1.0 INTRODUCTION

Everyday we hear about global warming or climate change. We experience intense storms, frequent floods, severe drought, melting glaciers etc. and the list goes on. For several years, global warming or climate change was considered as skeptics’ argument. But, today it has been accepted as a reality. This was possible due to the significant contribution made by various scientists engaged in climate science research. The French mathematician, Joseph Fourier highlighted the problem popularly known as greenhouse effect. Fourier realized that the earth’s temperature is determined not only by the radiation absorbed by, and emitted from the earth, but also by the existence of the atmosphere. The atmosphere absorbs some of the radiated heat and acts as a blanket over the Earth that maintains the temperature higher than it would otherwise be. The next major breakthrough was made in 1860 by the British scientist John Tyndall in terms of measuring the absorption of radiation by different gases. This led to the remarkable discovery that the most prevalent gases in the atmosphere i.e. oxygen and nitrogen weren’t absorbing any of the energy at all. Only the minor gases in the atmosphere, i.e., carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and water vapor, were doing so. These gases are called greenhouse gases (GHG).

The Swedish scientist, Svante Arrhenius was the first person to calculate the effects to our global temperature if we burnt enough fossil fuels to double the amount of carbon dioxide in the atmosphere. Presently, studying climate system is much more advanced due to the advancement in information and communication technology aided by space technology.
In this unit we shall study about the factors affecting global warming and its linkages with climate change. We will also discuss about the probable consequences and impacts of climate change both at global as well as at national level. The unit also highlights the threats of climate change to sustainable development. Finally, we will also discuss about climate change debates specifically about Kyoto Protocol, the failure of Copenhagen Summit and India’s Action Plan on Climate Change.

1.1 OBJECTIVES

After reading this unit you will be able to:

- define global warming and climate change;
- explain linkages between global warming and climate change;
- describe the adverse impact of human activities on climate change;
- analyze the probable consequences and impact of climate change with a special reference to developing countries; and
- highlight major climate change related debates that are taking place at International level and National Action plan on climate change implemented in India.

1.2 THE SCIENCE OF CLIMATE CHANGE

To have a clear understanding about the science of climate change, we should know the linkages between global warming and climate change. We should also know how human activities have been one of the crucial determinants in aggravating climate change situation.

1.2.1 Global Warming and Climate Change

In simpler terms, climate change may be expressed as any substantial change in the Earth’s climate that lasts for an extended period of time whereas global warming refers to a change in climate that causes an increase in the average temperature of the lower atmosphere. But, according to the Inter Governmental Panel on Climate Change (IPCC), climate change refers to “any change in climate over time, whether due to natural variability or as a result of human activity” (IPCC, 2001a). The United Nations Framework Convention on Climate Change (UNFCCC) in Article 1 defined it as: “climate change refers to a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period” (IPCC, 2001a).

Global warming can have many different causes, but it is most commonly associated with human interference, specifically the release of excessive amounts of greenhouse gases. These gases, act like a greenhouse around the earth. This means that these gases allow the heat from the Sun to enter into the atmosphere, but do not allow the heat to escape back into space. In other words, the more the greenhouse gases, the larger the percentage of heat that is trapped inside the earth’s atmosphere. The earth will not be able exist in its present state i.e. with life, without the presence of some naturally occurring greenhouse gases (GHG) because without them, no heat would be trapped in the atmosphere, so the earth would be extremely cold. Naturally occurring greenhouse gases (not fluorinated
gases) are good in naturally occurring amounts; it’s when people start contributing excessive amounts of these that greenhouse gases become a problem. With excessive greenhouse gas buildup, the earth’s atmosphere warms to unnatural temperatures.

For better understanding, we need to understand the global carbon cycle. It involves interaction among the atmosphere, oceans, soils and vegetation and fossil fuel deposits. The oceans contain about 39,000 Giga tonnes of carbon (GtC), fossil fuel deposits about 16,000 GtC, soils and vegetation about 2500 GtC, and the atmosphere about 760 GtC. Since 1850, land-use change is estimated to have released about 136 GtC and fossil fuel combustion about 270 GtC. Of this, 180 GtC has ended up in the atmosphere, while 110 GtC has been absorbed by growing vegetation and the remaining by the oceans. It is the increasing concentration of atmospheric CO$_2$ that is the cause for concern about global climate change. The combustion of fossil fuels and other human activities are the primary reasons for increased concentrations of CO$_2$ and other greenhouse gases. Between 1990 and 1999, an estimated 6.3 GtC/year was released due to the combustion of fossil fuels, and another 1.6 GtC/year was released due to the burning of forest vegetation. This was offset by the absorption of 2.3 GtC/year each by growing vegetation and the oceans. This left a balance of 3.3 GtC/year in the atmosphere. Controlling the release of greenhouse gases from fossil fuel combustion, land-use change and the burning of vegetation are therefore obvious opportunities for reducing greenhouse gas emissions and can decrease the projected rate and magnitude of warming. Future climate change is thus determined by historic, current and future emissions. Of the six aforementioned GHGs, CO$_2$ accounted for 63%, methane 24%, nitrous oxide 10%, and the other gases constitute the remaining 3% of the carbon equivalent emissions in 2000.

Let us understand how various human activities contribute in increasing these GHGs.

1.2.2 How do Human Activities Contribute to Climate Change?

Different anthropogenic activities lead to emissions of four principal greenhouse gases: carbon dioxide, methane, nitrous oxide and the halocarbons (a group of gases containing fluorine, chlorine and bromine). These gases accumulate in the atmosphere and have been increasing with the passage of time. The most significant aspect about the increases in all of these gases is that they have occurred in the industrial era which is not more than 300 years old. That is why this small geological period is named as Anthropocene era. (The term was coined by ecologist, Eugene F. Stoermer but has been widely popularized by the atmospheric chemist, Paul Crutzen). This is because of influence of human behaviour on the earth’s atmosphere in recent centuries is so significant that it has been affecting the living organisms on the earth.

- **Carbon dioxide** has increased from fossil fuel use in transportation, building heating/cooling and in the manufacture of cement and other goods. Deforestation releases CO$_2$ and reduces its uptake by plants. Carbon dioxide is also released in natural processes such as the decay of plant matter.

- **Methane** has increased as a result of human activities related to agriculture, natural gas distribution and landfills. Methane is also released from natural processes that occur, for example, in wetlands.
• *Nitrous oxide* is emitted by human activities such as fertilizer use and fossil fuel burning. Natural processes in soils and the oceans also release N₂O.

• *Halocarbon* gas concentrations have increased primarily due to human activities. Principal halocarbons include the chlorofluorocarbons (e.g., CFC-11 and CFC-12), which were used extensively as refrigeration agents and in other industrial processes before their presence in the atmosphere was found to cause stratospheric ozone depletion.

• *Ozone* is a greenhouse gas that is continually produced and destroyed in the atmosphere by chemical reactions. In the troposphere, human activities have increased ozone concentrations through the release of gases such as carbon monoxide, hydrocarbons and nitrogen oxide, which chemically react to produce ozone. As mentioned above, halocarbons released by human activities destroy ozone in the stratosphere and have caused the ozone hole over Antarctica.

• *Water vapour* is the most abundant and important greenhouse gas in the atmosphere. However, human activities have only a small direct influence on the amount of atmospheric water vapour. Indirectly, humans have the potential to affect water vapour substantially by changing climate. For example, a warmer atmosphere contains more water vapour. Human activities also influence water vapour through \( \text{CH}_4 \) emissions, because \( \text{CH}_4 \) undergoes chemical destruction in the stratosphere, producing a small amount of water vapour.

• *Aerosols* are small particles present in the atmosphere with widely varying size, concentration and chemical composition. Some aerosols are emitted directly into the atmosphere while others are formed from emitted compounds. Aerosols contain both naturally occurring compounds and those emitted as a result of human activities. Fossil fuel and biomass burning have increased aerosols containing sulphur compounds, organic compounds and black carbon. Human activities such as surface mining and industrial processes have increased dust in the atmosphere. Natural aerosols include mineral dust released from the surface, sea salt aerosols, biogenic emissions from the land and oceans and sulphate and dust aerosols produced by volcanic eruptions.

### 1.3 GLOBAL CHANGE AND CLIMATE CHANGE

Today, there are lots of discussions on global change issues rather than merely discussing about climate change. While talking about climate change, there is a need for a discussion on global change for two reasons:

1) Climate change is one among many global changes that has been affecting the earth.

2) Climate change has been affecting and has been affected by many of the global change phenomena.

Global change is a transformation that occurs on a worldwide scale e.g., an increase in carbon dioxide in the atmosphere or exhibits sufficient cumulative effects to have worldwide impact e.g., local species extinction resulting in global loss of biodiversity. In the past, the main drivers of global change have been
solar output, plate tectonics, volcanism, proliferation and abatement of life, resource depletion, changes in Earth’s orbit around the sun and changes in the tilt of Earth on its axis. There is increasing evidence that, now the main driver of global change, is the growing human population’s demand for energy, food, goods and services, and disposal of its waste products. In the last 250 years, global change has caused climate change, widespread species extinctions, fish-stock collapse, desertification, ocean acidification, ozone depletion, pollution, and other large-scale shifts.

More completely, the term “global change” encompasses: population, climate, the economy, resource use, energy development, transport, communication, land use and land cover, urbanization, globalization, atmospheric circulation, ocean circulation, the carbon cycle, the water cycle and other cycles, sea-level rise, food webs, biological diversity, pollution, and more. The International Human Dimensions Programme (IHDP) spearheaded a landmark science conference held in Amsterdam in 2001. The conference entitled, “Challenges of a Changing Earth: Global Change Open Science Conference”, led to the Amsterdam Declaration which has rightly stated that, “In addition to the threat of significant climate change, there is growing concern over the ever-increasing human modification of other aspects of the global environment and the consequent implications for human well-being. The basic goods and services provided by the planetary life support system, for example, food, water, clean air and an environment conducive to human health, are being affected increasingly by global change.”

Check Your Progress 1

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) Explain any four human activities responsible for climate change.

2) Differentiate between global change and climate change.

1.4 WHY IS CLIMATE CHANGE A CONCERN?

As mentioned above, the rapid increase in greenhouse gases within such a small period of human history is a problem because it is changing the climate faster
than the rate at which many living organisms may be able to adapt. Recent assessments have confirmed that, due to greenhouse gas emissions, global temperature has gone up by 10°C since 1850. If these emissions are not seriously reduced, probability is that global temperatures would rise between 20° and 30°C over the next 50 years. Scientists are already seeing some of these changes occurring more quickly than they had expected. According to the IPCC, eleven of the twelve hottest years occurred between the years 1995 and 2006.

As a consequence of this, the earth’s ice sheets such as Greenland and Antarctica have begun to melt resulting in extra water which could potentially raise the sea levels significantly. This rise in sea level would lead to submergence of many island countries in Pacific, Atlantic and the Indian Ocean. Apart from this, majority of megacities, popularly coined as Bombay to Boston would also submerge under sea water. In addition to this, weather can become extreme. This means more intense major storms, more rain followed by longer and drier droughts posing a challenge for agriculture and loss of water supplies which is directly related to livelihood of majority of population in the world and more specifically to the developing countries. In brief it would be one of the major threats to sustainability of the earth and its inhabitants.

1.4.1 Climate Change as a Threat to Sustainability

On the eve of India’s independence, Mahatma Gandhi was asked whether he thought the country could follow the British model of industrial development. His response was very relevant in today’s context. He said “It took Britain half the resources of this planet to achieve its prosperity. How many planets will India require for development?” As far as India is concerned, about 700 million populations out of 1.1 billion live in rural areas. These populations are directly dependent upon climate sensitive sectors like agriculture, forests and fisheries and derive their subsistence and livelihood from natural resources such as water, biodiversity, grasslands etc. Therefore, increase in temperature would adversely affect and put pressures in all these sectors and natural resources which are otherwise under pressure due to various other reasons like over population, overconsumption etc.

This has been highlighted by Human Development Report 2007/08 and World Development Report 2010. According to Human Development Report 2007/08 entitled ‘Fighting Climate Change: Human Solidarity in a Divided World’ which stated that

“Climate change is the defining human development issue of our generation. All development is ultimately about expanding human potential and enlarging human freedom. It is about people developing the capabilities that empower them to make choices and to lead lives that they value. Climate change threatens to erode human freedoms and limit choice. It calls into question the Enlightenment principle that human progress will make the future look better than the past.”

Climate change will undermine international efforts to combat poverty. Seven years ago, political leaders around the world gathered to set targets for accelerated progress in human development. The Millennium Development Goals (MDGs) defined a new ambition for 2015. Much has been achieved, though many countries remain off track. Climate change is hampering efforts to deliver the MDG promise.
Looking to the future, the danger is that it will stall and then reverse progress built-up over generations not just in cutting extreme poverty, but in health, nutrition, education and other areas. The report identified five key areas through which climate change could stall and then reverse development in general and human development in specific:

- **Agricultural production and food security**: Climate change will affect rainfall, temperature and water availability for agriculture in vulnerable areas. For example, drought affected areas in Sub-Saharan Africa could expand by 60–90 million hectares, with dry land zones suffering losses of US$26 billion by 2060 (2003 prices). Other developing regions, including Latin America and South Asia will also experience loss in agricultural production, undermining efforts to cut rural poverty. The additional number affected by malnutrition could rise to 600 million by 2080.

- **Water stress and water insecurity**: Changed run-off patterns and glacial melt will add to ecological stress, compromising flows of water for irrigation and human settlements in the process. An additional 1.8 billion people could be living in a water scarce environment by 2080. Central Asia, Northern China and the northern part of South Asia face immense vulnerabilities associated with the retreat of glaciers in the Himalayas. Seven of Asia’s great river systems will experience an increase in flows over the short term, followed by a decline as glaciers melt. The Andean region also faces imminent water security threats with the collapse of tropical glaciers. Several countries in already highly water-stressed regions such as the Middle East could experience deep loss in water availability.

- **Rising sea levels and exposure to climate disasters**: Sea levels could rise rapidly with accelerated ice sheet disintegration. Global temperature increases of 3–4°C could result in 330 million people being permanently or temporarily displaced through flooding. Over 70 million people in Bangladesh, 6 million in Lower Egypt and 22 million in Vietnam could be affected. Small island states in the Caribbean and Pacific could be affected by catastrophic damage. The warming of seas will also give rise to intense tropical storms. With an average of 344 million people currently exposed to tropical cyclones, highly intense storms can have devastating consequences for a large number of countries. The one billion people currently living in urban slums on fragile hillsides or flood-prone river banks face acute vulnerabilities.

- **Ecosystems and biodiversity**: Climate change is already transforming ecological systems. Around one-half of the world’s coral reef systems have suffered ‘bleaching’ as a result of warming seas. Increasing acidity in the oceans is another long-term threat to marine ecosystems. Ice-based ecologies have also suffered devastating climate change. While some animal and plant species will adapt, for many species the pace of climate change is too rapid: climate systems are moving more rapidly than they can follow. With 3°C of warming, 20–30 percent of land species could face extinction.

- **Human health**: Rich countries are already preparing public health systems to deal with future climate shocks, such as the 2003 European heat wave and more extreme summer and winter conditions. However, the greatest health impacts will be felt in developing countries because of high levels of
poverty and the limited capacity of public health systems to respond. Major killer diseases could expand their coverage. For example, an additional 220–400 million people could be exposed to malaria, which is a disease that already claims around 1 million lives annually. Dengue fever is already in evidence at higher levels of elevation than has previously been the case, especially in Latin America and parts of East Asia. Climate change could further expand the reach of the disease (Human Development Report, 2010, p. 9–10).

None of these five separate drivers will operate in isolation. They will interact with wider social, economic and ecological processes that shape opportunities for human development. We will discuss all the above mentioned issues in details in the succeeding three units.

1.5 PROBABLE CONSEQUENCES AND IMPACTS OF CLIMATE CHANGE

Climate change impact would be uneven in terms of geographical locations, sectors and socio-economic group. Therefore, some of the major impacts/consequences of climate change are mentioned for two levels. One is at macro scale i.e. at global level and the other at micro-level i.e. at national level. Some of the major observations of Fourth Assessment Report (2007) by IPCC are given below (cf. O’Brien, K. et al. 2008, p.9).

1.5.1 Observations of Changes in Climate at Global Level

- Widespread changes in extreme temperatures have been observed over the last 50 years.
- Reductions in the number of frost days in mid-latitude regions, increases in the number of warm extremes and a reduction in the number of daily cold extremes.
- Heat waves have increased in duration beginning in the latter half of the 20th century.
- Significant increased precipitation in the eastern parts of North and South America, northern Europe and northern and central Asia.
- Drying has been observed in the Sahel, the Mediterranean, southern Africa and parts of southern Asia.
- A substantial increase in heavy precipitation events has been observed.
- Increase of intense tropical cyclone activity in the North Atlantic since about 1970, correlated with increases in tropical sea surface temperatures. There are also suggestions of increased intense tropical cyclone activity in some other regions where concerns over data quality are greater.
- More intense and longer droughts have been observed over wider areas, particularly in the tropics and subtropics since the 1970s.
- Altered distribution of some infectious disease vectors.

**Future Climate Change Projections**

- Increased warming with the greatest temperature increases in high northern latitudes, with less warming over the southern oceans and North Atlantic.
• More frequent, intense and longer lasting heat waves.
• An intensification and expansion of wildfires is likely globally.
• Fewer, shorter, less intense cold spells/cold extremes in winter.
• Increased precipitation in high latitudes, and decreases in most subtropical land regions.
• More heavy precipitation events.
• Increased risk of flooding (intense and heavy rainfall coupled with high runoff).
• Increases in areas affected by droughts.
• Sea level is expected to continue to rise over the next several decades.
• More severe tropical cyclones, with greater wind speeds and more intense precipitation.
• Widespread increase in thaw depth in most permafrost regions.

1.5.2 India-National Level

The future impacts of climate change, identified by the Government of India’s National Communications (NATCOM) in 2004 include:

• Decreased snow cover, affecting snow-fed and glacial systems such as the Ganges and Brahmaputra. 70% of the summer flow of the Ganges comes from melt water
• Erratic monsoon with serious effects on rain-fed agriculture, peninsular rivers, water and power supply
• Drop in wheat production by 4-5 million tonnes, with even a 1°C rise in temperature
• Rising sea levels causing displacement along one of the most densely populated coastlines in the world, threatened freshwater sources and mangrove ecosystems
• Increased frequency and intensity of floods. Increased vulnerability of people in coastal, arid and semi-arid zones of the country
• Studies indicate that over 50% of India’s forests are likely to experience shift in forest types, adversely impacting associated biodiversity, regional climate dynamics as well as livelihoods based on forest products.

Indian Network for Climate Change Analysis (INCCA) in the recently released report titled “Climate Change and India: A 4x4 Assessment - A Sectoral and Regional Analysis for 2030s” assess differential impacts on the basis of observed climate change and climate change projections for the year 2030s on selected sectors such as water resources, agriculture, forests and human health of selected four distinct geo-ecological regions of India that are sensitive to climate change. These regions are the Himalayan region, North-Eastern region, Western Ghats and Coastal regions. According to the report “The choice of the sectors and regions is in conformity with the significance and importance of the climate sensitive sectors of the economy that cover the well being and livelihoods of the large population residing in these regions” (INCCA 2010, p.12). But the complete extent and level of climate change impacts on India are still to be studied because...
it is very diverse and complex in nature. This is because vulnerability to climate change increases due to “low adaptive capacity to withstand the adverse impacts of climate change due to high dependence of the majority of the population on climate-sensitive sectors like agriculture and forestry, poor infrastructure facilities, weak institutional mechanisms and lack of financial resources” (Shukla et al. 2003, p.13).

Check Your Progress 2

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) Describe any four likely impacts of climate change on India.

2) How can we say that climate change is a threat to sustainability of human development? Give any two arguments.

1.6 CLIMATE CHANGE DEBATES

There are so many debates and developments as far as climate change is concerned since Rio Earth Summit, 1992. But, we would discuss two important developments i.e. Kyoto Protocol and the Copenhagen Summit.

1.6.1 Kyoto Protocol

It’s a United Nations sponsored agreement among nations to reduce their greenhouse gas emissions. This protocol emerged from the United Nations Framework Convention on Climate Change which was signed by almost all the nations which attended Rio Earth Summit, 1992. The Framework pledges to stabilize GHG concentrations “at a level that would prevent dangerous anthropogenic interference with climate system.” The Protocol was initially adopted on 11th December 1997 in Kyoto, Japan and entered into force on
16th February 2005. As of November 2009, 187 states have signed and ratified the protocol. The most notable non-member of the Protocol is the United States, which is a signatory of UNFCCC and was responsible for 36.1% of the 1990 emission levels.

Under the Protocol, 37 industrialized countries (called “Annex I countries”) commit themselves to a reduction of four greenhouse gases (GHG) i.e. carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) and two groups of gases i.e. hydrofluorocarbons and perfluorocarbons produced by them, and all member countries give general commitments. Annex I countries agreed to reduce their collective greenhouse gas emissions by 5.2% from the 1990 level. Emission limits do not include emissions by international aviation and shipping, but are in addition to the industrial gases, chlorofluorocarbons, or CFCs, which are dealt with under the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. The benchmark 1990 emission levels were accepted by the Conference of the Parties of UNFCCC (decision 2/CP.3) were the values of “global warming potential” calculated for the IPCC Second Assessment Report. These figures are used for converting the various greenhouse gas emissions into comparable CO₂ equivalents when computing overall sources and sinks.

The biggest question is that ‘Will Kyoto make any difference?’ But it appears that if any of the big economies will meet their Kyoto targets by 2012. Even if they did, it would only make a tiny dent in the world’s ever increasing output of GHG’s. Therefore, century long lifespan of atmospheric CO₂ means that the planet is already committed to a substantial amount of greenhouse warming. Even if we turn off every fuel-burning machine on earth tomorrow, climate modelers tell us that the world would warm at least another 0.5°C as oceans slowly release the heat that they have collected in recent decades. The bottom line is that we cannot bring down our greenhouse gas emissions in check until changes in technology and lifestyle enable us to pull us back far beyond our current emission levels. We need to find some safe methods to remove enormous amounts of carbon or both.

1.6.2 Copenhagen Summit

The United Nations Climate Change Conference 2009, commonly known as the Copenhagen Summit, was held at Copenhagen, Denmark, from 7th - 18th December. According to the Bali Road Map, a framework for climate change mitigation beyond 2012 was to be agreed there. The Copenhagen Accord was drafted by the US, China, India, Brazil and South Africa on December 18th, and judged a “meaningful agreement” by the United States government. It was “taken note of”, but not “adopted”, in a debate of all the participating countries the next day, and it was not passed unanimously. The document recognized that climate change is one of the greatest challenges of the present day and that actions should be taken to keep any temperature increases to below 2°C. The document is not legally binding and does not contain any legally binding commitment for reducing CO₂ emissions. With no firm target for limiting the global temperature rise, no commitment to a legal treaty and no target year for peaking emissions, countries most vulnerable to climate impacts have not got the deal they wanted.

Early on Saturday 19th December, delegates approved a motion to “take note of the Copenhagen Accord of December 18th, 2009”. This was due to the opposition of countries such as Bolivia, Venezuela, Sudan and Tuvalu who registered their
opposition to both the targets and process by which the Copenhagen Accord was reached. The accord recognizes the scientific case for keeping temperature rises below 2°C, but does not contain commitments for reduced emissions that would be necessary to achieve that aim. One part of the agreement pledges US$30 billion to the developing world over the next three years, rising to US$100 billion per year by 2020, to help poor countries adapt to climate change. Earlier proposals, which would have aimed to limit temperature rises to 1.5°C and cut CO₂ emissions by 80% by 2050, were dropped. The Accord also favors developed countries’ paying developing countries to reduce emissions and degradation, known as “REDD”.

Despite widely held expectations that the Copenhagen summit would produce a legally binding treaty, the conference was plagued by negotiating deadlock and the “Copenhagen Accord” is not legally enforceable. The Copenhagen Accord asked countries to submit emissions targets by the end of January 2010, and paved the way for further discussions to occur at the 2010 UN climate change conference in Mexico. By early February, 67 countries had registered their targets. Countries such as India and Association of Island States made clear that they believed that Copenhagen Accord could not replace negotiations within the UNFCCC. Other commentators consider that “the future of the UN’s role in international climate deals is now in doubt.” Indian journalist Praful Bidwai puts the blame on both developed and a few developing countries such as India, arguing that the “Copenhagen Accord is an illegitimate, ill-conceived, collusive deal between a handful of countries that are some of the world’s greatest present and future emitters.” He argues that India’s policy is driven by elites determined to maintain high-consumer lifestyles which will have devastating effects for the vast majority of India’s poor.

1.7 NATIONAL ACTION PLAN ON CLIMATE CHANGE

India released its National Action Plan on Climate Change (NAPCC) on 30th June 2008. The entire action plan advocates broadly two pronged strategy. Firstly, to develop adaptation to climate change and secondly further enhancement of the ecological sustainability of India’s development path. In other words, the NAPCC outlines a strategy by which India will adapt to climate change, while maintaining a high growth rate, protecting poor and vulnerable sections of society and achieving national growth objectives. NAPCC proposed eight missions and 24 initiatives to minimize the climate change effects. These initiatives are aimed at promoting technologies and actions in the sectors pertaining to energy generation, transport, renewable energy, disaster management and capacity building etc. However, detailed action plans for each mission, and any clear targets are missing from the report. The real challenge is to implement these below mentioned eight missions into actions at diverse grass root level situations in India. The proposed eight missions are as follows:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
As our country is full of diversity, climate change would have differential impacts on different geo-ecological conditions. Therefore, it is pertinent to have different action plan for different regions apart from national level missions. In this context, attempt has been made by different states to develop state level climate change action plan. But if we analyze all these state plans, it has been found that it has still remains as a document and nothing significant has been implemented.

**State Level Action Plans on Climate Change in India**

The Prime minister in his address to Ministers of Environment and Forest from various states on 18th August 2009 called upon all the states to prepare a State level Action Plan on Climate Change consistent with the strategy outlined in the NAPCC. The State level plans will enable communities and ecosystems to adapt to climate change effectively and help to achieve the objectives of NAPCC. Accordingly, a programme for the preparation of state level plans has been initiated. Some of the states have already responded and initiated positive actions. Government of Himachal Pradesh and Karnataka has drawn up a programme and sought technical assistance and funding from the World Bank for the projected activities. Government of Delhi has prepared an action plan outlining the activities which was launched in November 2009. Kerala Government has constituted a steering committee to oversee the preparation of Action Plan. Gujarat has taken proactive steps to set up a dedicated department for climate change and prepare its action plan. Government of Orissa has also developed a draft of Action Plan and presently circulated it widely for feedback. Similarly Tamil Nadu Government has also initiated the process of preparation of Action Plan (Adapted from Rashmi, R. R. & Satapathy, S. (2010) Facing the Challenge, Yojana, Vol. 54, p. 9-10).

**Check Your Progress 3**

**Note:**

a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) **Why is there uncertainty in climate change prediction? Explain any two factors responsible for the uncertainties.**

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1.8 LET US SUM UP

- Climate change refers to a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period.

- Various anthropogenic activities lead to emissions of four principal greenhouse gases: carbon dioxide, methane, nitrous oxide and the halocarbons. These gases accumulate in the atmosphere and have increased with the passage of time.

- The increase in greenhouse gases within a small period of human history is a problem since it has adverse and differential impacts on different sectors and region. Some of the adverse impacts would be: melting of ice cap, rise in sea level, submergence of many island countries and densely populated coastal areas. Also weather can become more extreme which would impact agriculture. In brief it would be one of the major threats to sustainability of the earth and its inhabitants.

- Climate change threatens to erode human freedoms and limit choice. Climate change is hampering efforts to deliver the MDG promise. Unfortunately, despite of various efforts at international level, till now, no consensus has emerged and there are strong differences among developed and developing countries.

- To address the global problem, each country has to play a significant role. India released its National Action Plan on Climate Change (NAPCC) on 30th June 2008. The entire action plan advocates broadly two pronged strategy. Firstly, to develop adaptation to climate change and secondly further enhancement of the ecological sustainability of India’s development path. NAPCC proposed eight missions and 24 initiatives to minimize the climate change effects. The real challenge is to implement these eight missions into actions at diverse grass root level situations in India.

1.9 KEY WORDS

**Anthropogenic Activities**: The activities that are exclusively conducted or created by human beings.

**Climate Change**: It refers to a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and
which is in addition to natural climate variability observed over comparable time period.

**Global Change**
: Global change is a transformation that occurs on a world-wide scale or exhibits sufficient cumulative effects to have world-wide impact.

**Global Warming**
: It refers to a change in climate that causes an increase in the average temperature of the lower atmosphere.

**Kyoto Protocol**
: It is a United Nations sponsored agreement among nations to reduce their Green House Gases emissions.

### 1.10 REFERENCES AND FURTHER SUGGESTED READINGS


### 1.11 KEY TO CHECK YOUR PROGRESS

**Check Your Progress 1**

1) Your answer must include the following points:
   - Release of carbon dioxide by burning fossil fuel
   - Release of methane through human activities
   - Nitrous oxide emitted by human activities
   - Release of chlorofluorocarbons

2) Your answer must include the following points:
   - Global change is a transformation that occurs on a worldwide scale or exhibits sufficient cumulative effects to have worldwide impact e.g. local species extinction resulting in global loss of biodiversity.
Climate change is one among many global changes that has been affecting the earth.

Check Your Progress 2

1) Your answer must include the following points:

Some of the likely impacts of climate change on India are:

- Decrease in snow cover
- Erratic monsoon
- Drop in wheat production
- Rising sea levels
- Increased frequency and intensity of floods
- Shift in forest types, adversely impacting associated biodiversity, regional climate dynamics as well as livelihoods based on forest products

2) Your answer must include the following points:

- Climate change threatens to erode human freedoms and limit choice. It calls into question the Enlightenment principle that human progress will make the future look better than the past.
- Climate change is hampering efforts to deliver the MDG promise. Looking to the future, the danger is that it will stall and then reverse progress built-up over generations not just in cutting extreme poverty, but in health, nutrition, education and other areas.

Check Your Progress 3

1) Your answer must include the following points:

- As our country is full of diversity, climate change would have differential impacts on different geo-ecological conditions.
- Therefore, it is pertinent to have different action plan for different regions apart from national level missions.

2) Your answer must include the following points:

- It is a United Nations sponsored agreement among nations to reduce their green house gases emission.
- The provisions are: (i) under the Protocol, 37 industrialized countries commit themselves to a reduction of four greenhouse gases (GHG) i.e. carbon dioxide, methane, nitrous oxide, sulphur hexafluoride) and two groups of gases i.e. hydrofluorocarbons and perfluorocarbons produced by them, and all member countries give general commitments. (ii) Annex I countries agreed to reduce their greenhouse gas emissions by 5.2% from the 1990 level.