly to the sea, caused, perhaps, by melt water lubricating the base of the glaciers. See below for another look at dwindling ice mass in Greenland. The Tasman Glacier in New Zealand has thinned by more than 100 meters in the past century. A glacier from which Sir Edmund Hillary and Tenzing Norgay set out to conquer Mount Everest nearly 60 years ago has retreated three miles up the mountain due to global warming. The head of the Nepal Mountaineering Association, Tashi Jangbu Sherpa, says "that Hillary and Tenzing would now have to walk two hours to find the edge of the glacier which was close to their original base camp."

4. **Tsunamis and Hurricanes:** The global warming conditions would lead to an imbalance in the atmospheric temperature conditions leading to frequent storms, resulting in to a large scale loss of human life and property. The recent storms of Tsunamis and Hurricanes in USA, Canada and Europe were a result of global warming condition
5. **Impact on Ecosystem:** Global warming will disturb the ecological balance and will affect the capacity of various habitats to adjust themselves to the environment. This will have many impacts on the ecosystem such as Rapid global heating, increase in the ozone gas, extinction of certain species leading to environmental crisis, collapse of biological and ecological system.
6. **Increase in the ocean acidification:** Global warming and excess release of carbon dioxide would result in to acidification of the oceans, leading to heavy loss to the marine life and aqua culture. This will also disturb the food chain and ecosystem biodiversity.
7. **Increase in pests and diseases:** A sudden increase in the global environmental temperature will lead to outbreak of many epidemics of diseases. Many chronic and infectious diseases may result from the imbalance in the ecosystem.
8. **Decline in the agricultural production:** An increased global temperature would affect the agriculture and lead to a decline in the agricultural production of various crops. This may lead to global shortage of foodgrains and increased global hunger.
9. **Global warming and agricultural land:** As a result of global warming the amount of arable land in high latitude regions is likely to increase by melting if ice and reduction in frozen lands. At the same time arable land in coastal areas and islands is bound to be reduced due to rising sea levels and submerging the coastal areas.
10. **Desertification:** Global warming would adversely affect the natural vegetation and extreme hot climatic conditions leading to increasing desertification and loss to vegetation covers. This would result in to loss of agricultural land, unemployment, poverty, hunger and diseases.

11. **Climate change and its impact on women work:** In recent times, the temperature is rising rapidly and it is difficult for women because she has to manage household chores the family members. For example, in the drought areas in absence of rainfall all water sources will dry up and women suffer a lot from this as they have to manage drinking water from a large distances. They have to work harder for the secure food, drinking water and fuel wood for their homes. This leads ultimately in to adverse health condition of the women, deprivation from their rights and poverty and inequality in social and economic life.
12. **Climate change and human health:** Climate change has a direct impact on the human health. The warmer climate has adverse effects on the human health. An increase in the average temperature would lead to break out of the chronic diseases like malaria, cholera, infectious diseases, and pollution related problems. The population living in urban areas is more vulnerable from these diseases because urban areas have more pressure on drinking water, housing, sanitation and other health services as compared with their rural counterparts.

An Overview of Global Warming and Climate Change

We have seen already that how the unbalanced and over exploitation of natural resources has destroyed and polluted the earth's environment. This is creating many problems and crises. The situation can be understood by some instances given below:

Many parts of the world are facing serious climatic changes experiencing extreme hot or cold weather conditions, which were never felt in the past. European countries like France, Spain, Portugal and Italy faced Heat- Wave in the year 2003. Though known as the coldest, the average temperature in these countries rose up to 40º C during this year due to this Heat- Wave.

As for as Indian subcontinent is concerned, many states located in north western, central and central eastern parts of India have experienced extreme hot conditions than previous years. The duration of summer season is also much longer than the past many years. In India, 2016 and 2017 are going to be the hottest years in the history as the average temperature is rising up to 42º C in the months of March and April.

Another change in the weather conditions in the Indian sub continent is the deviation in the monsoon winds from the normal. Monsoons are coming late from the normal time which results in to longer spells of heat. The amount of rainfall received by the monsoons is either too much in some parts of the country or too low in other parts, which created flood like situations in many states like Maharashtra, Madhya Pradesh, Bihar, Jharkhand, eastern Uttar Pradesh and West Bengal while drought conditions in states of Punjab, Haryana and parts of Rajasthan.

Due to global warming and rise in the average temperature, snow line in the hill states of Himachal Pradesh, Uttrakhand and Jammu & Kashmir is changing its position, which is resulting in to failure of snowfall in many regions while very heavy snowfall in other areas. This has affected many fruit growing areas in these states and tourism industry which is base of economy in these states.

Policy and Managerial Recommendations

Global warming and climate change is a global problem. It affects everyone, the rich and the poor, the developing and the developed without any favourism. All the contributors whether major or minor, all are affected by the adverse effects of climate change. So its solution should be found jointly. Though it is difficult to check the emission of Greenhouse gases completely, but we can minimize this by adopting some measures and taking some precautions. Some of these measures are as following:

1. Adopting Eco friendly vehicles: We should reduce the emission of carbon dioxide and other gases from the vehicles. For this, eco-friendly vehicles equipped with latest technology and pollution free fuels should be promoted. In urban areas, use of public transport facility should be preferred rather than using private vehicles. Car pooling is another alternative, where people working in the same office or institution can use their car on sharing bases. This will help in reducing the vehicular traffic on roads and hence reducing the air pollution and carbon emission on roads.
2. To build energy efficient landscapes: Housing societies and offices should be designed in such a way that least amount of energy is consumed. This includes adopting modern architectural designs, installation of solar energy panels, use of non-conventional building materials and making use of renewable sources of energy etc. Government should provide subsidy and orientation programs for the users so that this type of technology may be promoted.
3. To check the forest cutting and soil erosion: To save the environment, haphazard forest cutting should be stopped. New trees should be planted and protected to replace the trees cut down every year. All the institution should make the students aware about tree plantation and afforestation drive should be launched. Community forestry is another concept, in which common public places and common land in rural areas can be used for forestry purpose. This will also bring additional income to the village panchayats and local governing bodies in the semi-urban areas.
4. Promoting Nuclear Power Plants: Modern technology should be adopted to produce electric energy. In India, only 15% of the total electricity is produced by the Nuclear power plants. We are still producing electricity by thermal power plants which emit large amounts of carbon and other pollutants in to the atmosphere and cause increase in the average temperature.

5. Geo- engineering is another tool which helps in reduction of greenhouse gases emission. It includes use of modern technology and save the green environment.
6. Using eco- friendly fuels is another option which helps in controlling the global warming and climate change. We should make use of the alternative sources of energy rather than using conventional methods. In Germany, scientists have developed Hydrogen based fuels for the vehicles which produce no carbon emission. This type of technology can be adopted in the developing countries also

Implications

On the basis of above discussion and analysis it would be wise on the part of humanity to act to minimize the global warming- to which burning of fossil fuels is main culprit. Cause of global warming is well documented and known by majority of the people, what is apparently failing is the action to minimize the production of global warming gases and excessive consumption of natural resources. Humans are most intelligent species, yet most skeptical and cynical creature who even walked the earth, choice are – to scum to habit of cynicism, or accept the fact for real and act to maintain the balance in nature for the sake of humanity. The developed countries should look beyond their narrow self-interest and work jointly with the developing countries to bring out a co-operative and collaborative strategy on this issue.

Summary and Conclusion

The rapid increases in greenhouse gases leads to continuous increase in temperature over the years, which is changing the weather patterns and disturbing the usual balance of nature. The issue of climate change poses many risks to human beings and all other forms of life on Earth. Some impacts of climate change include occurrence of heat waves and heat related illnesses, change in rainfall patterns and occurrence of severe storms resulting in loss of thousands of lifes; increased droughts and expansion of desert areas; rise in average sea level leading to submergence of coastal areas. This also makes the ocean water more acidic, which endangers marine life. Climate change poses risks to the survival of species on land and in the ocean. These risks increase with forest fires, extreme weather, and invasive pests and diseases. Decline in food production is another consequence of climate change which leads to shortage of food and global rise in hunger and poor nutrition. Heat stress can diminish water and grasslands for grazing, which in turn will destroy the fisheries, crops and livestock.

The issue of global warming and climate change should be addressed globally. The developed countries should look beyond their narrow self interest and work jointly with the developing countries to bring out a co-operative and collaborative strategy on this issue. The efforts made so far in this direction are sporadic and insufficient. Climate change risk management approach

includes, (i) mitigation - efforts to reduce emission of greenhouse gases; (ii) adaptation – increasing society's capacity to cope with changes in climate; (iii) geo-engineering – maintaining the natural ecosystems by way of protection and restoration; and (iv) community participation – provide an opportunity to bring everyone to the table and ensure participation of marginalized communities which suffered the most by climate change, most often these groups have been left out of the decision-making process. All countries of the world should adopt a scientific approach and handle this crisis so that the planet Earth can be saved and life continues on this planet for the years to come.

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