
UNIT 10 ANTHROPOCENE AND CLIMATE CHANGE•

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10.0 OBJECTIVES

After reading this unit, you should be able to:

- Understand the concept of the stages of the geological time scale;
- Conceptualise the idea of Anthropocene and its origin; and
- Explain the climate change and global warming in this period.

10.1 INTRODUCTION

It is often questioned, that for how long, are we existing on the earth? However, whatever, be its span, we will be surprised to understand the jarring impact it left on the planet. You will be amazed to know that every geological event, be it the ever increasing water levels, pollutants in the water bodies, soil and air are constantly creating ripples on the earth at different points on the geological history. The geological time scale or GTS as we call it, describes the different time periods of the geological continuum. The largest division of the continuum had been termed as eons. Eons are again classified as different eras. The eras in turn are re-classified into periods, epochs and ages. But the question which arises is what the Geologic time scale is?

The Geologic time scale is basically a system of chronological dating that categorizes the geological strata in time. This brings us to the further question of what geological strata is all about? Geological strata or stratigraphy is usually used by geologists, paleontologists and other earth scientists to describe the timings of events and their relationships in geological history. Stratigraphy is a branch of geology concerned with the analysis of the rock layers and their layering. It was by observing these rock layers and their mutual relations that the time scale was designed. The time scale observed different layers of rocks and their relationships. It also studied the times when different species of animals appeared, evolved and extinguished. This was possible because of the study of the fossilized remains and imprints. The practice of categorizing the geological epoch dated long back. It dated from the commencement of the significant human impact on the earth's geology and ecosystems. This at the same time included anthropogenic climate

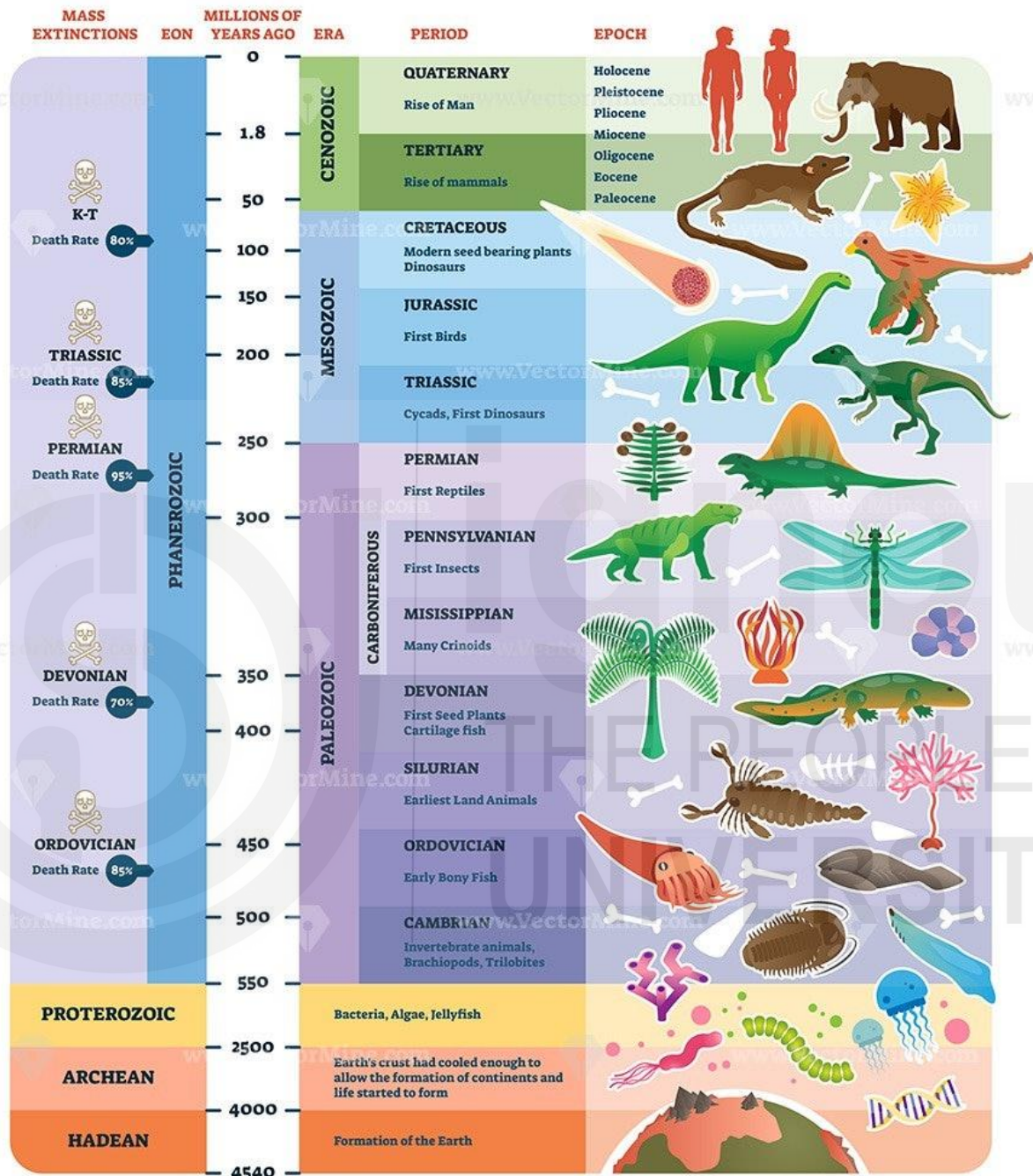
change as well. But now, the pertinent question is, what is anthropocene and why is it so important in our context today? Learners come, let's try to answer this.

10.2 ANTHROPOCENE: THE ORIGIN

The term Anthropocene is a combination of the coinage anthropo derived from the word anthropos which is an ancient Greek word, meaning human and cene from kainos, which is also an ancient Greek word, meaning “new” or “recent”. It is said that the biologist Eugene F Stoermer could be recognized as having coined this term “anthropocene”, however its usage was quite limited in the mid-1970s. The achievement for having popularized this term however goes to Paul J. Crutzen, who made all efforts to re-energize and re-vitalize this lost term. He made us realize that we are now living in the anthropocene epoch.

Soviet scientists had been using this term since as early as the 1960s. They used it to refer to another term, Quaternary, the most recent geological period. Geological period is, as we have seen above is one of the several sub-divisions of the geological time. These sub-divisions or periods form the elements of a hierarchy of the several divisions into which the geologists have fragmented the earth's history. Eras and eras are larger subdivisions than periods while the periods themselves may be rightly divided into epochs and ages. To understand the emergence of the Anthropocene, we must understand the broader geological time frame. We must have a knowledge of the various eons, eras, periods and epochs in which the geological timeline is broken into. This chronology is important to understand how the most recent phase of Anthropocene came into being along with the predominance of the human beings. The following diagram will give us an idea of the geological timeline and its detailed fragments, to understand the evolution of the animal life, right from the unicellular creatures to the matured human beings and the arrival of the Anthropocene.

GEOLOGIC TIMELINE



Title: Division of the Geological Time-Line

PictureCredit:

<http://img.selzstatic.com/items/206846/cwhsfmasttn/original.jpg?w=1600&fit=min&auto=compress.format&q=70>

10.3 GEOLOGICAL TIME SPAN AND THE EVOLUTION OF THE ANTHROPOCENE

Now let us delve a little deeper into this very interesting world of geological time span. This is important to understand the concept of anthropocene. Starting from the very beginning of the formation of the earth, we shall approach towards the emergence of man on the earth. This trajectory must be studied very carefully to understand the concept of anthropocene and its sheer relevance in the context of climate change. The geological time span is divided into eons, which is further divided into the cumulative stages and sub-stages of eras, periods and epochs. Let us begin with the eons, which are the first ever divisions of the earth since antiquity. We shall start our discussion with the Hadean eon and gradually move towards the maturation of Anthropocene.

10.4 HADEAN EON

To start with, we come to the four eons of which Hadean eon was the first of its kind. It was the first one which came around 4540 million years ago, when the earth was undergoing its formation. This term was coined after the mythical underworld Hades by the American geologist Preston Cloud. He labelled the period as pre-ancient, existing even before the earliest known rocks on the earth. The earth had just formed and the conditions were unsettling. Very few geological traces of this eon remain on the earth.

10.5 ARCHEAN EON

The next eon on the earth is Archean that existed around 4000 millions of years ago. At this point of time, the earth's crust had just cooled down enough. This permitted the formation of the continents and life started to roll over very slowly since free atmospheric oxygen was still lacking. Life was very simple, mostly comprising of shallow water microbial mats. These microbial mats are nothing but multi-layered sheet of micro-organisms, mostly bacteria and single celled organisms called archaea.



Picture Credit- https://upload.wikimedia.org/wikipedia/commons/7/7f/Cyanobacterial-algal_mat.jpg.

10.6 PROTEROZOIC EON

This eon was followed by Proterozoic which existed around 2500 to 541 million years ago when earlier forms of life like Bacteria, Algae and jellyfish begun emerging. It was the longest eon of the earth's geologic time scale and for the first time, this eon was sub-divided into three era. Starting from the oldest to the youngest, these are the Paleoproterozoic, Mesoproterozoic and Neoproterozoic. The Proterozoic eon covered the time from the production of atmospheric oxygen on the earth to just before the emergence of complex life forms such as the corals.

Box: 10.1

The three periods of Proterozoic this eon were equally significant. Paleoproterozoic era is the longest era of the earth's geological history. It was in this era, that the continents were stabilized. Mesoproterozoic era is the geological era that came into existence around 1,600 to 1000 million years ago. It was the first such period of the earth's history which is supported by a certain form of geological record. This era is characterized by the development of sexual reproduction which made life complex. Communal living started among the multi-cellular beings. The last sub-division was the Neoproterozoic era which evolved from 1000 to around 541 million years ago. This Neoproterozoic era is again classified into three stages, viz. Tonian, Cryogenian and the Ediacaran periods. The earliest fossils of the complex multi-cellular life are seen in the Ediacaran period, however most of these were the unknown animal types.

10.7 PHANEROZOIC EON

The next eon is the Phanerozoic Eon which is the current eon in the geological time span. It spans across 541 million years to the present. It is the eon in which the most abundant forms of animals and plants existed. This eon has three eras, viz. Paleozoic, Mesozoic and the Cenozoic eras, which is in turn divided in periods. This first era, i.e the Paleozoic era is comprised of as many as ten periods, starting from Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous, Paleogene and the Neogene period. Let us have a look at these eras.

10.7.1 Paleozoic Era

This era saw the evolution of lizards, crocodiles, snakes, turtles, mammals and dinosaurs. These living beings breathed oxygen on dry land and proliferated further to display diversity. This era has six periods such as the Cambrian, Ordovician, Silurian, Devonian, Carboniferous and the Permian. Let us look at each of these periods. We shall begin with the Cambrian period.

10.7.1.1 Cambrian period

This era ran from 541 million to 485 million years ago. Evolution of animal bodies took place on a wide scale. Most species of marine animals underwent evolution in this period. The next period was Ordovician Period.

10.7.1.2 Ordovician Period

This period spans from 485 million to 444 million years ago. What is interesting about this period is, many species still prevalent today, such as the coral. Then comes the Silurian Period.

10.7.1.3 Silurian period

This is a period which spans 24.6 million years and had existed around 443.8 million years ago. A significant evolution of the period was the appearance of the jawed fish and the bony fish.

10.7.1.4 Devonian Period

The Devonian period spanned across 60.3 million years. It was in this period that several seed-bearing plants begun to appear. Various types of insects also appeared. The vertebrates or the beings with spinal cords surfaced. Such vertebrates got adapted to walking on land, as their strong pectoral and pelvic fins slowly matured into legs.

10.7.1.5 Carboniferous Period

This period gets its name from the coal, since there were many coal beds formed globally during this time. The stage saw the development of amphibians, mammals and reptiles. Several of their forms like lizards, snakes and crocodiles appeared. Carboniferous Period is divided into two epochs such as the Pennsylvanian and the Mississippian.

10.7.1.6 Permian period

This is the last period of the Paleozoic era. This period was predominated by the reptiles, birds and the mammals. The Permian period is again divided into three epochs, starting from the oldest to youngest such as the Cisuralian, Guadalupian and Lopingian, each of which has its distinctive characters.

Now let us move to the Mesozoic era of the Phanerozoic Eon which is the 2nd era of the Phanerozoic eon.

10.7.2 Mesozoic Era

The Mesozoic Era is also called the Age of Reptiles. It lasted from 252 to 66 millions of years ago. It consisted of three periods, viz. the Triassic, Jurassic and the Cretaceous periods.

10.7.2.1

Triassic Period- this is the first and the shortest period of the Mesozoic Era. Dinosaurs first appeared in the late Triassic period.

10.7.2.2

Jurassic Period- The first birds appeared during the Jurassic period. They evolved from a species of dinosaurs called Theropods. Earliest lizards and marine reptiles were abundantly found.

10.7.2.3

Cretaceous Period- It lasted from about 145 to 66 million years ago. It was the longest geological period of the Phanerozoic Eon. This period saw the appearance of the first flowering plants. New kinds of birds and mammals started surfacing in this period while large many dinosaurs and reptiles died out in this period.

After the Mesozoic era, comes the last era of the Phanerozoic Era, called the Cenozoic Era. This era is again sub-divided into four separate periods. Let's study them very briefly.



Title-Theropod Dinosaurs

Picture Credit: https://static.greatbigcanvas.com/images/singlecanvas_thick_none/stocktrek-images/tyrannosaurus-rex-a-genus-of-coelurosaurian-theropod-dinosaur,2010377.jpg?max=1000

10.7.3 Cenozoic Era

After the Mesozoic era, comes the last era of the Phanerozoic Era, called the Cenozoic Era. This era is again sub-divided into two separate periods. It is the Earth's current geological era, existing for the last 66 million years of earth's history. It is moderately balanced with the fair dominance of mammals, birds and flowering plants, a cooling and a drying climate and the current arrangement of the continents. This era is better known as the Age of Mammals.

This era is further divided into two periods such as:

10.8 TERTIARY PERIOD

This represented the very first geological period in the Cenozoic era that lasted from approximately 66 million to 2.6 million years ago. This period began with the extinction of the non avian dinosaurs, which means any kinds of dinosaurs which are not birds. This period five epochs given below:

10.8.1 The Paleocene Epoch

The Paleocene, or Paleocene, is a geological epoch that lasted from about 66 to 56 million years ago. One major event of the epoch is that a major climatic modification took place. A huge amount of carbon was released into the atmosphere and ocean systems. This resulted in a spike in global temperature.

10.8.2 The Eocene Epoch

This epoch lasted from about 56 to 33.9 years ago. In this epoch greenhouse gases, played a very significant role in controlling the surface temperature, bringing a drastic change in climate.

10.8.3 The Oligocene Epoch

The epoch extended from about 33.9 million to 23 million years before the present. The epoch saw a global climate change. There was an increase in the ice volume and an accompanying decrease in the sea level.

10.8.4 The Miocene Epoch

This epoch is said to have existed 23.03 to 5.333 million years ago. The climate slowly cooled now to enter into ice ages. A major event in this epoch was the first evolution of the apes. By the end of this epoch, a very notable thing happened. The ancestors of the human beings had detached themselves the ancestors of the chimpanzees to follow their own revolutionary journey. There arose a sharp divide between the ancestors of the chimpanzees and that of the humans. The plants, animals and mammals were comparatively modern and were of particular interests to the scientists.

10.8.5 The Pliocene Epoch

The epoch extends from 5.333 million to 2.58 million years ago. It was quite warm in this period. Carbon dioxide levels were almost same as that of today. The end of the epoch saw the formation of ice caps leading to significant climate changes. The most significant development was the appearance of the Hominids or the human ancestors. With this epoch, the Tertiary period comes to an end, giving rise to the Quaternary period, which is the last and the most recent period of the Cenozoic era.

10.9 QUATERNARY PERIOD

The quaternary period **began around 2.6 million years ago and extends up to the present**. It experienced massive climate change that molded the land tremendously. The period has two epochs, viz. the Pleistocene (2.588 million years ago to 11.7 thousand years ago) when the ice age begins and the earliest humans appear. This is followed by the Holocene (11.7 thousand years ago to today) when the ice age ends and human becomes dominant. However, a third epoch, the Anthropocene, has been proposed but is not yet officially recognized by the International Commission on Stratigraphy or the ICS. The term "Late Quaternary" refers to the past 0.5–1.0 million years. Anthropocene is almost synonymous with Holocene. This evolution that we discussed at length to understand the coming of the Anthropocene is presented in the schematic diagram below:

10.10 ANTHROPOCENE

The term "anthropocene" is informally used in scientific contexts. The Geological Society of America entitled its 2011 annual meeting: Archean to Anthropocene: The past is the key to the future. Though it is doubtful to state the original date of the period, but based on the atmospheric evidences, certain presumptions may be made. One may identify its origin with the industrial revolution. Evidences of abundant human impact – such as the growing human influence on land use, ecosystems, biodiversity, species extinction and climate change, especially global change were substantial. Such changes started appearing on the earth with the coming of the men in the Quaternary period of the Cenozoic era of the earth. Scientists argued that the proposed quite some years ago. Based on geologic evidence; this has led other scientists to suggest that "the onset of the Anthropocene should be extended back many thousand years and this would make the Anthropocene essentially synonymous with the current term, Holocene. This evolution that we discussed at length to understand the coming of the Anthropocene is presented in the schematic diagram below:

Geological Time Scale

ERA	PERIOD	EPOCH / AGE	Million Years Ago	EVENTS
CENOZOIC <i>Age of Mammals</i> 65.5 mya – present day	<i>Quaternary</i>	<i>Holocene</i>	<i>Today</i>	Ice Age ends Humans are dominant
		<i>Pleistocene</i>	— 0.01 —	Earliest Humans appear Ice Age begins
	<i>Tertiary</i>	<i>Pliocene</i>	— 1.6 —	Hominids (human ancestors) appear
		<i>Miocene</i>	— 5.3 —	Grass becomes widespread
		<i>Oligocene</i>	— 23.7 —	Mammals are dominant
		<i>Eocene</i>	— 36.6 —	Eocene – Oligocene extinction event
		<i>Paleocene</i>	— 57.8 —	First large mammals appear
			— 65.5 —	
MESOZOIC <i>Age of Reptiles</i> 245 mya – 65.5 mya	<i>Cretaceous</i>	<i>Extinction of Dinosaurs</i>		K-T extinction event Earth looks closer to present-day Flowering plants appear
	<i>Jurassic</i>		— 144 —	First Birds appear Pangaea splits into Laurasia, Gondwana Dinosaurs are dominant
	<i>Triassic</i>	<i>First Dinosaurs</i>	— 208 —	Pangaea cracks First mammals appear Reptiles are dominant
PALEOZOIC 570 mya – 245 mya	<i>Permian</i>	<i>Age of Amphibians</i>	— 245 —	Permian – Triassic extinction event Pangaea forms
	<i>Carboniferous</i>		— 286 —	First reptiles appear First large cartilaginous fishes appear
	<i>Devonian</i>	<i>Age of Fishes</i>	— 360 —	Late Devonian extinction event First land animals appear First amphibians appear
	<i>Silurian</i>		— 408 —	First land plants appear First jawed fishes appear First insects appear
	<i>Ordovician</i>	<i>Age of Invertebrates</i>	— 438 —	Ordovician – Silurian extinction event First vertebrates appear
	<i>Cambrian</i>		— 505 —	End Botomian extinction event First fungi appear Trilobites are dominant
			— 570 —	
PRECAMBRIAN 4600 mya – 570 mya	<i>Proterozoic Eon</i>		— 570 —	First soft-bodied animals appear First multicellular life appear
	<i>Achean Eon</i>		— 2500 —	Photosynthesizing cyanobacteria appear First unicellular life appear
	<i>Hadean Eon</i>	<i>Priscoan Period</i>	— 3800 — 4600	Atmosphere and oceans form Oldest rocks form as Earth cools
Formation of Earth				

. Picture Credit- [geological timeline chart by andyckh-d4p1g1s.jpg \(1600×2062\)](http://geological.timeline.chart.by.andyckh-d4p1g1s.jpg)
(wixmp.com)

10.10.1 The Anthropocene and the global warming

The Anthropocene, as we have seen above is related to various human activities leading to global warming and the successive rounds of climate change. Before moving into global warming, let's learn what it is and why it is considered as the most acute form of climate change for the anthropocene? Global warming can be taken as one of the most alarming issues of the earth which shook the very fabric of our global society. It is not just a matter of climate and science but it is closely entwined with plural aspects of our society like economics, sociology, geo politics, regional politics and of course one's biography. Global warming is precipitated by an accretive increase of the greenhouse gases such as carbon dioxide in the atmospheric level. Causes of global warming may be many, but chief amongst them are burning of fossil fuels and massive deforestation noticed in the cities and its fringes. Trees, as you know flank our surroundings with a good supply of oxygen thus offsetting the excessive flow of carbon dioxide gas. Carbon dioxide as you know warms up the earth and if the concentration of atmospheric carbon dioxide gas reaches beyond the given limit, it has a blistering impact. The emission of carbon dioxide gas has not been quite new, rather it has quite a checkered history which shows the earth has accretively seen a steep rise in the carbon level in its atmosphere. Let us sneak into the history of global warming to see how its cumulative rise was alarming for the society per se and how it eventually contributed to the massive catastrophe that we see today brought to encounter more in the years to come.

10.11 BRIEF HISTORY OF GLOBAL WARMING

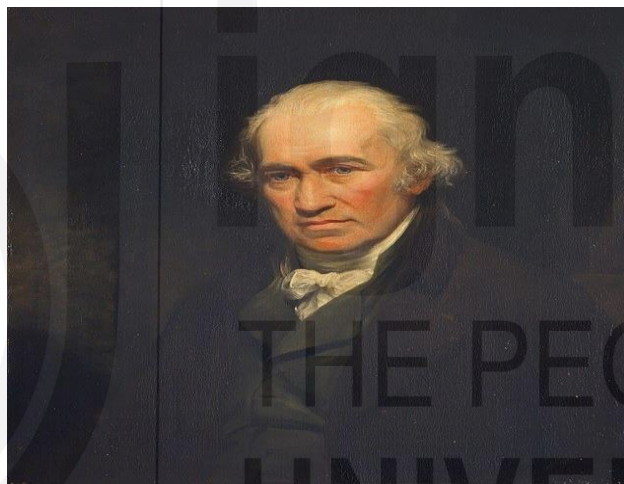
Looking at the timeline of global warming that hit the geological time scale quite with force, we can track down the concurrent events on the world map to trace its history. The factors were many but let us settle on some of the pertinent facts leading to global heating. The factors can be streamlined in the following manner:

10.12 INDUSTRIAL REVOLUTION

Of all the factors contributing to global warming, it was the Industrial Revolution that championed the cause of such an intense warming on the global scale. Europe's industrial revolution began in the eighteenth century Britain when hand-operated looms were converted into machine operated looms and spinning machines. These machines sped up the productivity of textile industries that exported wool and cotton through Europe and British colonies (Streissguth:2011). These textile companies in England contested with their counter parts in colonies. In its drive to boost its own industries, it even levied duties and charges on goods imported from outside. As a result, productivity went up and concomitantly, industrialization was reinforced. Perhaps, what was amiss was the exercise of any environmental ethics or constraint. Wanton use of machines pumped up the emission of

carbon dioxide and lethal gases which played havoc with the city landscapes, blue sky, lowlands and its greenery. We had already seen earlier that natural greenery and its protection was hardly an of concern for the state or for the society. The public sphere maintained a dead silence when it came to shield the environment and its rudiments. Instead, they were more engaged in accomplishing the greatness of the industrial revolution by churning more and more productivity from the machines that the revolution procured for them. All concerns for the green had been silently brushed away.

Of course, the invention of the steam engine was undoubtedly a drastic step towards not only automation but also towards global warming. It was after James Watt invented the steam engines that machines started replacing the bulky works of production. Watt brought about a right change in the ways steam engines operated in early sixteenth century England. However, it was Thomas Newcomen who created the first atmospheric engine for the English, which was also the first fuel-burning engine.



Picture 1: James Watt

Courtesy: <https://commons.wikimedia.org/wiki/File:James-watt-1736-1819-engineer-inventor-of-the-steam-engine.jpg>

back in 1712. The British ironmonger Thomas Newcomen perhaps invented the first widely used steam engine that eventually paved the way for the Industrial Revolution and industrial scale use of coal.

Watt worked upon this basic model to make it more efficient and suitable for the industrial revolution that brought a sea change in goods manufacturing both in Great Britain and the rest of the world. While his invention was genius for it improved the power, efficiency and cost-effectiveness of steam engines, his steam engine plundered the quietness and regale of the clear blue skies. The most suitable fuel for driving steam locomotives was of course coal. Another reason why Watt relied upon coal was because it was less polluting than coal and also it was bountiful in England.

Box:10.2

James Watt (30th January 1736 – 25th August 1819) was a Scottish inventor, mechanical engineer, and chemist. His steam engine in 1776 was fundamental to the changes brought by the Industrial Revolution in both his native Great Britain and the rest of the world. He, being an instrument maker at the University of Glasgow, became increasingly interested in the technology of steam engines.

Do you know he developed the concept of horsepower and also the SI unit of power, watt, which was named after him? He was such a dynamic inventor that the world changed radically with his masterpieces.

10.12.1 Industrialization and Global Warming

As industrialization sped up, so did the world population and eventually the mean temperature of the earth leading to global warming. By 1800, the world population had already surpassed the one billion mark and was showing no mark of receding. Massive destruction of the forest along with wanton burning of fossil fuel had been causing the carbon dioxide level along with other greenhouse gases to rise abnormally in the atmospheric level. These greenhouse gases contributing to global warming were many but chief among them were Methane, carbon dioxide and of course nitrous oxide that radically contributed to an unimaginable increase of the global temperature. Definitely it can be said that the world population had a direct relation with global warming as can be witnessed over the ages across the history. It is very true that human beings have the capacity to damage the climate by reckless emission of greenhouse gases that tamper with basic atmospheric elements. Between 1900 to 2000 it was noted that deposits of carbon dioxide into the atmosphere were aggravated by fifteenfold, while at the same time population increased by almost four fold. It can be argued that the growth of population alone cannot add to the carbon emissions to the level of atmosphere. Growth of population along with abnormal rise in the burning of fossil gases, oil and charcoal can be equally attributed to the rise of temperature. Global warming had been interfused with population increase from the very inception of civilization. Challenges that the world faced from the very beginning were many but one of the toughest one was of course the dangerous situations of industrialisation and the resultant worries of the population rise and global climate change³. Industrialization and a rapid expansion of the population led to the increase in the mean global temperature already recorded in the 1800s, especially in the 1850s.

We have already said that global warming is one of the pressing challenges the world faced today. Industrialisation and urbanization undoubtedly changed the global landscape and downplayed the sanity of the environment. Urban air pollution, waste management and man handling of the environment by its nature as well as reckless planning strategy had yielded more damages

to the environment than one could have ever thought of. The rising sea levels have led to the increased victimization of the people especially living on the low lands and along the coastal plains. All this started from as early as the nineteenth century and went on to become more turbulent with time. Far back in the 1850s, the mean global temperature was roughly 13.7 degree Celsius. The very early half of the nineteenth century strangely had almost no summer seasons. The year 1816 was known as a year without a proper summer. Let us look into the history of the climatic periods to understand the journey towards global warming. It did not begin from the scratch but had an illustrated history which must be studied properly to understand the evolution of warming as a global phenomenon in the current times. The climatic periods had been discussed below to ease your understanding of the emergence of global warming.

10.13 THE LITTLE ICE AGE

England had quite cold winters in 1813 and 1814. Cold winters were quite a prevalent scenario between 1550 and 1850. This was the period known as the Little Ice Age in the history of climate. The Little Ice Age ended in around 1940 succeeded by a periodic chain of climate warming that had started in the middle of the nineteenth century. Again after 1940, we find that global average temperatures snook down a little till it rose quite sharply again after 1976. The Little Ice Age could be referred to a period of extensive cooling that came immediately after the Medieval Warm period. The term was introduced into scientific discourse by Francois E. Matthes in 1939.

Check Your Progress 1

- 1) Industrial revolution in Europe began in
- 2) Rise in the burning of and charcoal can be equally attributed to the rise of temperature.
- 3) How is the industrial revolution related to global warming?

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The NASA Earth Observatory noted that there were three particularly cold intervals such as the one starting from 1650, another originated in 1770 and the last sneaked in 1850. All of these spans were intermittent with spans of slight warming. There were various reasons attributed to these cooling phases but the socially significant one was the de. Perhaps, Black Death was the deadliest of the pandemics to have ever been recorded in human history. It

resulted into millions of deaths in Eurasia and North Africa, especially in Europe from 1347 to 1351. The American era of controlled diseases came to an end with the arrival of the Europeans. European diseases soon killed billions of native American populations not initially exposed to such diseases introduced by the European colonizers. All this reduced the population size such that the weather remained serene and cool. There was a modest amount of cooling of the Northern Hemisphere during this phase. It was not characterized by a large presence of glaciers, instead the weather remained fairly chilled. The little Ice age came to an end in the latter half of the 19th century or early in the 20th century.

10.14 MEDIEVAL WARM PERIOD

Immediately before the Little Ice Age, the earth was quite warm. This was quite evident by the fact that England in those days was one of the major producers of high quality wine. It had grape vineyards spread across the north of the country. That was the time of the Medieval Warm period after which the increasing sea ice cut off the English trading routes with Scandinavia (Allaby, 2009). In the 13th century, the farms in England had to be abandoned owing to the ice age, whereas in the Medieval warm period, weather was quite benign.

This is in fact, the most debatable of the climatic periods because many scientists believed that the period did not actually exist on the earth. Nevertheless, historical accounts confirm the global presence of the Medieval Warm Period from about 900 AD to 1300 AD. Its impact was heavily felt in Europe where harvests were plenty, urbanization speeded up and the population nearly doubled. In other parts of the world, dry spells were evident, especially in the southwestern United States and Alaska, which faced droughts⁸. It was assumed that since 900 AD, the northern hemisphere comprising almost 90 percent of the world's population and most of the world's land, had been going through the warmest span in this phase of the Medieval Warm Period. This was, however, not considered a phenomenon of global warming because the degree of warmth varied across time zones and regions. Therefore, though different parts of the world experienced different blankets of warmth, Medieval Warm period could not possibly be taken as a universal epiphenomenon of global warming. However, the phase was considered the warmest phases in the Roman Warm Period.

10.14 ROMAN WARM PERIOD

This was the period of unusually warm weather in Europe and the North Atlantic that spanned across 250 BC to AD 400. One evidence of such a climate is well supported by the fact that date trees could often grow in Greece if they were planted, but they could not bear fruits here. It could be said that the Greek climate then was almost the same as it had been around AD 2000. The phrase “Roman Warm period” appeared for the first time in a

1995 doctoral thesis. The thesis suggested that though this warm period was partly responsible for advances in civilization, it had dangerous drawbacks as well. The period little discussed before had been made popular by an article published in *Nature* in 1999. However, recent studies on a larger data set had confirmed the prevalence of the “Roman Warm Period” along with other pre-industrial climate zones such as “Little Ice Age” or the “Medieval Warm Period” which we had already discussed above. Perhaps, this must be stressed that all of the climatic periods that we had discussed above were regional occurrences and could not be attributed with a global under-current. As we moved in the 20th century, especially after the 1950s, warming could be accorded global incidence with increase in carbon dioxide becoming a permanently consistent feature across the globe. Let us now move into the historical roots of Global Warming.

10.16 HISTORICAL ROOTS OF GLOBAL WARMING IN THE ANTHROPOCENE

Far back in 1827, the French mathematician and physicist Jean-Baptiste Joseph Fourier (1763–1830) had written an article in the journal, *Mémoires de l'Académie Royale des Sciences de l'Institut de France* (Memoirs of the Royal Academy of Sciences of the Institute of France) in which he wrote extensively on the planetary temperatures. He discussed not just temperatures of earth but of other planets as well. The arguments and the evidence were further fortified by Claude Pouillet in 1828. On the other hand, John Tyndall was the first scientist to measure the absorption and emission of various gases and vapours of which he showed carbon dioxide had a very significant impact. Tyndall inferred that while oxygen, nitrogen, and hydrogen are completely transparent to infrared radiation, other gases, especially water vapor, carbon dioxide, and ozone, are opaque. This was a significant step towards the understanding of the concept of Global Warming.

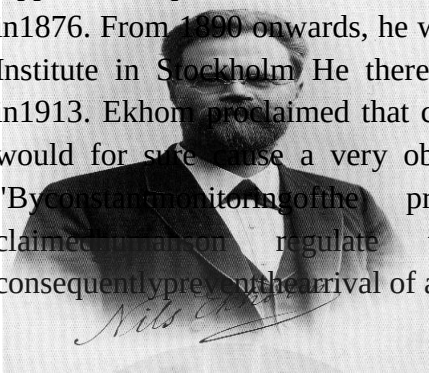
The concept was however, studied more carefully and with greater precision by Svante Arrhenius in 1896. He possibly was the first scientist to have made the first quantitative prediction of global warming. He spelled out that increase of atmospheric carbon dioxide was the instrumental cause behind global warming. He concluded that if one doubles the concentrated level of carbon dioxide, it would by default increase the mean annual temperature at the equator by 8.91°F.

This is quite strange that though these scientists researched a lot on global warming, none of them had coined the term, which perhaps was first used by Nils Gustaf Ekholm in 1901.

Another milestone in the development of the theory of global warming was Mikhail Ivanovich Budyko(1920-2001). He was a Belorussian climatologist who modified the angle from which the scientists were currently researching

Box: 3 Nils Gustaf Ekholm

Nils Gustaf Ekholm was a Swedish meteorologist who successfully led a Swedish geophysical expedition to Spitsbergen in 1882–1883. Ekholm was born in Smedjebacken in Dalarna, son of a pharmacist. He enrolled at the University of Uppsala in September 1869, and graduated with a Candidate of Philosophy degree in 1876. From 1890 onwards, he worked as an assistant at the Swedish Meteorological Institute in Stockholm. He thereafter became professor and head of the institute in 1913. Ekholm proclaimed that concentration of the atmospheric carbon dioxide gas would for sure cause a very obvious rise of the mean temperature of the Earth. "By constant monitoring of the production and consumption of CO₂, he claimed, man can regulate the future climate of the Earth and consequently prevent the arrival of another new ice age (Fleming 1998).



Picture: Nils Gustaf Ekholm

climate. Initially climatologists would work by collating all the data they had gathered from across the globe. It was Budyko who studied the balance of radiation on the earth. Climatology as a discipline was thus studied in a more objective, quantified and precise manner. In 1972 Budyko countered the claim, gaining ground among the scientists that the global climate was slowly entering a cooler phase. It was he who made the forecast that the increasing consumption of fossil fuels by the domestic and industrial units were pushing us towards an incurrence of atmospheric carbon dioxide gas, the propelling factor for global warming. Many scientists had now come to believe that the piling of greenhouse gases would eventually lead to a global temperature rise in years to come.

10.17 THE TREND CONTINUES

India continues the trend from quite some time now and it irreverently refuses to slow down its heat and humid, now that it is continuing for so long. Carrying forward the trend right from 2018, extreme weather cases had been rampant across the country in 2019. In early March, the southern states of Tamil Nadu, Andhra Pradesh and Kerala had experienced scorching heat. The heatwaves took four innocent lives in the state of Kerala. Not just the south, heat waves hadn't spared the states of Maharashtra, Gujarat and Orissa as well. The extreme weather conditions had become now a regular character of the Indian states. Along with a surge in temperatures, recurrent cyclones like Fani and Amphan had devastated the states and caused irreparable damage to its living. People reeling under the double blows of pauperization and spreading Novel Corona virus infection are finding it extremely difficult

to sort their lives. While Super cyclone 'Fani' had been ruffling the lives of the people along the east coast, the country as a whole had been gasping to break free from the extreme spells of heat waves. By the first week of June in the last year, the country underwent 73 spells of heat waves, of which 11 were horrible. The heat waves ran across 22 state and union territories recording the largest death counts in Bihar where over 200 people died. Cyclones like Hikaa, Kyarr and Maha in the Arabian Sea and cyclone Bulbul in the Bay of Bengal came in quick proximity in October and November 2019. Reports suggest that there had been a whopping number of cyclones in 2019, almost five whereas 2018 received another six tremendous cyclones. The last time we had more than five cyclones in consecutive years was 1976-77 when more than five cyclones were formed according to the IMD data (Sangomla:2020:111-112).

It is quite evident that India is warming much faster compared to the rest of the world. Even in 2016, the average temperature was found to be 1.2 degrees celsius higher than the average temperature recorded between 1901 and 1930. This was a dire contrast to the pledge that India took in 2015 on the condition that it would never allow the average temperatures to rise beyond 1.5 degrees celsius above pre-industrial levels. The situation continues to remain the same without the extent of warming showing any signs of recession. The Intergovernmental Panel on Climate Change (IPCC) is said to represent an urgent and a looming threat to the human societies and our planet as a whole. Keeping this in mind, most of the countries around the globe resolved to adopt the Paris Agreement in December, 2015. The idea behind the agreement was to restrict temperature rise across the globe to 1.5 degree celsius. These countries therefore, asked for the mediation of the United Nations Framework Convention on climate change (UNFCCC) in order to invite the IPCC to get an overall perspective of global warming. The first document of UNFCCC or the United Nations Framework Convention on Climate Change capped an upper limit for global warming of 1.5 degree celsius in the Cancun Agreement that was adopted at the sixteenth COP in 2010. Allen et al., "Framing and Context "in Global Warming of 1.5 C: An IPCC Special Report on the Impacts of Global Warming of 1.5 C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty".

10.18 CONCLUSION

There has been a continuous discourse, as you will find on the issue of climate change and the anthropocene. As you will see, this has got to do with the continuing phase of political actions, policies, trends, controversies and activist efforts following the concerns of global warming. It will be interesting for you to note that climate change emerged as a political issue in the 1970s, when it was first understood that institutional actions must be undertaken to save the earth from the ensuing danger. Haibach and Schneider, "The Politics of

Climate Change: Review and Future Challenges.” This definitely could be marked as a milestone in the history of global warming for it initiated the co-operation and the erection of an international decorum to address the issues of global warming. Such an institutional body was of course the UNFCCC which we already mentioned before. It had over the ages, been publicly recognized as an international agreement that flourished to address the difficult challenges cropped up before us. We can observe that in the late 20th and the 21st century, the policies for global warming saw a sea change. They gradually shifted from withering away these verity of climate change towards taking for granted the inevitable phenomenon of such warming. The policies thereby were seen adapting to such an extreme but inevitable climate change Ford, “Emerging Trends in Climate Change Policy: The Role of Adaptation.”).

Individual actions directed towards climate change took an important shape and activism became an initiator of big changes. Since the early 1970s, climate activism was slowly gaining ground to address the varied range of global climate discrepancies. In 1970, Earth Day was the turning point in the history of climate change policies for it was invoked for the protection of all life on the earth. In 1970, a large scale environmental movement, probably the first of its type, the Earth Day was celebrated. It was around the same time

Box :4 Greta Thunberg

Greta Thunberg is a 17 year old Swedish environmental activist who got international fame for her constant effort to showcase the fatal effects of global warming and climate change over the earth. At 15, she started demonstrating outside the Swedish parliament in her school uniform to press for stricter regulations against global warming. This was slowly followed by other students across the world. In this way they even organized a massive school climate strike movement under the name of,

Fridays for Future. It is interesting to note that in 2019, there were protests across the world engaging over a million students to decry global warming.

Picture

http://commons.wikimedia.org/wiki/File:Greta_Thunberg_in_Global_Strike_for_Climate_2019_-2.jpg



that the Friends of Earth Organization was formed Dietz and Garrelts, *Routledge Handbook of the Climate Change Movement*. Several demonstrations and sit-ins had been organized to protest the spiraling effects of global warming and the trend refuses to disperse. The movement of this kind was also noticed in 2019 when young people organized a global climate strike to demonstrate against the state's negligence towards a problem of this magnitude. These are often known as the school strike for climate which is named differently in different parts of the world. Such names include Fridays for Future, Youth for Climate, Climate Strike or Youth Strike for climate. These are interestingly, international movements spearheaded by the school students who skip their Friday classes to stage protests against the callous political leaders. They urge the leaders to take prompt actions against global warming and fossil fuel burning. The movement of this kind was perhaps popularized by a Swedish school girl, Greta Thunberg.

Check Your Progress 2

- 1) was the first scientist to measure the absorption and emission of various gases and vapours of which he showed carbon dioxide had a very significant impact.
- 2) was the first scientist to have made the first quantitative prediction of global warming.
- 3) Who is Nils Gustaf Ekholm? What is his role in arresting global warming?
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10.19 LET US SUM UP

We conclude the section by saying that as far as policies for climate action are concerned, we are on the right track. There are several limitations which we face, especially in safeguarding the rights of the poor and the marginalized who are at the heart of this sustainability issue, but we continue to fight against all odds. Protecting the environment from all the possible dangers and to sustain our ecological growth remains a pertinent issue as we try to preserve the human civilization and its environment in the anthropocene.

We see that we started with a general introduction of the geological time-scale to understand the evolution of the anthropocene. We saw the impacts of climate change and went on to conceptualise global warming and tried unearthing its historical roots. We spoke of industrialisation and tried finding the nexus between industrialisation and global warming and its consequences for the anthropocene.

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SPECIMEN ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) 18th century
- 2) Fossil fuels
- 3) As industrialization sped up, so did the world population and eventually

the mean temperature of the earth leading to global warming. By 1800, the world population had already surpassed the one billion mark and was showing no mark of receding. Massive destruction of the forest along with wanton burning of fossil fuel had been causing the carbon dioxide level along with other green house gases to rise abnormally in the atmospheric level. These Green house gases contributing to global warming were many but chief among them were Methane, carbon dioxide and of course nitrous oxide that radically contributed to an unimaginable increase of the global temperature.

Check Your Progress 2

- 1) John Tyndall
- 2) Svante Arrhenius
- 3) Nils Gustaf Ekholm was a Swedish meteorologist who successfully led a Swedish geophysical expedition to Spitsbergen in 1882–1883. Ekholm was born in Smedjebacken in Dalarna, son of a pharmacist. He enrolled at the University of Uppsala in September 1869, and graduated with a Candidate of Philosophy degree in 1876. From 1890 onwards, he worked as an assistant at the Swedish Meteorological Institute in Stockholm. He thereafter became professor and head of the institute in 1913. Ekholm proclaimed that concentration of the atmospheric carbon dioxide gas would for sure cause a very obvious rise of the mean temperature of the Earth. "By constant monitoring of the production and consumption of CO₂, he claimed human can regulate the future climate of the Earth and consequently prevent the arrival of another new ice age (Fleming 1998)

UNIT 11 POLLUTION•

Environmental
Sociology: Nature
and Scope

Structure

- 11.0 Objectives
- 11.1 Introduction
- 11.2 What is pollution?
- 11.3 Air Pollution
- 11.4 Water Pollution
 - 11.4.1 Water pollution in the Lower Ganga River: An illustration
- 11.5 Land Pollution
- 11.6 Conclusion
- 11.7 Let Us Sum Up
- 11.8 References
- 11.9 Specimen Answers to Check Your Progress

11.0 OBJECTIVES

After reading this unit, you should be able to:

- Explain the concept of pollution;
- Enquire into the history of pollution and its early evolution;
- Learn about its different forms;
- Investigate the social implications of pollution in the present scenario; and
- Evaluate the policy regulations framed to arrest pollution and chalk the way ahead.

11.1 INTRODUCTION

In the last unit we discussed the extension of the geological time span and the evolution of the anthropocene. In this unit, we shall see how the coming of the anthropocene and the arrival of the man had created conditions for pollution on the earth. However, problems pertaining to air pollution are as old as the mighty planet itself. Volcanos, fumaroles, natural fires and desert dust all must have together constituted the whole body of the air pollution. Perhaps, with the arrival of the early men on the planet, the problems of pollution became more grave and drastic. Human beings first emitted air pollutants when they discovered fire. The burning of the wood emitted air pollutants when they burnt wood and cleared the land. It will be interesting for you to note that air pollution in ancient Greece and Rome was likely to be quite severe because of metal production and wood burning. From 500 BC to

300 AD, lead concentrations in Greenland ice cores were around four times their natural values. These concentrations were solely because of the Greek and Roman lead and silver mining and smelting operations. Lead emissions, as we will see, in ancient Greece occurred mainly because of the production of the silver coins. This is because of the fact that each gram of silver produced 300 gm of lead by-product. Lead emissions rose tremendously in the Roman Empire during the manufacture of cookware, pipes, face powders and paints. Romans mined huge quantities of lead and copper ores that were smelted in open fires that spread pollutants over short and long distances.

However, after the fall of the Roman Empire, pollution owing to lead smelting came down substantively. But, again with the discovery of the lead and silver mines in Germany, Austria, Hungary and parts of central and Eastern Europe, such a kind of air pollution re-appeared. The discovery of these mines led lead pollution to gradually shift from southern to central Europe. The conditions deteriorated with the gradual increase in wood burning which went on relentlessly across all the population centres of the world. Besides, other factors like quicklime production, discovery of the coal and steam engine added to the rising levels of urban air pollution. Quicklime was produced by the heating of limestone in kilns and furnaces as the primary source of fuel. Quicklime was mixed with water to produce cement, used extensively as the building material, with the rise in urbanisation. However, between the thirteenth and eighteenth centuries, the use of charcoal increased in England. Coal was not merely used in lime kilns, but also alongside in glass furnaces, breweries, boilers and home heating. (Jacobson: 74). Smoke was increasingly becoming a big problem for London and all over Europe.

After the eighteenth century, the air quality deteriorated further in Great Britain owing to the invention of the steam engine. The Industrial Revolution that initiated between 1760 and 1880, the use of coal was triggered up many fold times. In the nineteenth century, the steam engine was used not just in Great Britain but also in other countries, contributing to the volume of the air pollution. Between 1800 and 1900, coal combustion in the factories of the United States, Belgium, Germany, Russia, Japan, India, South Africa and Australia rose up dramatically and with this the extent of air pollution escalated like never before. However, it is not just air pollution which catches our fancy, but due importance must be given to the other forms of pollution as well for the damage they incur. Therefore, apart from air, land and water pollution are equally important in assessing the gravity of pollution and the impact it leaves on the earth. We shall be learning in detail these three major types of pollution and the implications it carry for the mother earth. Come, let's explore it.

11.2 WHAT IS POLLUTION?

Pollution is the introduction of the contaminants into the natural environment that inflicts severe damage to the environment. The components of pollution,

usually called pollutants may either be foreign substances or energies or the naturally occurring contaminants. A pollutant is a chemical out of place. Oil enclosed within a tanker is not a pollutant, but if the same oil spills in the sea, it definitely will act as a pollutant. A small oil spill may not be that disastrous but a bigger one may be dangerous. Almost any substance, be it synthetic or natural, may pollute the environment, but obviously, it is the synthetic and other industrial chemical substances that are of greater concern. Therefore, the addition of any substance to the environment, be it solid, liquid or gas, or even any form of energy, such as heat, sound or radioactivity, in a detrimental way, may be termed pollution. The major forms of pollution, are the air pollution, water pollution and of course the land pollution. Modern society, however, is also concerned with distinct types of pollutants like noise pollution, light pollution and plastic pollution (source *Britannica*, <https://www.britannica.com/science/pollution-environment>).

11.3 AIR POLLUTION

Air pollution has been a major and an increasing risk factor for ill health in India. The rapid rate of urbanisation and industrial development, have all impacted the urban air quality, especially due to the vehicular and industrial emissions. Over two-thirds of the rural populations use biomass fuels such as wood, dung or coal for their cooking and heating activities, leading to the deterioration of the quality of air. Long term exposure to air pollutants lead to a broad range of respiratory and cardio-vascular diseases, may be fatal for the people.

In India, the major metropolis and industrial towns, have a very high concentration of particulate matter and therefore has a higher risk of exposure towards air pollution. The same is also true for the 'smart cities' developed by the government. These cities serve as the industrial and commercial hub and therefore act as the site for severe pollution. The same may also be true for the Indo-Gangetic plain where we find, a combination of different sorts of pollution. These include urban and industrial pollution, agricultural and cooking fires and temperature inversion. In such a plain, especially during the winter, owing to temperature inversion, cold air settles down and traps pollution near the surface. This situation is extremely hazardous to human health. According to the Health Effects Institute (HEI 2019) Report, particulate matter pollution was the third most important cause of death in 2017 and this rate was considered the highest in India.

The rising trends in population growth and the consequent effects on air quality are clearly evident in the Indian scenario. For instance, as we have noted above, the megacities of Delhi, Mumbai and Kolkata all together hold a population exceeding 46 million (Gurjar, Ravindra and Nagpure, 2016). Over the years, it is interesting to note that there had been a massive scale expansion in industries, population density, anthropogenic activities and the massive use of automobiles which had degraded the quality of air in India

(Gurjar and Lelieveld 2005). Alongwith it, in the preceding decades, the emissions of the greenhouse gas as well as other gases owing to anthropogenic activities had been very high. This played havoc with the environment and the health of the people. The impact had been maddening because the sources of air pollution had been numerous and increasing even more with time. However, the sources of air pollution are generally classified into seven major sectors, such as transportation, industries, agriculture, power, waste treatment, biomass burning, residential, and construction and demolition waste. Since these points of dissemination are multiple, air pollution is rampant in our country and with burgeoning population and faulty regulations, it is quite difficult to control air pollution altogether. Now, let us come to the next most common type of pollution and this is land pollution.

11.4 WATER POLLUTION

Though water plays a very vital part in our daily lives, it still remains one of the most abused resources on the planet. Water is a very kind resource because it can tolerate pollutants up to a considerable limit without compromising with the quality of the water. Only when the water fails to absorb the pollutants, beyond a certain limit and its regenerative capacity fails, only then water pollution sets in. water pollution may be defined as any kind of physical or chemical change that may have a wrong impact on the living organisms.

The causes of water pollution can be many but chief amongst them are agricultural activities, industry, mining, disposal of human waste, population growth, urbanisation, climate change etc. agriculture is the most common cause of water pollution when pesticide contamination leads to the increased salinity and nutrient enrichment of the water. Often effluents of organic and inorganic pollutants from various industrial and other allied activities get added to the water, causing its severe degradation. These polluting substances for water are many but noteworthy ones are organic matters, minerals, sediments of solid wastes, suspended solids, bacteria, toxic chemicals, acids and alkali. Other toxic chemicals such as arsenic and fluoride can get dissolved from the soil or percolate from the rock layers. Sometimes direct contamination of the water bodies may also happen from hazardous wastes or the industrial sites.

Box 11.1

Marine pollution is one of the worst forms of pollution that occurs when substances used or spread by humans, such as industrial, agricultural and residential waste, particles, noise, excess carbon dioxide or invasive organisms enter the ocean and cause harmful effects out there. Most pollutants come from the land, the rivers, sewage or the atmosphere. Of course, we must talk of ship pollutions which contaminate the waterways and oceans in many different ways. The most devastating can be the oil spills which can prove to very toxic to the marine life. Do you know, not just oil, even the cargo residues discharged from the bulk carriers in the oceans can be equally dangerous. These bulk carriers are the merchant ships designed to transport unpackaged bulk cargo such as grains, coal, ore, steel and cement. These ships are sometimes known to deliberately discharge illegal waste material, violating the strong foreign and domestic regulations condemning such acts.



Marine Pollution

Picture Credit: [Ocean Water Pollution - Bing images](#)

11.4.1 Water Pollution in The Lower Ganga River: An Illustration

The holy lower Ganges river that flows across the country, has one of the most polluted stretches. It however, receives less attention than the famous Ghats of the Varanasi and the toxic tanneries of Kanpur. Over 7 billion litres of the raw sewerage are dumped into this river almost every day from as many as towns along its tributary and perhaps, half of this waste comes from West Bengal. Though West Bengal state produces a large quantum of the

waste water, only a portion of it gets treated. The rest of the untreated waste water flows down relentlessly. Untreated sewerage is the most gruelling problem for the river, especially the lower reaches of the Ganga. It contributes the most to the water pollution in Bengal while there are other factors as well such as industrial heavy metals, pesticides from agriculture, sold waste, human bodies, wastes and animal carcasses. This has impacted in fact the whole river and therefore the comparatively clean water of the Upper Ganga, such as the holy pilgrim sites at Rishikesh and Haridwar could not escape the evils of pollution. To minimise the impact of water pollution, Bengal closed down many of its vital but heavily polluting industries. Walking up the Bhagirathi-Hooghly stretch, we can see how the cottage industries, brick kilns and coal fired power stations release gallons of waste into the water. Irrespective of the measures taken, water pollution is refusing to step down.

The Ganga Action plan launched in 1986 under the leadership of Rajiv Gandhi aimed at freeing the river from all sorts of pollution. The motive was to divert away all the drains spilling waste water into the river to the sewerage treatment plants. The waste water will be treated and re-cycled, but despite all the concerted efforts, water pollution has remained out of our bounds. It has continued to plague the people of the state with its adverse impacts. There is still another very important form of pollution, the land pollution. Let's see how it affects our environment and leaves behind very sharp scars that refuse to ebb out with time.

Check your Progress 1

1) What is pollution?

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2) What are the causes of water pollution?

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11.5 LAND POLLUTION

Land pollution is yet another source of pollution in the environment which degrades or destroys the earth's surface and the soil, directly or indirectly. The deterioration of the earth's land surfaces, at and below ground level, is usually termed as the land pollution. With the rise in anthropogenic activities which have shot up in the name of development, the land is getting abused in ways more than one. The accumulation of the solid and liquid waste materials that contaminate the groundwater and soil, largely effects our environment. These waste materials are often referred as the municipal solid waste, which may include both the hazardous and non-hazardous waste. When waste gets deposited onto an area of land, it is the permeability of the soil formations below the waste, which can either increase or reduce the risks of land pollution. The higher the permeability or transmissibility of the soil, more likely for the land pollution to happen.

It was only after the mid-twentieth century that the solid wastes were collected carefully, keeping the environmental concerns in mind. Before that, the land wastes were left open on the ground with no one to cater them. They were literally piled up in open dumps which became the heavens for rodents, rats, mosquitoes and microbes. It let out foul smell and spread out infections in the air. Though the latter half of the twentieth century saw the rising concern for waste management tactics, yet the situations hadn't improved much by then.

The causes of land pollution are many but some noted factors are of course, mining, agricultural activities, litter, urbanisation and construction activities etc. One significant way in which lands get polluted are by bio-solids or what is usually known as the sewage sludge. This may be defined as the residual solids generated from the processing of domestic wastewater. In most of the cases, this product may be used benevolently. However, domestic waste water may consist of wastes in the form of liquid generated from residences, businesses and institutions. Any of the matter that move inside the municipal waste water collection system, finally get transformed into bio-solids.

11.6 CONCLUSION

There are other kinds of pollution worth mentioning like noise pollution, plastic pollution, radio-active pollution, thermal pollution, but basically the primary types of pollutions are the ones described above. We have tried various means to arrest pollution. Pollution control is a term extensively used in environmental management. It means the judicious control of emissions and effluents into air, water or soil. Without pollution control, the waste products from overconsumption, heating, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will contaminate the environment. In the hierarchy of

controls, pollution prevention and waste minimisation are definitely more desirable than pollution control.

Check Your Progress 2

- 1) What are the different forms of pollution?

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- 2) What are the factors responsible for land pollution.

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11.7 LET US SUM UP

Pollution is the introduction of contaminants into our natural environment that cause harmful change. Pollution can take several forms of chemical substances or energy, such as noise, heat, or light. Pollutants or the components of pollution, can be either foreign substances/energies or naturally occurring contaminants polluting the environment. Major forms of pollution include air pollution, light pollution, litter, noise pollution, plastic pollution, soil contamination, radioactive contamination, thermal pollution, visual pollution, and water pollution. Pollution control mechanisms though are getting evolved with time, pollution still remains beyond control of our society at large.

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11.9 SPECIMEN ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) Pollution is the introduction of the contaminants into the natural environment that inflicts severe damage to the environment. The components of pollution, usually called pollutants may either be foreign substances or energies or the naturally occurring contaminants. A pollutant is a chemical out of place. Oil enclosed within a tanker is not a pollutant, but if the same oil spills in the sea, it definitely will act as a pollutant. A small oil spill may not be that disastrous but a bigger one may be dangerous. Almost any substance, be it synthetic or natural, may

pollute the environment, but obviously, it is the synthetic and other industrial chemical substances that are of greater concern.

- 2) The causes of water pollution can be many but chief amongst them are agricultural activities, industry, mining, disposal of human waste, population growth, urbanisation, climate change etc. agriculture is the most common cause of water pollution when pesticide contamination leads to the increased salinity and nutrient enrichment of the water. Often effluents of organic and inorganic pollutants from various industrial and other allied activities get added to the water, causing its severe degradation. These polluting substances for water are many but noteworthy ones are organic matters, minerals, sediments of solid wastes, suspended solids, bacteria, toxic chemicals, acids and alkali. Other toxic chemicals such as arsenic and fluoride can get dissolved from the soil or percolate from the rock layers. Sometimes direct contamination of the water bodies may also happen from hazardous wastes or the industrial sites.

Check Your Progress 2

- 1) Major forms of pollution include air pollution, light pollution, noise pollution, plastic pollution, soil contamination, radioactive contamination, thermal pollution, visual pollution, and water pollution.
- 2) There many factors responsible for land pollution but the chief ones are; mining, agricultural activities, litter, urbanisation and construction activities etc. One significant way in which lands get polluted are by bio-solids or what is usually known as the sewage sludge. This may be defined as the residual solids generated from the processing of domestic wastewater. In most of the cases, this product may be used benevolently. However, domestic waste water may consist of wastes in the form of liquid generated from residences, businesses and institutions. Any of the matter that move inside the municipal waste water collection system, finally get transformed into bio-solids.

UNIT 12 ENVIRONMENTAL POLICY IN INDIA•

Structure

12.0 Objectives

12.1 Introduction

12.2 The Global Warming Policies in the World In The 20th Century

12.3 Global Warming Programmes in India: A Review

12.4 Changing Lenses of Global Greenhouse Gas Emissions in the State

- 12.5 Indian Climatic Negotiations, Resolutions And Environmental Colonialism
- 12.6 Ecology, Sustainable Development and Climate Change
- 12.7 The Indian Model of Sustainable Development
- 12.8 Conclusion
- 12.9 Let Us Sum Up
- 12.10 References
- 12.11 Specimen Answers to Check Your Progress

12.0 OBJECTIVES

After reading this unit, you should be able to:

- understand the changing focus of the environmental policies;
- conceptualize the idea of Sustainable Development; and
- discuss the policies and the programmes of the State and the World at large.

12.1 INTRODUCTION

In the preceding units of the module, you have made an idea of the shape of the environmental canopy shielding us, it is time for us to quickly review the plans and programmes on the fore and to charter the future course of actions to further the green campaign in the country. Let us therefore, very promptly move in to the discussion for to day that very justifiably talks about global warming, one of the worst outcomes of climate change in the country as well as the policies undertaken to achieve the much sought after goals of sustainable development in the country. Come, let us dive deeper in our endeavour for a moment.

Before moving into global warming, let's learn what it is and why it is considered a grave concern for human civilization? Global warming can be taken as one of the most alarming issues of the century which shook the very fabric of our global society. It is not just a matter of climate and science but it is closely entwined with plural aspects of our society like economics, sociology, geo-politics, regional politics and of course one's biography. Global warming is precipitated by an accretive increase of the greenhouse gases such as carbon dioxide in the atmospheric level. Causes of global warming may be many, but chief amongst them are burning of fossil fuels and massive deforestation noticed in the cities and its fringes. Trees, as you know flank our surroundings with a good supply of oxygen thus offsetting the excessive flow of carbon dioxide gas. Carbon dioxide as you know warms up the earth and if the concentration of atmospheric carbon dioxide gas reaches beyond the given limit, it has a blistering impact. The emission of carbon dioxide gas has not been quite new, rather it has quite a checkered

history which shows the earth has made a steep rise in the carbon level in its atmosphere. Let us see what measures our country too to counter these grave situations. We shall see the policies and programmes that the society adopted to counter this crisis of ever increasing global warming.

12.2 THE GLOBAL WARMING POLICIES IN THE WORLD IN THE 20TH CENTURY

In the mid-1970s, climate change took a sharp turn from being just a scientific idea to becoming a socio-political issue. The formalized discussions on climate change began in June 1973 with the United Nations Conference on the Human Environment (UNCHE) in Stockholm (Haibach 2013). It was held in Stockholm, Sweden from June 5-16, 1972. It was perhaps the United Nations (UN) first major conference on international environmental matters that could be taken as a turning point in the development of environmental politics on an international forum. The Conference proclaimed that the mankind's whole hearted focus should be on establishing a peacefully habitable and an extremely just planet (United Nations 1973). The first World Climate Conference that was held in 1979 tried framing climate change on the wider political horizon, giving rise to similar meetings in 1985, 1987 and 1988. Such conferences are regularly organized by the World Meteorological meetings conducted by the World Meteorological Organisation or better known as WMO. These meetings deliberate about global climatic issues especially global warming in alliance with other climate researches as (Gupta: 2010).

It was in 1985 that the Advisory Group on Green Houses Gas, better known as AGGG was formed to draft international policy recommendations involving climate change with a special emphasis on global warming (Gupta 2010). The greatest importance accorded to the carbon emissions was probably the Toronto Conference in 1988 which compared the threats evoked by global warming almost to that of a nuclear war and warned of its lethality. Three years later, the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) collaborated to form the Intergovernmental Panel on Climate Change in 1988, which we have already discussed before. Some of the meetings worth mentioning in this context were the Francophone Summit in Dakar, the Small Island States meeting, the G7 meeting, the Commonwealth Summit and of course the Non-aligned meeting which voiced climate change as a global political issue of grave importance. In 1992, the United Nations Conference on Environment and Development (UNCED) was organized in Rio de Janeiro that penned the Rio Declaration on Environment and Development. It was at the same conference that the United Nations Framework Convention on Climate Change (UNFCCC) was initiated. It was UNFCCC which conceptualized Common but Differentiated Responsibilities (CBDR). CBDR proclaimed that all the states across the world would be entitled to shared obligation to heal

the injuries incurred on the earth owing to its environmental blows. However it denied equal responsibilities of all states in matters pertaining to environmental upkeep. The Earth Summit bifurcated the responsibilities between developed and developing countries indicating the disparity of economic prosperity between developed and developing countries. The Summit led upon the collusion between industrialization and global warming. The CBDR principle assumed that industrialization was a major stakeholder in global warming and therefore industrialized countries must remain accountable for it (Cullet 1999). States mutually agreed that since developed countries degraded the environment more, they should share greater responsibility than the developing ones. In accordance with this recommendation, the first Conference of the Parties (COP) was held in Berlin in 1995.

The COP is however, the apex decision making body of the convention. All states that are parties to the convention act as representatives at the COP. They assess the implementations of the policies and other legal dispensations adopted by the COP. This is done to boost up the effective functioning of the body. Therefore COP meets every year by rotating among the five recognized United Nations regions—that is, Africa, Asia, Latin America and the Caribbean, Central and Eastern Europe and Western Europe and others. In 1997, the third COP passed the Kyoto Protocol which constituted the first legally compelling green house gas reduction guidelines. These were some of the ground breaking policies which played an instrumental role in changing the perspectives towards climate change in general and global warming in particular across the world. Let us look at some of such policies in the national context to map the climate change policy in India.

12.3 GLOBAL WARMING PROGRAMMES IN INDIA: A REVIEW

Climate change became a substantive issue to ponder upon for the first time among Indian political scientists in the late 1980s, when Indian government was taking its plunge into the market economy to boost its economy against its social evils (Thaker 2014). As we know climate change as an issue is quite an intricate one, involving a power game among the developed and developing nations, thus producing a very complicated international policy turf from where arguments are generated. There is an obvious uncertainty surrounding global warming policies especially when talking of the international policy debate and in particular, when we talk of the Indian context, the discussions become even more engaging. India being a country with multiple dimensions which refuse to fit in one box, policy analysis has become a tricky matter for the country. We have already looked at the international global warming policies, let us now our nation's response to the international policy debate and its impact on our domestic front. Reading the previous sections, by now you must have developed a fair idea about the

character of the international global warming policies and the pressure they exert on the developing countries like us. However, among developing countries, India is of course an exception, for it has a reasonably strong scientific infrastructure and manpower base.

Right from the very beginning, the state had been allocating substantive resources for building up a consolidated scientific and technical base. Higher education, science and engineering went a long way with an eye to make the nation self-reliant with a sound industrial base. However, these ambitious projects faced an economic setback, for India is still counted as one of the poorest countries of the world. This heavily compromises India's ability to provide the updated, cross-cutting and sophisticated training and professional skills to its manpower despite having some of the best higher educational and training institutes of its own. India's capacity in optimizing its own climate research and drafting its policy recommendations were therefore seethed with such handicaps (Kandlikar 1999). In India, there is a clear cut division between scientific research and policy related issues of climate studies. While scientific research is carried out by government laboratories of the CSIR and other academic institutes. Policy makers however, belong primarily to the non-governmental organizations (NGOs), research institutes and of course to the academic organizations. Policy making is more important for the fact that India is one of the greatest green house gas emitters in the world with its emissions likely to shoot up almost by 2.5 times between 2008 and 2035 (IEA 2013). In this context of increasing Indian carbon emissions, the industrialized countries like the United States had refused to sign a legally compelling treaty to arrest its own green house radiations (National Academies 2010). On the other hand, developing countries felt that given the triple arguments of equity, lower-capita emissions and the historical responsibility of the developed countries, it is the duty of the developed countries to pull down their emissions first (Dubash:2011; Michaelowa 2012).

12.4 CHANGING LENSES OF GLOBAL GREENHOUSE GAS EMISSIONS IN THE STATE

India however, began to shuffle its position in both the domestic and international forum. Shifts in global warming policy have been evident for quite some time and it is impacting the policy negotiations in both the domestic and international circles. Traditionally, the policy recommendations concerning climate change reflected a relaxed approach towards greenhouse emissions. India's basic orientation towards international climate negotiations interestingly remained static for over two decades though there were politico-economic shifts happening on a significant scale. The reasons for this were many but chiefly two. One was, there developed a clear cut water-tight compartmentalization between the environmental and foreign issues. The top-

rung bureaucrats particularly from the environmental ministry who carved the climate change policies were in darkness about the other foreign policy issues. This isolation from the external policies and foreign affairs left its impact on the framing of environmental policies. The policies grew up almost in a void without having any alliance with their foreign counterparts. The second reason is the successful indoctrination of a normative frame based on the idea of 'equity'. This underlines the equal responsibility of both the developed and developing countries in the matter of global warming, with the blame more soon on the developed countries for historically they had championed such widespread warming. We had already mentioned the Conference held in Rio De Janeiro in 1992 which proclaimed the CBDR principles initiated by the United Nations Forum for Climate Change Conventions (UNFCCC).

It acknowledged the different responsibilities of the industrialized and developing countries in carbon missions. Therefore going by the idea of equity, the state put the onus on the developed countries in correcting its greenhouse eradications instead of arresting the economic growth of the developing nations. Indira Gandhi maintained that persistence of socio-economic development and handling management issues can be a difficult task. She was doubtful about the extent to which the state can commit itself to binding climatic negotiations. She believed her economy has its own set of domestic problems for which it shall be difficult to go for any law abiding global climatic commitment. The situation however changed soon in the first decade of the 21st century. In 2007, then prime minister, Manmohan Singh made an announcement that India's per capita emissions shall never surpass those of industrialized countries. India for the first time was capping its emissions. It was no longer as free as it was before. It was coming out of its age-long commitment to emit the required greenhouse gases as her economy demanded of her. It willfully subjected itself to emission constraints which were legally binding as those of the developed economies.

Actually, the state mechanism was framing the lines of climate diplomacy in respect of India's broader Foreign policy agenda. India perhaps, was favouring greater alignment with the United States and China in foreign policies. For this, there was an absolute necessity for it to toe the line of these international stakeholders in allied contexts of climate negotiations. Such negotiations became more rampant when Jairam Ramesh was elected the Minister for Environment and Forests in 2009. At his tenure, India had voluntarily offered to reduce carbon emissions. At the 2010, COP 16 conference in Cancun, Ramesh, declared that all countries must make a serious commitment to bring down its greenhouse gases level to a reasonably lower level. Ramesh pledged to voluntarily cut down its emissions by 20-25 percent by 2020, taking 2005 as the base year. It definitely was a commitment to shrink carbon emissions in spite of India being the one of the least "offending" countries in the world. (Jairam Ramesh in his lecture on the eve of said,

We are convinced that a low-carbon strategy is an essential aspect of sustainable development. While we already have one of the lowest emissions intensity of the economy, we will do more. We are targeting a further emissions intensity decline of 20-25% by 2020 on 2005 levels. This is significant given our huge developmental imperatives (Ramesh: 2010).

More than going by its face value, the Indian climate negotiation policies in this stage can be taken as pursuit of far strategic diplomacy. It was soon after declaring the Greenhouse gas emission policies that India succeeded in winning many international deals. Be it, framing a positive diplomatic relation with China, with whom India however had an otherwise strained relation, bagging a major nuclear deal with the US Congress in 2008, being publicly offered support by US President Obama in 2010 in India's bid to win a permanent seat on the United Nations Security Council to being given greater voting rights to both China and India by the International Monetary Fund; the Indian climate diplomacy had a long way to go (Atteridge: 2010).

Check Your Progress 1

- 1) The formalized discussions on climate change began in June 1973 with the United Nations Conference on the Human Environment (UNCHE) in
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- 2) What does CBDR stand for and what are its aims?
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12.5 INDIAN CLIMATIC NEGOTIATIONS, RESOLUTIONS AND ENVIRONMENTAL COLONIALISM

The above policies were critiqued heavily by a group of environmental scientists who felt the negotiations were heading towards a very fatal trend, which they termed as "environmental colonialism". A study published in the United States by the World Resources Institute (WRI) in collaboration with the United Nations is what the scholar terms 'environmental colonialism'. WRI²² claimed that developing countries are scared of the fact that their development processes would be stunted by controlling their capacity to produce energy especially from coal, which perhaps is mostly responsible for producing carbon dioxide. Besides coal, Indian agricultural activities produce a lot of methane, another suspect in global warming. A segment of Indian political scientists feel that the world itself is so disproportionately divided

that developing countries ought not be blamed for any climatic disruption. What the developing country pollutes is nothing compared to the scales of consumption of the developed ones. Riding on the logic of carbon emission and restricting the growth of the developing economies is an unjust practice which is absolutely out of the purview of any kind of 'development' whatsoever. It is just a tactic designed to marginalize the poor economies even more. More so, it is a tactic applied by the rich countries to exert its burden of undue emissions pressure on the poor economies. Sunita Narayan asks can we really compare the The famous environmentalist, Sunita Narayan said, it is time that richer countries must learn to undo their development or as she prefers to use the term, 'de-develop', so that developing countries too will get the equal opportunity to brush up their economy. She asks the question:

"Can we really equate the carbon dioxide contributions of gas guzzling automobiles in Europe and North America or, for that matter, anywhere in the Third World with the methane emissions of draught cattle and rice fields of subsistence farmers in West Bengal Thailand? Do these people not have a right to live? (Agarwal:1991)".

This definitely is a case of "environmental colonialism" for the rich countries have already used up the earth's ecological resources and are persistently doing so. Rather than concentrate in on the poor developing economies, we all are busy hauling up these poor people and accusing them for consuming up the natural assets. This definitely is a matter of North-South Divide where the richer countries of the North are trying hard to define the issues as well as attempting to monitor and control the development policies in the South that are having deep underlying implications. This approach of singling out only the developing countries as the ultimate source of threat to the global environment and limiting their industrial autonomy is often taken as a ploy employed by the North to victimize the South and exerting a control on her

Box:1 North South Divide

The North-South Divide is a socio-economic and a political division of the earth that had been popularized in the late 20th century and the early 21st century. This is not a geographical term and has socio-political implications. Global North includes Australia, Canada, most western European countries, Israel, Japan, New Zealand, Singapore, South Korea, Taiwan and the United States. The Global South is made up of Africa, Latin America and the Caribbean, Pacific Islands and the developing countries in Asia, including the Middle East.

resources. This is what we term 'environmental colonialism. The North with only 20% of the world's population accounts for almost 85 % of the global consumption of non-renewable energy. The North as we said had already used up the lion's share of the world's resources and according to the critics like Agarwal and Narayan feel must reduce the intake of the non-renewable energy to make room for the rapid industrialization and growth of the South,

which had been long due to them (Agarwal: 1991).

Another very influential think tank was the (then) Tata Energy Research Institute (TERI) who also posed a critique (Pachauri 1992). Among the scholars participating in the debate agreed on three pertinent facts such as:

- The possible negative influence of climate change on India
- The limiting effect so far climate treaty
- In insistence upon the fact that the industrialized countries must be held responsible for their green house emissions.

India held it very firmly that developed countries with high per capita emissions of those gases must be held responsible for incremental global warming. They agreed that the principle of equity must be made the touchstone for making the judgments (Dasgupta 2012). India definitely played a very substantial role in the making of the Global South, which we spoke about, through its claims and dispensation.

12.6 ECOLOGY, SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE

Though India maintained that consistent position cannot be taken to reduce its green house emissions, for it maintains that it still exhales one of the lowest per capita emissions. It also likewise claimed that the developing countries need the carbon space to grow (Anantha Padmanabhan 2007). Despite that as the fore - runners of sustainable development, our country felt that as responsible citizens we must ensure that we achieve the goals of sustainable development, one of which is to respond positively to the exigencies of climate action. Sustainable development is the instrumental principle for meeting the human development goals while simultaneously taking care of the natural resources and our ecosystem. The outcome is a condition in which the living conditions and the available resources are used to the optimum without compromising the integrity, stability and effectiveness of the future generations to meet their own needs. But of course, the agenda of sustainable development was offset by the adverse impacts of climate change and especially global warming. Therefore, Asian policymakers considered climate change more seriously. As the concept of sustainable development developed gradually, it shifted its focus more towards



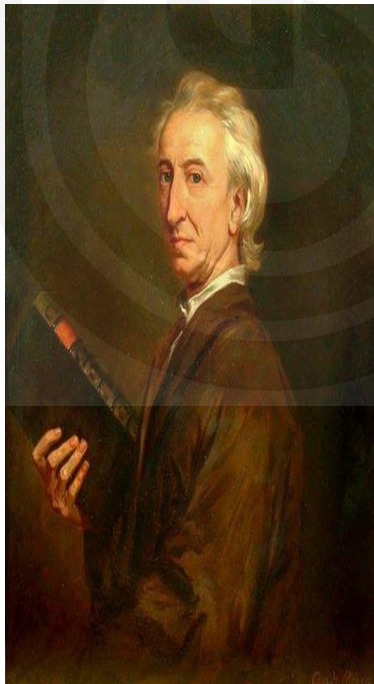
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economic and social development with a special emphasis on environmental preservation and the persistence of the ecology.

To instill the required knowledge, based skills, values and attitudes in order to establish a sustainable world, ESD or as we say, the Education for Sustainable Development had been developed. Its aim was to empower and brush up the present and future generations so that they can meet their needs through a well developed strategy. The strategy incorporates all the economic, social and environmental approaches so that one is not compromised by the other and vice-versa. With the launching of the UN Decade of Education for Sustainable Development (2005-2014), there started a global movement to make certain modifications in education to counter the limitations of sustainable development. Thereafter UNESCO endorsed

Box :2 early origins of Sustainable development

Sustainable development has its origin in ideas about the sustainable forest management which were formed in Europe during the 17th and 18th centuries. In context of the growing awareness of the depletion of the timber resources in England, a name suddenly became very significant and it was John Evelyn.



John Evelyn, a writer, gardener and diarist said that sowing and planting of trees must be taken as a moral duty of every citizen. This is done to ensure the banning of destructive over-exploitation of the natural resources. It was in his 1662 essay, *Sylva*, that he first made such an argument.

Title: John Evelyn Courtesy:

the Global Action Programme (GAP) on ESD in the 37th session of its General Conference. Recognized by the UN and launched at the UNESCO World Conference on ESD in 2014, GAP aspires to bring an all-round development. The role of the ESD stands recognized in three major UN Summits such as in Rio de Janeiro, Brazil in 1992 and Johannesburg,

South Africa in 2012. Other pivotal global agreements such as the Paris Agreement also recognized the key importance of ESD. ESD with its 17 sustainable development goals today occupy the central position at the 2030 agenda for sustainable development.



Title: 17 Sustainable Development Goals

Credit:

https://commons.wikimedia.org/wiki/File:Sustainable_Development_Goals_text_only.png

Check Your Progress 2

1) what do you understand by environmental colonialism?

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2) What does EDS stand for and what are its goals?

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12.7 THE INDIAN MODEL OF SUSTAINABLE DEVELOPMENT

This country required a versatile strategy to fight the adversities of climate change. India did not sit still but went a long way in preparing itself for adopting the Sustainable development model. Let us look at the Indian take on the problem, especially in terms of its national policies. This section has largely been drawn from the Government of India 2019 Report on Sustainable Development Goals (Aayog 2019).

a) Climate Action and policies.

The Global Action programme (GAP) we studied above mentioned 17 sustainable development goals of which the 13th goal spoke of the climate action. India had already adopted the National Action Plan on Climate change (NAPCC). It underlined an all-round strategy to tackle the climate impacts while working out the solutions aided by best of the technologies. Globally India assumed leadership roles especially in the United Nations Framework Convention on Climate Change (UNFCCC). India championed the International Solar Alliance which aimed at cultivating a large pool of solar resources as well as cutting down the cost of technology and financing.

b) Clean Energy

A target of around 175 GW of renewable energy generation capacity by 2022 especially from solar, wind, biomass and hydropower is being chalked out. The over-use of biomass for cooking, especially in rural areas is being resolved under the scheme of Pradhan Mantri Ujjwala Yojana, such that 80.3 million LPG connections had been implemented by the state in various domestic, industrial and non-industrial sections of the society.

c) Emission Intensity

The National Electricity Policy finalized in 2018 predicts a sharp decline in fossil fuel capacity at least by 2027. Super-critical thermal power units have risen so as to avoid carbon emissions. The Central Pollution Control Board monitors air quality across the country under the National Air Quality Monitoring Programme or NAMP as we say. It plays a pivotal role in monitoring emission intensities in as many as 300 cities / towns all across the country.

d) Improving Disaster Risk Reduction and Preparedness

Our country's geography is extremely susceptible to natural disasters, which especially is adverse for the poor. The National Policy on Disaster

Do you know?

Unnat Jyoti by Affordable LEDs for All (UJALA) is a scheme by our country that promotes energy efficiency through the mass distribution of low-cost LED bulbs. On an average, India saved a lot of its energy by switching to LED bulbs. Among the States, Odisha saved the highest, to be soon followed by Gujarat and Uttar Pradesh.

Management (2009) and the National Disaster Management Plan, 2016 concentrates on this issue of disaster risk reduction. Programmes such as the National Cyclone Risk Mitigation Project can help in strengthening its disaster combat forces more effectively. India had recently launched the International Coalition for Disaster Resilience Infrastructure (CDRI) in collaboration with 12 partner countries to strengthen its resilience capacity.

India is strengthening itself on the grounds of sustainability. It is exploring

there reservoir so renewable and alternative sources of energy to cut down its fossil fuel sources. Equitably ensured regular access to affordable, reliable and clean energy is a definite prerequisite for socio-economic progress in India. The Goal has three key components: universal access to electricity and clean cooking fuel, increasing share of renewable energy in the country's energy mix and improving energy efficiency, endorsed in the National Energy Policy (Aayog 2019). The state is trying to achieve the full electrification of all habitations and so all the targeted programmes are in place. The national policies are also trying to pace up the schemes for increased access to LPG for clean cooking and reduced reliance on biomass for the households. The country's energy mix can be made diversified by broadening the pool of renewable energy choices (solar, wind, small hydro power, and waste-to-energy, among others).

At the same time, to adopt the policies towards sustainability and preservation of ecology, the nation is also in creating its installed capacity access. The sustainable path can be sharpened more through developing strategies for energy efficiency. It is in this direction that we are enforcing standards and labeling our equipment and appliances, implementing energy conservation building codes for commercial buildings and developing energy consumption norms for industries. This will go along way in strengthening the sustainable policies and programmes in controlling global warming and arresting the adversities it creates for the earth.

12.8 CONCLUSION

We conclude the section by saying that as far as policies for climate action are concerned, we are on the right track. There are several limitations which we face, especially in safeguarding the rights of the poor and the marginalized who are at the heart of this sustainability issue, but we continue to fight against all odds. Protecting the environment from all the possible dangers and to sustain our economic growth remains a pertinent issue and we try adopting the sustainable tactics to pursue it. The energy expedition to harness as much renewable energy as possible is a challenge for the state but we have remained focused on it. India had committed to gaining 40 percent of its total electricity generation from non-fossil fuels latest by 2030 as part of its NDC. Karnataka, Tamil Nadu and Maharashtra led the country in power production from renewable energy whereas Jammu and Kashmir tops the chart in the case of the Union Territories. Together we should go a long way in saving our earth from the possible predators and at the same time ensuring its necessary socio-economic boost.

12.9 LET US SUM UP

We started with a general introduction of climate change and went on to discuss at length the international time line of the policies and how the perspectives changed over time especially in recognising the wedge between the developed and developing classes. We then spoke at length on the shifting paradigms in the field of national policies. We saw how our country had responded to the call for sustainability and taking all the necessary measures for moving towards the greener earth and a clear sky.

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12.11 SPECIMEN ANSWERS TO CHECKYOUR PROGRESS

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Check Your Progress 1.

- 1) Stockholm
- 2) The United Nations Framework Convention on Climate Change (UNFCCC) was initiated, and it was UNFCCC which conceptualised Common but Differentiated Responsibilities (CBDR). CBDR proclaimed that all the states across the world would be entitled to share obligation to heal the injuries incurred on the earth owing to its environmental blows. The CBDR principle assumed that industrialisation was a major stakeholder in global warming and therefore industrialized countries must remain accountable for it (Cullet 1999). States mutually agreed that since developed countries degraded the environment more, they should share greater responsibility than the developing ones. In accordance with this recommendation, the first Conference of the Parties (COP) was held in Berlin in 1995.

Check Your Progress 2

- 1) There is a North-South Divide where the richer countries of the North are trying hard to define the issues as well as attempting to monitor and control the development policies in the South that are having deep underlying implications. This approach of singling out only the developing countries as the ultimate source of threat to the global environment and limiting their industrial autonomy is often taken as a ploy employed by the North to victimize the South and exerting a control on her resources. This is what we term 'environmental colonialism'
- 2) To instill the required knowledge, based skills, values and attitudes in order to establish a sustainable world, ESD or as we say, the Education for Sustainable Development had been developed. Its aim was to empower and brush up the present and future generations so that they can meet their needs through a well developed strategy. The strategy incorporates all the economic, social and environmental approaches so that one is not compromised by the other and vice-versa. With the launching of the UN Decade of Education for Sustainable Development (2005-2014), there started a global movement to make certain modifications in education so as to counter the limitations of sustainable development.