CHAPTER - II

ENVIRONMENTAL POLLUTION: CAUSATIVE FACTORS.

2.1 MEANING OF ENVIRONMENT:-

For a happy, progressive and purposive living, the Earth and its Environment must not only be kept pollution-free but also be protected from the hazards of pollution. The threat of pollution to the Environment is multidimensional in as much as it may be in the form of Air Pollution, Water Pollution, Noise pollution, Space Pollution, Heat Pollution, Food Pollution and Pollution caused by births and deaths as also by the Acts of God. Recent trend goes to Electromagnetic Radiation (EMR) Pollution caused by cell phones, cell towers and electronic media. It is very dangerous to human body and Environment also.

Generally speaking, Environment means surroundings. The concept is relative to whatever object is to which is surrounded. It includes anything and everything having life in living and non-living of goods. In this connection, Einstein once observed: “Environment is everything that is not me”. However, a specific meaning is given to Environment which covers the physical surroundings that are common to all of us. In this sense Environment includes Air, fire, Space above, Water, Land, Plants and wild life.

Clean Environment possibly keeps the mind and body clean and sound. A sound mind and a sound body obviously help in the prosperity of the individual which in turn contributes in the progress of the country in general and the World at large. For better understanding of the subject of ‘Environment’ it is essential to understand what is ‘Environment’.

2.2 DEFINITION OF ENVIRONMENT:

Etymologically the term, “Environment” connotes surrounding. It is a composite term referring to conditions in which organisms consisting of air, water, food, sunlight etc., live and become living sources for all the living and non-living beings includes
temperature, wind, electricity, etc., Environment is the life support system. It is from the Environment that all the essential necessities of life are derived\(^1\).

Nature constitutes the Environment or the ecology of man. Not only the beauty but also the every existence of life depends on nature. "Environment includes water, air and land and the inter-relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro-organism and property.\(^2\)

The word environment embraces the conditions or influences under which any individual or things exists, lives or develops.\(^3\) The environment defined as that outer physical and biological system in which man and other organisms live is a whole Albert a complicated on which many interacting components.\(^4\) The usually identified components of the environment generally include: its rocks, minerals, soils and waters, its lands and their present and potential vegetation, its animal life and potential for live stock husbandry and its climate. Environment has been considered as the aggregate of all external conditions and influences affecting the life and development of an organism.\(^5\)

According to C.C.Park (1980) the term "Environment" refers to the sum total of conditions which surround man at a given point in space and time.\(^6\)

According to Goudi (1984) Environment is the representative of physical components of the earth herein man is the important factor influencing his environment.

According to K.R. Dikshit (1984) our minimum concern is the quality of space we live in, the purity of air we breathe, the food e eat, the water we drink and the resources we draw from our environment to support our economy.

According to Dr. T.N. Khoshoo (Secretary), Department of Environment, Government of India, "Environment" means sum total of all conditions and influences that affect the development of life of all organisms.\(^7\)

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\(^1\) See Dr.N.maheswara Swamy's Law relating to Environmental pollution & protection, 1998, p.2
\(^2\) Section 2(a) of the Environment Protection Act, 1986.
According to the United States Council on Environmental Quality, “Environment means man’s total environmental system including not only the biosphere, but also his interactions with his natural and man-made surroundings. First Annual Report 6 (1970).

According to the Encyclopedia Britannica, the term “Environment” means the entire range of external influence acting on an organism, both the physical and biological, and other organism, i.e., forces of nature surrounding an individual.

The dictionary meaning of the word “Environment” is a surrounding: external conditions influencing development or growth of people, animals or plants; living or working conditions, etc.  

In the beginning the Environment of early man consisted of only physical aspects of the planet Earth i.e., land, air, and water and biotic comparases with the march of time and advancement of society man extended his Environment through his social, economic and political functions.

In fact Environment is an inseparable whole and is constituted by the interacting systems of physical and biological elements which are interlinked individually as well as collectively in myriad ways physical elements (Space, landforms, water bodies, climate, soils, rocks and minerals) determine the variable character of the human habitat, its opportunities as well as limitations. Biological elements (plants, animals, micro-organism and mass) constitute the biosphere.

Since the Environment is both physical and biological concept, it encompasses both the non-living (Abiotic) and living (biotic) components of the planet Earth.

2.3. COMPONENTS OF ENVIRONMENT;

Environment consists of the following three important components namely:

1. Abiotic or non-living component, which is subdivided into the following three categories,

   i. Lithosphere (Rocks, soil and solid air)

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8 Savindra Singh, Environmental Geography, 1995 p.15.
ii. Hydrosphere (water component)

iii. Atmosphere (gaseous envelope) which is in turn divided into four zones, namely:
   a) Troposphere
   b) Stratosphere
   c) Ionosphere, and
   d) Exosphere.

Thus the three basic divisions of physical environment may be termed as
   a) Lithospheric Environment
   b) Hydrospheric Environment
   c) Atmospheric Environment.

2. Biotic or living component consists of flora and fauna including man as an important factor.

Thus the biotic environment may be divided into
   i) Plants Environment and
   ii) Animals Environment.

All the organisms work to form their social groups and organizations at several levels and are formed social environment wherein the organisms work to derive matter from physical environment for their sustenance and development.

3. Energy component, which includes solar energy, geo-chemical energy, thermo-electrical energy, hydro-electrical energy, nuclear atomic energy, energy due to radiation etc., that helps in maintaining the real life of organisms.
2.4. ENVIRONMENTAL POLLUTION:

The Royal Commission on Environmental Pollution in U.K. in its third report gave the following definition to the term "Pollution", namely,

"The introduction by man into the environment of substance or energy liable to cause hazards to human health, harm to living resources and ecological systems, damage to structure or amenity or interference with legitimate uses of the environment".

According to Section 1(3) of the U.K. Environment Protection Act, 1990, the term "Pollution" means as follows:-

"The release (into any environmental medium) from any process of substances which are capable of causing harm to man or any other living organisms supported by the environment.

Pollution occurs when there is the potential for harm. Harm of man is not confined to physical injury but encompasses offence caused to any of his senses or harm to his property, therefore smells and noise which may not cause injury can constitute pollution. Harm to living organisms can include harm to their health or interference with the ecological system of which they form a part".

Pollution derives from the Latin word "Polluts" which means defiled. Known pollutants differ so much in nature, effect and origin that no common feature is discernable.\(^9\) Pollution is an undesirable change in the physical, chemical or biological characteristics of our air, land and water etc., that may or harmfully effect, human lives or that of desirable species, our industrial process, living conditions and cultural aspects or that may or will waste or deteriorate our raw material resources.

For the present purpose, pollution is defined as the introduction by man into any of the environment of waste matter or surplus of energy, which so changes the environment as directly or indirectly adversely to effect the opportunity of man to use or

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Environmental pollution is not a modern phenomenon. It is not peculiar to man and may indeed have preceded him. Pollution by man or the twentieth century is a reflection of development of technology and the resulting increase, in living standards and consumption habits associated with economic growth. Our only abode the earth is in danger. Man's relentless march towards "progress" has been so heavily dependent on science and technology that the natural environment stands almost transformed. The human quest for material "progress" seriously threatens the fragile eco-system. Most of our present days environmental difficulties can be said originate from man's ecological misbehavior.

According to McLaughtin, "Environmental Pollution" means the introduction by man into any part of the environment, of wastes, water energy or energy or surplus energy which so changes the environment directly or indirectly adversely to effect the opportunity of men to use or enjoy it.

According to Section 2 (c) of the Indian Environment (Protection) Act, 1986, "Environmental Pollution" means the presence in the environment of any environmental pollutant".

According to Section 2 (b) of the said Indian Act, "Environmental Pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment".

Environmental Pollution may be classified into

i) Natural Pollution – Earthquakes, flood, drought, cyclone.

ii) Artificial Pollution – Human activities.

Environmental Pollution, lowering of environmental quality at local scale caused exclusively by human activities whereas environmental degradation means lowering of environmental quality at local, regional and global levels by both natural process and human activities. It is commonly agreed that pollution is, without doubt, the outcome of urban industrial technological revolution and rapacious and speedy exploitation of natural

\[10\] Section 2 (e)
resources, increased rate of exchange of matter and energy and ever increasing industrial wastes, urban effluents and consumer goods.

The problem of environmental pollution is global and concerns all counties irrespective of their size, level of development or ideology. Notwithstanding political division of the world into national units, oceanic world is inter connected whole, and winds that blow over the countries are also one.\textsuperscript{11} Environment is a universal phenomenon pervading the whole world at large. If the nuclear test is carried out in one part of the world the fall out may be carried by winds to any other part of the world and such fall out of irresponsible disposal of radioactive from a remote energy plant in one country may turn out to have greater of full fledged war.\textsuperscript{12}

Science and technology brought in revolutionary change in human life. Modernization made man's life more and more comfortable. Today one can travel faster, speak or send message to distant lands through the modern means of communication. Villages have become growing cities as a result of industrialization which in turn presents its own side effect. Modern industries produce industrial wastes and toxic gases which are hazardous to human health. In other words modern man is exposed to Air pollution, Water pollution etc., in and around as a result of industrial wastes and of the toxic gas produced by industrial houses and modern automobiles.

2.5. KINDS OF POLLUTION:

The classification of Environmental Pollution is a difficult task because the pollutants and the media through which the pollutants are transported are all interconnected and inter-related. However, pollution may be classified from the point of view of object which is polluted. From this angle pollution may be classified as follows:-

1. Air Pollution:

Air is the symptom of life. It governs the mechanism of Earth. Pollution of air is a dangerous threat to the earthly existence. Protection of air from pollution is as essential as the protection of life.

\textsuperscript{11} M.C.Mehta v. Union of India, (1911) 2 SCC 353, 354.
\textsuperscript{12} P.S.Jaswal and Nishtha Jaswal, Environmental law, 1999 p.1.
“Air Pollution means the presence in the atmosphere of any air pollutant” and the latter denotes “any solid, liquid or gaseous substance, present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment. 13

Air pollution means the presence on the outdoor atmosphere one or more air contaminates or combination there of in such quantities of such duration as are or may tend to be injurious to human, plants, animal life or property or the conduct or business. Air pollution may be described as imbalance, inequality of air which causes ill effect in the nature. Air pollution may be defined in many ways. In simple terms air pollution can be defined as any ambient condition in which substances are present at concentrations high enough above their normal levels to produce measurable effect. In this effect it is the addition to the atmosphere of any material which will have a deterious effect on life.

India took appropriate steps to preserve natural resources of the earth which among other things include the preservation of the quality of air and control of air pollution.14 The presence of air, beyond certain limits, of various pollutants discharged through industrial emissions an from certain human activities connected with traffic, heating, use of domestic fuel, refuse incineration, etc., has a detrimental effect on the health of the people as also on animal life, vegetation and property.15

Air is a mixture of gases that forms earth’s atmosphere. It contains 20.95% oxygen, 78% Nitrogen, 0.93% Argon, 0.03% carbon-dioxide with smaller quantities of ozone and inert gases, water vapor varies between 0 and 4% and in industrial areas sulphur gases may be present in it. In this way it is clear that various components of air are present in it in a definite proportion.

Sources of Air Pollution:

The sources of air pollution are divided into natural and man-made. Natural sources include volcanic eruptions, dust, storms-- etc., the principal man made sources of

13 Lall: Commentaries on water and air pollution laws, 2nd ed., law publishers, (Allahabad 1986, 211-213)
14 See the "statement of objects and reasons" of the Air Act, 1981.
air pollution are transportations, fueled combustion from stationary sources, industrial processes and solid wastes disposal, domestic burning, includes the pollution from ships, planes, train and automobiles but the automobile is the worst contributor to air pollution particularly two wheelers.

i) General: the study of air pollution requires a clear understanding of all sources of air pollution. Even for the control of view, the sources of pollution are to be identified. A source of air pollution is a point or place from which pollutants are discharged into air.

ii) Natural sources: The natural sources of air pollution are as important as the man-made sources. The natural sources can be enumerated as follows.

iii) Volcanoes: volcanoes which erupt naturally emit huge quantities of particulate matter and gases like sulphur dioxide, hydrogen sulphide and methane. Control of such eruption is not possible but the effects continue for a long time.

iv) Forest Fires: Forest fires caused due to lightening are only natural and such fire can also be initiated by man for his selfish ends. Forest fires create smoke, unburned hydrocarbons, carbon monoxide, sulphur dioxide and oxides of nitrogen. Certain precautions are generally taken to avoid extensive damage to charge areas of forest by leaving bold margins between stretches of forests.

v) Dust Storms: This problem is more pronounced in arid and semi arid zones. If vegetation cover is absent and top soul is exposed to atmosphere. Wind picks up solid and transports to far away places. Apart from the damage due to abrasive action of such soil particulate visibility in the area is hampered severely. Dust from Thar Desert in India is attributed to cause problems in Northern India. Only a rainfall or long span of time can break such a problem and visibility can be restored.

vi) Oceans: Oceans continuously emit aerosols into the atmosphere in the form of salt particles, which are corrosive to metals and paints. Further the wave can act on rocky surfaces and dispense particulate to the atmosphere.
vii) **Vegetation**: Vegetation, though, very useful to humanity in many ways, is also a natural source of air pollution. Plants produce hydrocarbons and air born pollen can cause severe respiratory problems in some people.

viii) **Radioactive materials**: Though the natural radioactive from soils and rocks containing. Radioactive mineral is small, it is still important as radioactive material is continuously exposed to the atmosphere.

ix) **Transportation**: Though all types of transport namely air, water and land contribute to air pollution. The land transport is the most important and is by using vehicles of many types, fuelled by variety of products and emits varying amounts of both simple and complex pollutants. The omni-presence of automobile makes it a very important source. Automobiles are present everywhere – urban or semi-urban. Also the pollutants are emitted at ground level and the dispersion is very limited. The exhaust emission is a major source of air pollution is an automobile. Evaporative losses from fuel tanks and carburetor and losses from crank case, particulate from road surface rubber types, brake lines. It rings and clutch plates also contribute significantly.

Although both petrol engines produce similar products in their exhausts, the relative proportions present are different.

**LEGISTATION TO CONTROL AIR POLLUTION:**

The Air Act was passed by the Parliament under Article 253 of the Constitution to implement the decisions taken at the United Nations Conference on the Human Environment held at Stockholm in June, 1972 in which India participated. Under the impact of the Stockholm declaration it was decided to make appropriate steps for, the preservation of the natural resources of the earth which, among other things, included the preservation of air and control of air pollution. In order to implement the decision, the Parliament enacted Air (Prevention and Control of Pollution) Act, 1981.
The preamble to the Act reads as follows:

"An Act to provide for the prevention, control and abatement of air pollution, for the establishment, with a view to carrying out the aforesaid purposes, of Boards, for conferring thereto and for matters connected therewith”.

The Act after came into force, was being implemented by the Central and State Governments and the State Boards. The implementing agencies had experienced some administrative and practical difficulties in effectively implementing the provisions of the Act. The ways and means to remove these difficulties had been examined by the Government in consultation with the various Central Government Departments and taking into account the views expressed the Government brought about various amendments to the Act through the Air (Prevention and Control of Pollution) Amendment Act, 1987.

The definition of Air pollutant is given under Section 2(9) of the Air Pollution Act, 1981. Section 2(a) of the Air Pollution Act defines air pollutant as follows:

“Air Pollutant means any solid, liquid or gaseous substance including noise present in the atmosphere in such concentration as may be or tend to be injurious to human being or living creatures or plants or property or environment”.

Section 2 (b) of the Air Act defines Air pollution in the following words:

“Air Pollution means the presence in the atmosphere of any air Pollutant”.

**EFFECT OF AIR POLLUTION;**

The primary concern of the human kind is to consider the relationship that air pollution has to human health. The effects of air pollutants may be conveniently divided into four categories, which are namely,

1. Effects upon human health.
2. Effect upon animal.
3. Effects upon vegetation and
4. Economic and sociological effects.
Air pollution effects of human health, animals, and plant materials and on atmosphere. Though the direct causes and effect relationship of air pollution is not our concern but it may be said of effect the human health particularly respiratory system, lung cancer bronchitis, emphysema and asthma is some of the chronic diseases caused due to exposure to polluted air. The effects of air pollution on domestic animals are similar to those observing man. The effects on plant primarily concern to agriculture. The effects of the sulphur Dioxide (SO$_2$) are proved clearly that the gas is set to be absorbed through the stomach into the mesophel of the leaves; fluorides seem to interface with the photosynthesis and respiration plants. Air pollutants also caused damaged to property and materials to increased combustion of fossil fuel and oil increase the carbon dioxide (CO$_2$) concentration of the atmosphere in recent years. Carbon Dioxide absorbs great strongly and the radioactive cooling effect of the earth is thus decreased. Calculation and prediction shows that present amount of carbon dioxide will be double in the future, resulting in an increasing in the temperature of the earth surface.

Since polluted air reaches not only industrial and residential areas but also agriculture regions in addition to man its impact on plants and animals are also beginning to manifest them. In present day environmental control the conservation of forests has gained in importance for two reasons.

Firstly the forests need increased protection, secondly on the future can be at greater help against environmental contamination. Industrial air pollution caused greater damages to forests.

2.6. CAUSTIVE FACTORS OF ENVIRONMENTAL POLLUTION;

Since the middle of the 19th century on wards things have started happening in quite disproportions putting the ecological system of the balance. The population explosion, affluent society with a desire for a vast array of products, increase radiations, the automobile, greater energy use, increased food production needs some other
development are set to be some of the potent factors responsible for creating the imbalance.16

Since the very beginning of human civilization, some thousands years ago man started interfering with the environment, the devastated the forest by cutting trees for the wood and for other household needs. He removed stretches of forests for bringing the land under civilization, only to find water supply, diminishing and his supply of soil eroding away. All these activities did not effect the environment too seriously up to a fairly long time because the population was not too high and life style was not so complex. The nature self purifying and self cleaning capacity of the environment was un-deteriorated.

The major factors of pollution are being discussed under the following heads:-

(i). Population Growth:

The problem of population growth has become a global phenomenon, which has got its alarming proportion in India. According to the Census 2001, the population of India has crossed one billion marks. Of the six persons of world one is an Indian. We being the second largest populated country in the world represent 16% of human race against the 2.4% of global land.

The increase in population in an area would have its impact in the environment, it is important to examine the data more carefully and study the specific relationship between populations and environment. Much of the debate on this issue is polarized between two extreme views. The developed world and the wildlife conservation enthusiasts hold the view that population growth is the prime cause for the degradation of the environment, while the exponents of the social justice hold the view that consumption patterns and inequity within and between societies is the principal cause for the ecological degradation. However, the reality is that the problem of population and environment is more complex and population increases and consumption patterns compound to impact on the environment

16 Environment Protection – Horold and Gotass – forward XI–XIII.
To understand the population-environment dynamics, it may be useful to look at human population not as a homogeneous entity but rather as composed of three groups of people, depending upon their relation with the environment. The ecosystems people are groups who have subsisted in the same environment over a long duration of time and evolved mechanisms to adapt to the spatial and temporal variation in the environment. They derive a wide variety of biological resources from their environment as well as utilize a technology including cultivars that are specifically adapted to their environment.

The second group is the biosphere people who are more integrated with the global market economy. They derive a diversity of biological products from the markets in exchange for certain specialized high value products that they extract from the local environment. They are in the commercialization of natural resources and make intensive use of land, water and soil to produce a limited range of products for the market.

The third group is the ecological refugees who have been displaced from their own environment by an erosion of their resource base and have migrated into the area in search of livelihoods. This group derives livelihood from the commercial activity and are involved along with the biosphere people in the commercialization and intensification of natural resources use. However, they make considerable subsistence demand on the environment, in the form of biomass and water.

The problem of population growth has been a very emotional issue, there is a direct relationship between increase in population numbers and environmental impact, more people, require some utilizing more land for buildings, more minerals, more water and more energy. The side effects include enhanced use of chemicals, chemical fertilizers, insecticides, pesticides, deforestation, increased population and heavy load on transport etc., 17

Thus the population growth has become the main cause of environmental pollution, which should be reduced through some comprehensive legislation.

(ii). Urbanisation;

As the population moves from the villages towards the town and the city, Urban India is descending into chaos facing a lack of water and sanitation, affordable housing, roads, public transport and clean air. Another problem is that Indian cities are seeing an increase of urban poor, who live without access to basic amenities. According to the 2001 census, about 285 million people live in urban areas. By 2015, half the country’s population is expected to be city-based and there will be over 50 cities with a population of one million and above.

Urbanization while having a positive impact on income levels, employment and production economics has brought with it many problems including a shortage of housing, inadequate water supply, sanitation and waste disposal facilities, congestion, traffic problems, air, water and noise pollution as well as an unsafe social environment. The overall quality of urban environment has deteriorated over the years with the largest cities reaching, saturation points and unable to cope with the increasing pressure on their infrastructure. While cities are considered ‘engines of economic growth’, given the fact that they contribute nearly 60% of the national income, they are also inherently unsustainable in environmental terms. They drew upon a vast hinterland, often across natural boundaries, for resources and dispense their wastes also over a vast hinterland.

There is a great awareness of environmental issues today, but unfortunately attention is largely drawn to global issues rather than local issues. Thus, while urban residents witness the rapid deterioration in their environment, there is a total antipathy towards the state of the urban environment from policy makers. The concept of a ‘sustainable city’ has so far remained only on paper. However, with the dwindling of basic resources like water and increasing air and water pollution, it is imperative that city planning be taken up with a rigorous analysis of the assimilative and supportive capacities of the environment. There is also a need for a consultative process among the urban residents, governments and non-governmental organizations to make cities more livable. Chapter 28 of agenda 21, drafted at the 1992 Earth Summit in Rio, has also highlighted the need for local area action plans. Such consultative processes must be preceded by baseline information about the state of the urban environment.
Urban water supply:

Water has always played a decisive crucial role in the location of settlements. Most of the earlier settlements including major civilizations were located in the banks of major rivers. Technological advancement has changed this situation. With the transportation of water made possible due to technology, the constraint of locating settlements near rivers began to weaken and settlements started coming up in different places.

The demand for water has been rising in the urban centers not only due to a growth in population but also due to a growth in economic activities. In 1981, nearly 22% of the urban population or 33 million people were without safe water supply in the country. The existing systems are crumbling under the increase demand for water. Under pressure to supply adequate water, cities are exploring sources which are hundreds of kilometers away. In the long run this is likely to upset the ecological balance in the region. Excessive withdrawal of ground water to meet the growing demand creates it own set of problems.

The impact of inadequate water and poor water quality is on the health of the population. Water born diseases create a major problem every monsoon when water logging, particularly in the low income families, causes contamination of water leading to a variety of water borne ailments. Cholera, dysentery and gastroenteritis claim many lives in these families every year. Water and sanitation related illness account for almost 60% of all urban deaths. Increased consumption of water, for various uses has increased the generation of waste water in Indian cities. Untreated/partially treated waste water, discharged in surface water bodies, has contaminated the aquatic resources of the country.

The situation of waste water treatment is not satisfactory even in metropolitan cities. Almost every city has a number of open drains passing through it which carry the untreated waste water to nearby rivers. The foul smell emanating from these drains is unbearable and the water in them creates an unpleasant sight, making the life of urban citizens miserable. In the absence of proper availability of water for various uses, the
people especially poorer sections of the society are forced to use this water for washing and bathing, inviting various types of skin diseases.

Lack of planning and absence of ineffective legal controls have encouraged many air and water polluting industries to come up near urban areas. Thermal power plants existing in many urban areas are a major cause of air and water pollution.

(iii). Agricultural development:

Current agricultural practices in developing countries are causing both ecological and social harm. In recent years, there has been considerable concern about human capacity to produce adequate food to meet both the needs of the growing population, and the increase in purchasing power resulting in higher consumption of animal product. The concern arises from the fatigue of the Green Revolution and the growing damage to the ecological foundations essential for sustainable food security, such as land, water, biodiversity, forests and the atmosphere. Compounding such problems is the threat of climate change leading to potential adverse changes in temperature, precipitation, sea level and ultra-violet beta radiations

U.S. experts like Lester Brown and John Bongaarts feel that the future of food security may be in the hands of family planners rather than farmers. In an article titled, "Can the Growing Human Population Feed Itself?" published in the March 1994 issue of Scientific American, John Bongaarts states:

"Feeding a growing world population a diet that improves over time in quality and quantity is technologically feasible. But the economic and environmental costs incurred through bolstering food production may well prove too great for many countries. The course of events will depend crucially on their governments ability to design and enforce effective policies that address the challenges posed by mounting human numbers, rising poverty and environmental degradation. What ever the outcome, the task ahead will be made more difficult if population growth rates cannot be reduced."

Nearly 99% of the human food supply comes from the land. That is why President Roosevelt said in 1937, "a nation that destroys its soils destroys itself."
Aldo Leopold said over a century ago, “the use of the soil is a down to earth index of a civilization.” By this yardstick we have a poor record.

The agricultural development pollutes the environment in various ways e.g., i) through the application of chemical fertilizers and pesticides and insecticides, ii) through increase in irrational facilities and amount of irrigation, iii) by making changes in biological communities etc.,

Increased use of pesticides, insecticides and herbicides to control diseases of crops, in the agricultural fields, contaminates the soils. The water and fruits and grains and thus harms human body via fruits and grains when we eat.

The chemical fertilizer, Ammonium sulphate is used as a pesticide to boost the agricultural crops results in increase of concentration of sulphate ions because ammonium ions are largely consumed by crops but sulphate ions are left unused. The increase in concentration of sulphate ions in the soils makes them acidic. Excessive use of Potassium and Sodium nitrates results in the high concentration of Potassium and Sodium ions respectively. The left over Nitrates are partly washed out by surface layer and are brought to the lakes, ponds and streams. Thus ground and surface water are heavily contaminated and polluted.

Globally, about one-third of agricultural land is devoted to crops and the remaining two-third is devoted to pastures and grazing lands hardly occupy 40% of agricultural land, although we have over 20% of the world's cattle, buffalo, sheep and goat population. Overgrazing of all community lands has converted them into barren lands. We are yet to introduce in every district of our country a sustainable land use system based on the following three conditions:

a) Sustainable intensification: These are prime farm lands which can be subjected to intensive farming, provided there is proper attention to the health of the soil.

b) Restoration Areas: These are degraded lands which can be restored to good health through appropriate wasteland development enterprises.
c) Conservation areas: These are forest or other areas rich in biological diversity which ought to be maintained for their pristine purity.

(iv). Industrialization:

The East India Company which came as a trader in the 1600's has captured political power in 1757 and completed the process of establishment of British rule in India after the Sepoy Mutiny in 1857. The British rule conquest of India and their colonization of territories elsewhere coincide with the period of ongoing industrial Revolution (1780-1820) in England. The industrial Revolution had brought about radical changes in manufacturing, agriculture, animal husbandry and transport among other things. This in turn had created enhanced demand for machine made goods whose raw materials requirements and supply of input resources was abundantly met from resourceful colonies, like India at cheap prices.

Despite the explicit policies of industrial dispersal of the 1960s and 1970s, the concentration of industries in and around major centre has continued. The large industries that can internalize the entries production process have moved away from urban canters to take advantage of the various subsidies and concessions. With very poor environmental controls being exercised by the authorities, such industries in urban areas have been causing severe water and air pollution. Most industries discharge waste water into rivers and water courses without adequate treatment. Industrial effluents are not easily biodegradable and after beyond the natural assimilation capacity of the rivers, with the result that water bodies remain polluted affecting the health of the population in the region.

The rapid economic growth, rise in agricultural production, rapid urbanization and industrialization are increasingly affecting the natural environment. Exploitation of natural resources in order to meet industrial demands of raw materials has resulted into i) the reduction of forest covers due to reckless cutting of trees, ii) excavation of land for mining purposes, iii) reduction in arable land due to industrial expansion, iv) lowering of
ground water level due to excessive withdrawal of ground water, v) collapsing of ground surface due to withdrawal of mineral oil and ground water etc.,

The Bhopal Gas tragedy, the world’s worst industrial disaster occulted on December 2, 1984, when 60 tones of the deadly methyl isocyanate leaked out of the Union Carbide factory in Bhopal killing in its wake over 8,000 people, and Chernobyl nuclear disaster, the danger of fallout of radioactive elements due to bursting nuclear plant of Chernobyl is still looming large over many of the neighbouring countries, are few examples of deterous effects of industrialization.

The 17th century monument, The Taj Mahal, is losing its luster and has developed yellow spots at various paces on its translucently white surface. The collective effect of the dust particles, corrosive gases and carbon particles visibly demonstrates the decay of the outer as well as inner surface of the monument. The Taj Mahal has suffered much more damage during the past 20 years that in the previous 300 years of its existence due to alarming air pollution in the Agra region by polluting factories.

The ship-breaking industry is also one of the most polluting the discharge and emissions of toxic materials to sea, sediments, ground and air cause both acute and long-term pollution. Discharge of oil to the sea has resulted in physical damage to birds, mammals and marine organisms and their natural habitats. Light petroleum products are highly toxic and represent a fire hazard. Wastes like blasting residue and paint chips contaminate the soil and surface water. Improper storage and disposal of scrap metal and wastes also causes lead contamination. Environmentally hazardous fumes may evolve when metal and paint is heated during hot work, and cutting with a blow-torch generates smoke and particulates of manganese, nickel, chromium and iron, asbestos and lead.

(v) **Deforestation:**

Under British rule, the State established monopoly control over forests, reserved large tracts for timber extraction, severely restricted the customary rights of local populations to these resources and encouraged commercially profitable species at the cost of species used by the local population. There was also large-scale forest clearance and

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18 See "Environmental Law" by Dr. Jai Jai Ram Upadhyay, p.70, Central Law Agency (2005), Allahabad.
felling for railways, ships, bridges, tea and coffee plantations, crop cultivation to increase the Government's land revenue base, and so on. After Independence, State monopoly over forests continued, as did the practice of forestry in the interests of commercial gain, while the local people's rights to non-timber forest produce were further curtailed.

Forest ecosystems are highly vulnerable to climate change. According to the Intergovernmental Panel on Climate Change reports, even with a modest global warming of 1-2° C, most forest ecosystems will be impacted through changes in forest species composition, biodiversity and plant productivity. In fact currently available scientific literature suggests that the unprecedented warming observed in the recent decades has already made an impact on forest ecosystems such as a pole-ward and an upward shift in ranges of plant, insect, bird and fish species. Further, plant flowering, bird arrival and dates of breeding and flowering are observed to be occurring earlier than before in the seasons.

Forests play a crucial economic, social and cultural role in India. Many river systems originate in forests and anchor rich biodiversity. Forests provide timber, industrial wood, and fuel wood and non-timber products to the local communities and the national economy. Even though the forest sector's contribution to national Gross Domestic Product is low and declining, it is of great importance to the livelihoods of forest-dependent communities.

The area now under forests in India is half of what it was 50 years ago. Fortunately, further denudation seems to have been halted, although human and commercial pressures on forest land are growing. Although India is regarded as a mega diversity area from the point of view of richness of biological diversity, two of the 16 most threatened biodiversity “hot spot” locations are present in our country. These are the Eastern Himalayan region and the Western Ghats. Sinking land, water, forest and plant genetic resources and expanding biotic and abiotic stresses that we have to examine the prospects of increasing food production to meet the needs of the growing population at global and regional levels are conversion of forest land into agricultural land, shifting cultivation transformation of forests into pastures, overgrazing forest fires, lumbering, multipurpose river projects etc.,
Deforestation gives birth to several problems encompassing environmental degradation through accelerated rate of soil erosion, increase in the sediment load of the rivers, siltation or reservoirs and river beds, increase in the frequency and dimension of floods and droughts, changes in the pattern of distribution of precipitation, intensification of greenhouse effects increase in the destructive force of the atmospheric storms etc., economic loss through damages of agricultural crops due to increased incidence of floods and draughts, decrease in agricultural production of loss of fertile top soils, decrease in the supply of raw materials to the industries and building matters etc., Thus deforestation cause a chain effects which adversely affect the natural environment.

India has a large diversity of tropical and subtropical forest ecosystems subjected to diverse socio-economic pressures. Climate change will be an additional stress on the complex forest ecosystems. Thus there is a need for modeling to incorporate the socio-economic and land use change pressures along with the projected climate change parameters to make a realistic assessment of the implications of climate change on forest ecosystems.

(vi) Electronic Waste (E-waste):

In a fast developing economy like India, electronics, telecommunications and computerizations are now inseparable from the idea of “modernization”. Education and communication are developmental goals, and their connectivity is good, but when they contain toxic substances, their disposal and recycling becomes a health nightmare. Electronic gadgets have penetrated every aspect of our lives and most of us do not think about what happens to the gadgets we discard or upgrade. The impact of digital technology on human life may vary. But, if we were to analyze the footprint of digital development, we would find that everyone is being touched by the fast-growing electronics industry.

E-waste is one of the fastest growing waste streams, with people changing their computers, television sets, and mobile phones more frequently that ever before. Every year these computers and mobile phones are either dumped in landfills or burnt in smelters. According to one estimate, about 20-50 million tones of E-waste is being
generated annually worldwide. In India, the figure stands at nearly 4,00,000 tonnes a year. E-waste makes up 5% of all municipal solid wastes worldwide, more or less the same amount as general plastic waste, but much hazardous. With fast and rapid technological change and lesser lifespan of all products, the problems seem to be further compounding. The government of India’s plan to increase the penetrations of personal computers (PCs) into villages, illegal import and the ever increasing consumption of electrical and electronic products are not making e-waste management easier.

According to Manufacturer’s Association for Information Technology projection (MATT), India, should achieve a personal computers penetration of 65 per 1,000. At present India have 15 million computers, the target being 75 million computers by 2010. The life span of computer has been reduced from 7 years to 2 - 4 years. Robust PC, TV and mobile phone sales are going to increase the volume of E-waste in India.

A computer that is thrown out lands up in one of the many recycling localities in metro cities such as Chennai, Mumbai or Delhi, that cannot be made reusable, or cannibalized, are broken by hand. For example, the plastic casing of the monitor is opened, the glass of the display smashed, the plastic-coated copper wires burnt to reclaim copper of the circuit boards melted in very strong acid to extract the tiny amounts of gold and copper. While doing so, many toxic compounds are released. Burning PVC-coated copper wires releases high amounts of dioxins and furans. Breaking glass releases high amount of lead, a neurotoxin slated for worldwide removal. Inside the computer can be mercury in switches and cadmium, besides printed circuit boards (PCBs) in old capacitors, all highly toxic. The plastic shell uses antiflammanents such as Brominated Flame Retardants (BFRs), which causes cancer and endocrinical system disruptions. The contamination soaks into the soil, ground water and also lands up in landfills where it leaches down. It is like a toxic brew, the highest exposures being to the most vulnerable urban poor. These chemicals are a strain on human health and the environment. Long-term exposure to these substances can damage the nervous system, kidney and bones and the reproductive and endocrine systems, and some of them are carcinogenic. Indiscriminately dumped components can pollute the ground water. A study conducted
by Greenpeace in 2005 in electronic recycling yards in Delhi clearly indicates the presence of hazardous chemicals in high levels in the area.

Most electronic devices are toxic due to the presence of deadly chemicals in production. Global initiatives to phase out chemicals from electronics devices started in 2006 with the launch of the Restriction of Hazardous Substances Directive (RoHS) in Europe. This directive bans the use of six deadly substances in the manufacturing process, namely, lead, cadmium, mercury, chromium and two brominated flame retardants (BFRs). Since, then, many other countries have used the directive or taken other initiatives to control and regulate the industry.

The Indian IT industry is growing rapidly and the government needs to ensure that it is competitive at an international level. However, India currently has no regulatory framework to govern the use of toxins in the electronic industry. The government of India must enact legislation based on the principle of extended producer responsibility (EPR), which empowers the electronics industry to manufacture clean products. The legislation should also be based on the precautionary principle and producer responsibility. The government must enforce a ban on the import of E-waste for recycling and also ban the import of secondhand computers for re-use, as most of these products end up in the recycling yard.

(vii) Thermal Power Plants:

Power plants either in public or private sector mainly use coal for generation of electricity. Energy in the form of electricity is a basis requirement for all modern developmental activities and can be generated by a variety of methods, materials and mechanisms. The problem with Indian coal is that all major deposits of the mineral are geographically concentrated and, except the lignite which has relatively lower calorific value, the Indian bituminous coal is high in ash content. High ash coal means more wear and tear of plant and machinery, low thermal efficiency of the boiler, slagging, choking and scaling of furnaces and tubing’s and most serious of all generation of a large amount of slag and fly ash. Normally all new thermal plants make their own ponds for solid waste disposal, but quite a few, especially the older one having little land space or being
in cities, cannot afford an ash pond and simply let the solid waste run into the nearby river or stream, choking the natural drainage system and despoiling the land own stream. Ultimately the fly ash finds its way into coastal plains, producing siltation and increasing flood hazards. Between 85 to 90 percent of solid waste generated in the form of bottom ash and fly ash normally collected in the nearby ash ponds, but around 10 percent is lost as fall-out from the chimneys. The fall-out increases the suspended particulate matter in the air and in many instances adversely affects the agricultural land, flora and vegetation around.

A coal based thermal plant pollutes the atmosphere by gaseous emissions of sulphur dioxide (SO$_2$), Nitrogen oxide etc., causing acid rain, to damage soil, vegetation and acquatic life of the region and also produces a tremendous amount of solid wastes, fly ash even mild acidic rain fall, characteristic of the thermal plant region due to emitted sulphurous gases, gas mobilize these metals from the particle surface and pollute the aquatic regime. A noteworthy feature of the flyash is the increased concentration of metals with a decrease in the particle size. When inhaled the 10 to 1 micron size particles are caught in the nasal mucus, 75% of which are swallowed. On reaching the stomach most of the metals could be transferred to blood plasma across the cell membrane. The residual particles being silica or mullite are refractory and inert and cause silicosis.

The first order impact of a coal-based thermal plant, manifested by acid rains, increased suspended particle matter in air, despoiling of land, choking of the drainage system etc., are amenable to technological solution by way of installation of precipitators scrubbers and provision of tall stacks, ash ponds etc. the higher order effects of a large scale entry of toxic metals into the ecosystem around a coal-based thermal plant creates genotoxic damage like teratogenic and mutagenic changes has grave implications for the survival of mankind. Besides toxic heavy metals, coal carries 0.3 to 0.5 per cent of halogens, chlorine, fluorine etc., combined with carbon atoms to generate chloro-fluorocarbons.

Every three tonnes of carbon burnt consumes eight tonnes of oxygen. That is, we are borrowing from the present oxygen reserve of the atmosphere. Power plants need large quantities of water for cooling purposes. Cold water is taken in, run through the
cooling cycle and then discharged at a higher temperature. If this water raises the ambient temperature of the water body into which it is discharged, it increases the biological growth rate and the oxygen demand while at the same time reducing oxygen diffusivity. As a result, the dissolved oxygen levels can drop drastically and directly affect biological life forms like fish spawning areas will be affected.

Power plants are preferably placed away from the human settlements and moreover on wastelands, but with course of time some of the cultivable area is also covered for ash mount site. Presence of ash particularly in the atmosphere is of major concern to the people living close to the plant site. This is particularly severe in summers due to prevailing high wind speeds. The finer fractions of fly ash are potentially harmful as they get deposited in lungs pulmonary tissues of respiratory track when inhaled.¹⁹

(viii). Modern Productive Technology:

Today the modern technologies then exceeding the high rate of rapacious exploitations of natural resources and uncontrolled development by developed countries are responsible for alarming situation of grave environment crisis and ecological disturbances all over the globe.

But still today the man equipped with a variety of skills and superior technology has ruined the natural resources without understanding the rebounding repercussions even on his own existence, huge industrial installations every year, introduction of faster mode of transport and sprouting up of large crowded cities. As a population explosion, increased urbanization and unprecedented expansion of science and technology may be said to be the basic causes and responsible for the deterioration of environment.

Technological progress has brought enormous number of chemicals into every day life. They have brought immense benefit to the society, increase food production improve heath care, eradicate deadly diseases and bestowed longer life expectancy and later standard of living. But they have also brought new dangerous, largely through the


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wastes generated in their manufacturers. Large quantity of toxic and hazards substances enter the environment every year as unwanted waste. Managing and disposing of this hazard ways properly races man kind with significant problem. It may also be noted that food production can only be sustained, if the environment is preserved, conversation is a precondition of long term food security, but threats to the environment in developing countries are very serious and things are mounting generating the resources which should be preserved as sources of pollution, deforestation and the neglect of traditional species, crops and life stock.

Man is unique in many ways and one of his ability to device new way of using resources for his well being. So long as the requirements of economic activities were small in relation to global stock of critical natural resources. However economic activities have increased at an exponential rate in the past decades and now his requirements have began to press in the physical limits of nature. The result in the prospect of serious alteration is the earth's sources and life support system. The principle manifestations of these impacts are on global climate. The intricate web of forests, ecology and diversity of living beings and increased transparency of earths atmosphere, protective sheet to harmful ultra violate radiation, all these impacts are related directly or indirectly with man's economic activity with each other. They have serious implications for his future well being.

The modern technology has entered every aspect of human society in four fields, which are i) economic field, ii) political field, iii) academic field, and iv) social field. The industrial development through the development of highly advanced and sophisticated and most efficient machines, computers and complete automation, quick and efficient exploitation of natural resources, development of quick means of transportations are related to economic field. The development of fast moving vehicles like tanks, supersonic war jet planes, ships etc., manufacture of deadly weapons such as atom and hydrogen bombs, nuclear war heads, inter continental ballistic missiles, chemical bombs etc., are related to political field. The development of computer and several types of audiovisual aids, aerial photographs and imageries etc., are related to academic field. In the similar way development of numerous types of luxury goods, such as refrigerators, innumerable
cosmetic goods, super sonic jets, air conditioners, motor cars etc., are related to social field.\textsuperscript{20}

Modern techniques have enabled the man to construct huge dams and reservoirs for the purpose of irrigation and generation of hydroelectricity which is immensely required by the industrial sector to augment the production processes and by the domestic sector to increase the comfort of human beings. Such activities create several environmental problems of greater dimensions. Large reservoirs submerge vast areas of natural forests and thus degrade the environment in the source catchments area of the concerned river. The most dangerous impact of modern technologies is the production of a host of toxic chemicals, synthetic materials and biologically non-dangerous materials. The problem if disposal of some new products of modern technologies such as plastic has become headache even for the industrially and technologically advanced countries. The most dangerous effect of modern technologies is the problem of disposal of nuclear waste materials coming out of nuclear reactor plants.

Modern technology for increasing agricultural output has also had high environmental costs. The green revolutionary technology, in particular, with its high dependence on chemical inputs and an assured water supply, while dramatically increasing outputs in the short term, has over time led to falling water tables due to the indiscriminate sinking of tube wells, waterlogged and saline soils from many large irrigation schemes, declining soil fertility with excessive fertilizer use, water pollution with pesticides, the loss of genetic variety with monoculture cultivation and the marginalization of indigenous knowledge systems.

Finally, the high energy intensive consumption patterns of the elite, the type of products consumed and the technologies used to produce them, have all contributed to the menace of environmental degradation.

\textsuperscript{20} See,"Environmental Law" by Dr. Jai Jai Ram Upadhyay, p.74, Central Law Agency (2005), Allahabad.
2.7 CONCLUSION:

The major sources of water pollution are discussed in this chapter, which are domestic sources in both rural and urban areas, industrial sources, agricultural run off and deforestation. In addition to that the Electronic Waste (E-Waste) is one of the fastest growing waste streams, with people changing their computers, television sets, and mobile phones more frequently that ever before. The government must enforce a ban on the import of E-waste for recycling and also ban the import of secondhand computers for re-use, as most of these products end up in the recycling yard.

The thermal power plant either in public or private sector mainly use coal for generation of electricity is one of the major source of pollution, the fall-out increases the suspended particulate matter in the air and affects the agricultural land, flora and vegetation around. Today, the modern technologies then exceeding the high rate of rapacious exploitations of natural resources and uncontrolled development by developed countries are responsible for alarming situation of grave environment and ecological disturbances all over the globe.