



Review Paper

## Impact of Global Warming on Environment

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### Abstract

Climatic changes is driven by changes in atmospheric concentration of number of relatively active gases called as GHG (Green House Gases). These may be CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, O<sub>3</sub>, CFC, fluorinated gases. Out of these, CFC has very high relatively potential impact but due to high concentration of CO<sub>2</sub>, it is assumed to be major culprit. An attempt has been made to study how gases affect average temperature of the earth. All the nation in the world contributes to global atmosphere change. As per UNFCCC report, America has just 4% of total population but contribute 31.1% of the total emission. China which is 1/5 of the total world population, its consumption of energy is doubled in last 20 years. Only Russia has less industrial activity, its emission is reduced by 35%. So far India is concerned, it has been calculated to be risen by more than 50%. The studies revealed that these drastic changes in the climate adversely affect the agricultural production, new crop become unsuitable for climatic condition, soil degradation. Rise in sea level will threat to Maldives republic lying only above 2 m sea level. The drastic changes are heavy rain, snowfall in Middle East, unusual cold winter in Indian plains and snowfall in North western Himalayas. The study concluded that not only this affect on ecosystem, but also shows that some species would be forced out of their habitats, affect on human health, lifestyle and economy.

**Keywords:** Climate, ecosystem, greenhousegas, global temp, health.

### Introduction

Human living requires a balanced environment and any disturbance to this environment leads to harmful effects on human health. There was a time when our ancestors used to talk of purity in everything. However with the advancements in technology and industrialization, such undesirable materials are being added into the environment that have disturbed this ecological balance (suitable co-existence of living organisms i.e. animals and plants with non-living components i.e. air water and soil). Around the world, there is rapid economic growth is dependent on burning of fossil fuel. Simultaneously, large quantity of pollutants are released into the atmosphere which affecting our ecosystem<sup>1</sup>.

The burning of fossils, combustion of gasoline in automobiles, increase in population, fast industrialization has led to increase in concentration of trace gases (like CH<sub>4</sub>, CO<sub>2</sub>, nitrogen oxides, sulphur oxides, sulphur oxides, chlorofluorocarbons, hydrocarbons, ozone etc.) in atmosphere. These trace gases are also called as Greenhouse gases. Some of the other sources of green house gases are: i. A number of factories spread all over the world burn coal, oil, and natural gases and spew huge amount of CO<sub>2</sub>, together with undesirable gases. ii. Power stations based on fossil fuel are major source of CO<sub>2</sub>, iii. Burning of fire woods and deforestation are major source of CO<sub>2</sub>, iv. Halogenated gases (CFCs) and halons are released into the atmosphere. v. A large fleet of automobiles, railways, air craft etc. use an immense quantity of diesel and petrol releasing huge amount of CO<sub>2</sub> every year<sup>2</sup>.

These trace gases cause increase in temperature of earth atmosphere by absorbing heat radiation being emitted by earth. This warming of earth atmosphere due to absorption of heat radiation by trace gases present in earth atmosphere is called Greenhouse effect. This raises the temperature of the earth known as Global warming.

This has adversely affected climate change, sea level, ecosystem etc. In 1822, Jean Fourier, a French mathematician compared earth's atmosphere to the glass house. In 1861, Tyndal suggested that change in CO<sub>2</sub> could be connected to temporal variations in climate. In 1896 Arrhenius suggested that if atmospheric concentration of carbon dioxide were doubled, the earth atmospheric system might warm by 5K by 1938<sup>2</sup>. As far as India is concerned, during the two or three decades, there is acceleration in frequency of floods. No doubt, it leads to destruction of forest land and draining of natural wetlands<sup>3</sup>.

### Discussion

**Why Global Warming?** The earth atmosphere allows shortwave solar radiations to reach the earth surface. When our earth surface receive solar radiation (corresponding to visible light), it gets heated up. When our warm earth cools, it emits long wave (infra red) heat radiations. The carbon dioxide and water vapours present in earth atmosphere do not allow these radiations to escape out<sup>2</sup>. The CO<sub>2</sub> and water vapours absorb a part of these outgoing streams of infrared radiations and get excited. These excited molecules then re-radiate the heat energy both outward towards the space and backward towards ground

thereby raising surface temperature thus keep global earth atmosphere warm around 15°C. Without this re-radiation the global average temperature would be around-18°C.

In addition to carbon dioxide, the other gases which also contribute to warming of earth atmosphere are methane, chlorofluorocarbons, Nitrogen oxides and SO<sub>2</sub>.

Thus it is evident that as in figure 1, if concentration of these gases in troposphere increases, more of heat radiations (infra-red) will be re-radiated back towards earth surface<sup>4</sup>. This will lead to average rise in temperature of earth called as global warming. For example since last glaciations the temperature has increased by 5°C. The gases which cause Global Warming are called as Greenhouse Gases. In such a condition, will life flourish? Will man's ingenuity and new technology headlong? Will we see energy revolution through solar or wind energy to meet the challenge?

There are more than 35 trace gases which could contribute to global warming. These trace gases are carbon dioxide, nitrogen species, sulphur compounds, chlorofluorocarbons, chlorocarbons, hydrocarbons, ozone and aldehydes. Of these five are most important. The trace gases such as CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFC, O<sub>3</sub> have steadily risen in concentration for last two or three decades as it was recorded in global backgrounds station of world meteorological organization<sup>5</sup>.

### Carbon Dioxide-Major Culprit

Since the industrial revolution (in mid-1800s) when human beings learned that fossil found within the surface of earth and the burning of fossil fuels (like oil, gas, coal) provides provide energy which lead to increase in concentration of CO<sub>2</sub> in earth atmosphere<sup>5</sup>. In Greenland and Antarctica, presence of ice cores showed that during the last glacial age (20,000 years ago) CO<sub>2</sub> level was only 190-200 ppm (ppm = parts per million) and world temperature was 5°C colder than today. CO<sub>2</sub> level rose to 280 ppm at the beginning of industrial age. As per the measurement record at global baseline station on Mauna Loa Hawaii (main source of information about yearly trends in CO<sub>2</sub>) the concentration of CO<sub>2</sub> has been accelerating at a rate of 1.8 percent per year. It is estimated that CO<sub>2</sub> level may go 450 ppm by year 2030<sup>6</sup>. The scientist reached to the conclusion that increases in CO<sub>2</sub> may threaten life on earth. Nature's well designed CO<sub>2</sub> cycle also unable to absorb increased level of CO<sub>2</sub>. Consequently, its percentage is increasing day by day. The oceans are saturated and are losing their capacity to dissolve more of it.

### Future concentration of Greenhouse gases

Table-1 below shows that best estimates of the future concentrations of the major green house gases from Ramanathan et.al by the year 2030<sup>5</sup>.

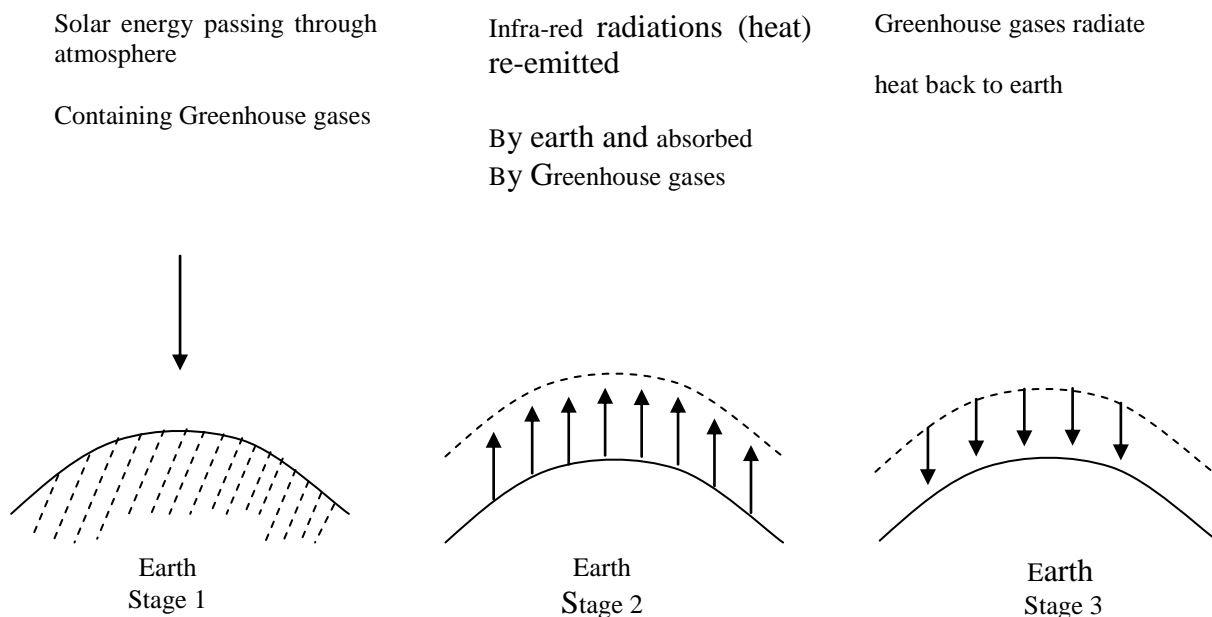


Figure-1

The Greenhouse gases and the variation in their concentration Stages of Greenhouse effect (due to which Global Warming occurs)

**Table-1**  
**Major Greenhouse Gases and their estimated rise in temperature**

Characteristics	H <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CFC-11	CFC-12	O <sub>3</sub>
Concentration (ppm) pre-1850	Variable	275	0.7	0.28	0	0	0.25
-1985	-do-	345	1.7	0.30	0.22	0.28	0.1-1.0
2030 (estimated)	-do-	450	2.3	.038	1.1	1.8	12.5
Approx. life time in atmosphere (years)	-do-	204	5-10	1.0	65	130	0.1-0.2
Estimated temperature increase	-do-	0.71	0.14	0.10	0.24	0.2	0.06

Source = Ramanathan 1986, 1988; Dickson & Cicron – 1986 (ppm = parts per million by volume)

However with co-operation of major industrialized countries CFCs concentration increase are expected to be below estimates. Concentration of CH<sub>4</sub>, N<sub>2</sub>O and ozone is likely to be as per estimates, because the present industrial and agricultural situation is likely to continue around the globe.

On the average the impact of other major trace gases combined is likely to be much as that for CO<sub>2</sub>. The study revealed that the earth will be warmer by mid of 21<sup>st</sup> century and average temperature may go somewhere between 2-4<sup>o</sup>C.

## Results

### Relative Global Warming potential of Greenhouse Gases:

Global Warming Potential (GWP) is a comparison of measuring the amount of heat trapped by green house gas as compared to amount of heat trapped by similar quantity of CO<sub>2</sub> gas. For relative measure, the concentration of CO<sub>2</sub> gas is considered and assumed as 1. Fossil fuel burning has produced about three-quarter of increase in CO<sub>2</sub> from human activity over the past 20 years. The present atmospheric concentration of CO<sub>2</sub> is about 383 ppm by volume. This rate will rise depend on uncertain economic, sociological, technological and natural developments but may be ultimately limited by the availability of fossil fuels. Fossil fuels reserves are sufficient to reach this level and continue emission past 2100, if coal, tar sands or methane clatherates are extensively used. The role of various Greenhouse gases warming primarily depends on their existing concentrations in the atmosphere, and also on the global warming potentials (GWP) of various gases<sup>7</sup> (figure 2). With GWP of CO<sub>2</sub> taken as 1, equal concentrations of methane would absorb 30 times as much heat. N<sub>2</sub>O is nearly 300 times and CFCs is nearly 13000. It means every molecule of CFCs can create same global warming effect as 13000 molecule of CO<sub>2</sub>. However, CO<sub>2</sub> on much higher concentrations than other trace gases remains the most important greenhouse gas. In spite of this, the future emissions of these gases would be critical especially CFCs with huge GWP and the rate at which their concentration continues to increase in the atmosphere. It is however, expected that CO<sub>2</sub> will dominate the influence on climate change. As time passes, GWP of green house gases usually decrease but case of fluorinated gases already has high GWP, it takes a long time to break down. These gases are not normally found in nature and also no natural process to “sink”

down these fluorinated gases. Table 2 shows Global warming potential of different greenhouse gases after a span of 20 and 100 years.

**Table-2**  
**GWP of Green House Gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HCFC-23 AND SF<sub>6</sub> GASES) after 20 and 100 years (When compared with CO<sub>2</sub>)**

Greenhouse Gases(GHW)	GWP after 20 years	GWP after 100 years
Carbon dioxide	1	1
Methane	72	125
Nitrous Oxide	289	298
HCFC-23	12000	14800
SF <sub>6</sub>	16300	22800

Global Warming Potential (GWP) of Green house Gases (When compared with CO<sub>2</sub>)

### Potential Impacts of Global warming on Environment

The infra red absorption tendency of CO<sub>2</sub> made it possible to treat CO<sub>2</sub> as a major cause of warming of earth. The rise in temperature is not uniform across the globe. The study revealed that rise will be least in tropics while maximum in the poles. It has been estimated that if the earth’ temperature increases, it will result in receding many glaciers, melting of ice caps in the polar region found over Greenland and Antarctica and disappearance of deposits of ice on the globe. In the official confirmation of Intergovernmental on climate change consisting of over 2500 leading scientist and their research found that “the balance of the evidence suggests a human influence on climate.” So with rapid build-up of greenhouse gases and continuing trend, projected temperature increase of 0.7<sup>o</sup>C to 3<sup>o</sup>C is expected by 2040AD. There may be few areas of uncertainty , but scientist are sure that global warming 3-4<sup>o</sup>C could lead to alarming and unpredictable changes in the established weather patterns – that rainfall and wind patterns could change dramatically and serious affect agriculture. Scientist from 66 nations who studied the earth during International Geographic Year has confirmed that increase in 4<sup>o</sup>C would completely flood many populous and island nations from the earth. The scientist also confirmed that world’s climate is becoming warmer due to greater concentration of CO<sub>2</sub> being fed in to the year. This predicated global warming is likely to cause following impacts.

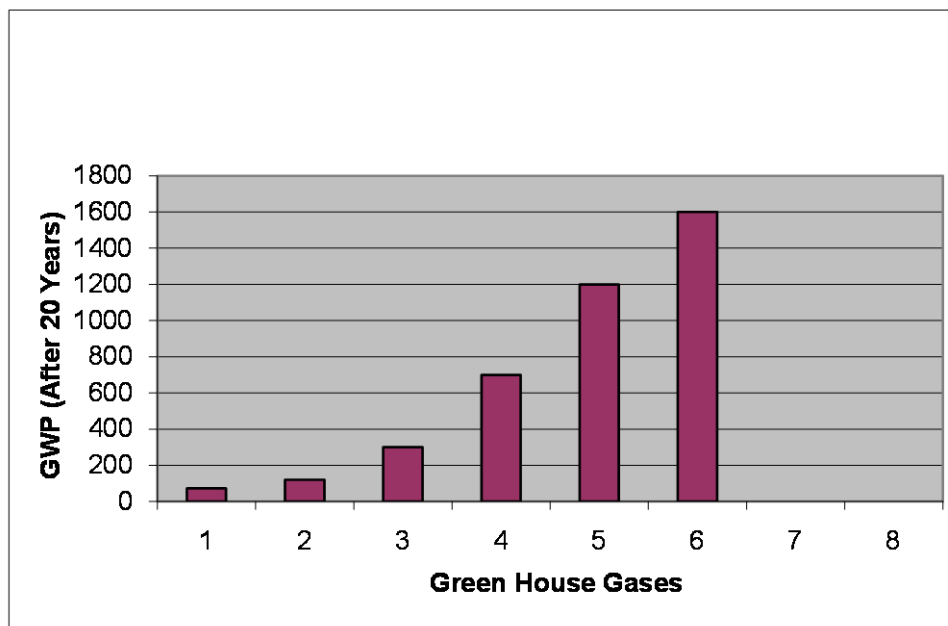


Figure-2

Global warming potential of different green house gases can be depicted graphically (Global warming potential of Greenhouse Gases, the efficiency with which equal emissions of each gas can change climate relative to CO<sub>2</sub> GWP of CO<sub>2</sub> taken as 1)

## Climate Change

The fact that rise in atmospheric temperature results in increased evaporation from oceans and brings down increased precipitation has led to several prediction about climate change over the globe<sup>8</sup>. The study revealed that warmer temperature will speed evaporation leading to drought in some places and heavy down pours and flooding in others For example in 1999 the US experienced one of the most extreme droughts ever recorded and Maryland, New Jersey, Rhode island and Delaware faced their driest growing season on record. The same year the Pacific Northwest experienced its second wettest year on record. Nevada, California and Iowa all experienced deadly floods. Recent years have seen record Hurricanes, including Hurricane Mitch the deadliest in 200 years, Hurricane Andrew the most destructive ever. Change in global climate is observed because of three major changes such as global average temperature, rise in sea level and regional precipitation<sup>9</sup>.

Infect we do not know enough to predict the severity of the consequences because the warming would not be uniform over the surface of earth. Some parts of earth would become warmer, some wetter and some drier.

Some truths about climate change<sup>10</sup>. i. Average global temperature increased by 1°C in the 20<sup>th</sup> century, ii. United states of America (USA) has just marginal i.e. 5% of world population but contributing maximum emission of carbon, approximately 31 percent. iii. The study revealed that 0.8°C rise in temperature in the planet will have highest carbon emission level in 80 thousand years. iv. Fluctuation in temperature has adverse effect on health of human beings. This may cause

hyperthermia (Intense heat) or hypothermia (Intense cold). v. Intense heat raises the levels of pollen and aeroallergens which cause asthma to 300 million people. vi. Recently Beijing coal induced smog forced people to stay in the homes and closed pathways and diverted flights. vii. Because of climate change, the Golden Toad species is threatened to extinct almost. viii. Every American home consume half of its electricity for cooling or heating purposes. ix. Too much variation in climate helps in spreading of disease such as dengue fever, malaria and Niles virus.

In the year 1988, two U.N Agencies namely as World Metrological Organization and the United Nations Environment Programme. Established IPCC (inter governmental Panel on climate change) which monitor the climate change. According to report, temperature will rise by 0.3°C per decade (range 0.2 to 0.5°C) from 1990 to 2005 in a business ‘as usual’ scenario; that oceans will warm more slowly than land surfaces (because of presence of heat sinks in oceans) and that the large areas of northern Atlantic and Arctic Ocean will hardly change. From Tropic to arctic, climate changes have potential impact on life of human beings. Sometimes, drastic climatic changes cause disaster such as heavy rainfall, floods, and disasters like Katrina endanger health and destroy human wealth and livelihoods.

In the latest IPCC report of the meeting at Stockholm, Sweden, a panel of renowned scientist strongly emphasis that it is extremely likely that “Human influence has been the dominant cause” of warming of earth<sup>11</sup>. They emphasized that if the government of different countries does not appropriate steps to reduce the pace of green house gas, whole of the earth will

merge into the sea. Another study finding that No doubt, humans are contributing maximum to warm this planet. The study also revealed that all the ice sheets of Antarctica and Greenland get melted in the last two decades. Glaciers get shrink and this may cause increase in the level of sea by 3 feet by 2100. Model experiment show that if radiative forces are kept at year 2000 level, then expected warming would occur at 0.1°C in the next two decade. The data in table 3 are assessed from Fourth assessment report of IPCC<sup>12</sup>.

The study revealed that during last century, there is rise in sea level between 12 and 15 centimeter<sup>13</sup> (However the relationship between Greenhouse warming and the ocean is not yet clear). According to latest IPCC report, sea level rise has been increased considerably on its last projection in 2007. Now estimation shows that it will rise between 26 and 82 cm (figure-3).

It is expected that between 1991 and 2010, rise in sea level by 19 cm, an average of about 1.7 mm per year. It is observed that there is an average about 3.2 mm per year occur. The increase in sea level is mainly due to. expansion of water, melting of glaciers<sup>14</sup>. The net effect of Antarctic and Greenland ice-sheets may be small but they make a major contribution to uncertainty.

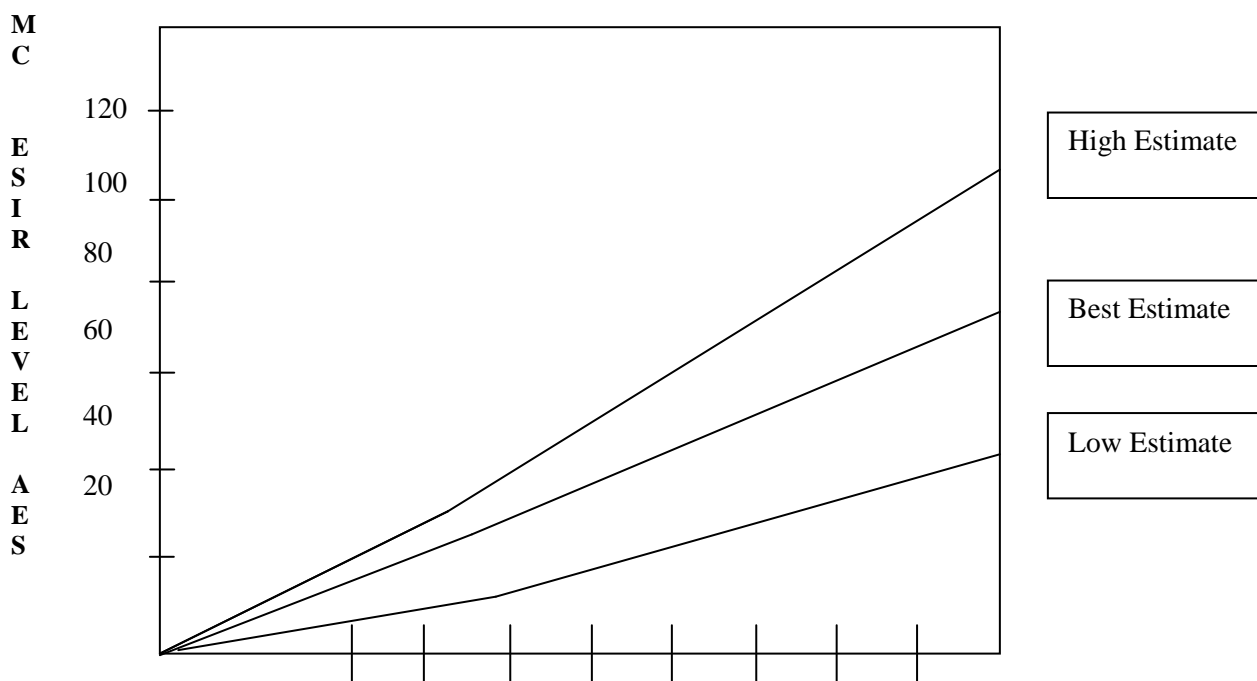
Rising in sea level cause serious threat to existence of coastal areas. In the world, there are many cities which are under danger such as large area of Netherland. Recently, small country just on coastal line such as Maldives, which is just 7 feet above sea level. There is serious threat of heavy flooding, soil erosion, change the structure and shape of coast line. A rise in sea level of only 50-100 cm caused by ocean warming would flood in low lying areas such as Bangladesh and west Bengal. It may cause submerging of many islands and continents making the land inhabitable for human beings.

**Table-3**  
**Represents rise in temperature and sea level rise as shown according to SRSS report**

CASE	Temp. Change in °C at 2090-2099 relative to 1980-1999		Sea level rise (m) (Further rapid dynamic changes)
	Best Estimate	Likely range	
2000 (Constant level)	0.6	0.3-0.9	NA
B1 Scenario	1.8	1.1-2.9	0.18-0.45
A1B Scenario	2.8	1.7-4.4	0.21-0.48
A2 Scenario	3.4	2-5.4	0.23-0.51

B1= Integrates and ecologically friendly world having rapid economic growth, A1B= A balanced emphasis on all energy source, A2= More divided world having regionally oriented economic development.

**Rise in sea level**



**Figure-3**  
**Prediction of sea level rise in centimeter at three different estimation**

## Impact on Ecosystem

There are two ways by which ecosystems can be affected by global warming. First plant growth will be influenced by higher concentration of CO<sub>2</sub>, stimulating net photosynthesis and second is any benefit from increasing CO<sub>2</sub> levels may be either enhanced or offset by the changing climate patterns associated with global warming. As a result of changing temperature and precipitation patterns, the degree of response will vary between species and thus prediction becomes more difficult<sup>15</sup>.

Changing climate due to global warming may also bring a whole series of different stresses to the ecosystem such as pests, diseases, drought or flood which may create major variation in species and in ecosystem. However at present there are more questions than answers regarding the potential impact of global warming on ecosystem.

Some facts about effect on ecosystem: i. Global warming may lead to extinction of bird species by more than 30 percentages. Rising in sea level high temperature also affecting their habitat of many species of birds. ii. Melting of glaciers lead to rise in sea level affecting the breeding grounds of many fish species resulting in declining population. iii. Fluctuation and continuous rise in temperature cause more danger to bird species and pose serious threat to survive in intense hot or cold condition. In addition, too much CO<sub>2</sub> exposure reduces plant nutrition value.

## Impact on Health of Human beings

The increased warmth and humidity in many parts of the world will increase chances of diseases in both humans and animals. Rates of infectious diseases will rise with spread of mosquitoes and other disease causing organisms that thrive in warm, wet climates. More frequent and more severe heat wave will pose a threat of public health, with children and the elderly especially vulnerable.

E.g. in the 1990s outbreaks of malaria have occurred in Michigan, Texas, Florida, Georgia, California, New Jersey and New York. In 1999 on a camping trip on Long Island, two Boy scouts were infected with malaria. Two major heat waves in Chicago in 1995 and Dallas in 1998-killed more than 600 people.

## Conclusion

No doubt, with the increase in concentration of green house gases, there will be drastic change in the climate. The study revealed that average rise in global surface temperature by 1 to 4.5°F (0.6 to 2.5°C) in the next fifty years and 2.2 to 10°F in the next 100 years with significant regional variations. It is estimated that when there is increase in concentration of CO<sub>2</sub>, the oceans become more acidic. This obviously reduce in pH value between 0.14 and 0.35 units by the end of 21<sup>st</sup> century. Evaporation will increase as the climate warms which will

increase average global precipitation. Soil moisture is likely to decline in many regions and intense rain storms are likely to become more frequent. Sea level is likely to rise two feet along most of coastal regions. Efforts are going on to reduce and minimize the effect of green house gas. Recent discovery finding that by German Scientists that during grazing, cows released CH<sub>4</sub> gas which is one of the culprit of green house gas<sup>16</sup>. The scientist manufactured a pill which trap methane produced by cow during digestion and convert it into glucose. The pill must be given along with a diet of cow. And at a clearly defined feeding a time which is difficult to accomplish through grazing. Presently, India is facing many important challenges which not only restrict the development but also danger for the future<sup>17</sup>. India is facing environmental degradation in the hands of uncontrolled human activities which affecting social and economic growth. To meet these challenges, Government of India need environmental legal and institutional system within framework. There is dire need to establish environment impact assessment to assess whether a proposed project have any impact on natural environment or not<sup>18</sup>. So, Current patterns of development and consumption around the globe pose serious threat to global ecosystem and needs to be restrained at a first priority.

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