1. Humans and Environment

1.1 Population growth

The human species dates back to 3 million years ago. Until about 12,000 years ago, humans were mostly hunters and gatherers who typically moved as they needed to find enough food for survival. Since then, there have been three major cultural changes :

(1) Agricultural revolution (which began 10,000-12,000 years ago),

(2) Industrial revolution (which began about 275 years ago), and

(3) Information and globalization revolution (which began about 50 years ago).

These major cultural changes have

1. Provided much more energy and new technologies with which to alter and control more of the planet to meet our basic needs and increasing demands.
2. Allowed expansion of the human population, mostly because of increased food supplies and longer life spans.
3. Increased human environmental impact because of increased resource use, pollution and environmental degradation.

By 1st Christian Era (C.E.) there were more than 170 million human beings on earth. They had acquired enough skills and tools to manipulate the natural world and to some extent had begun to carve niches, which were entirely man-made. This led to a faster growth of population, which is indicated by an addition of more than one hundred million members to the human race, by 1000 C.E. By then various civilizations of human beings were prospering in different parts of the world, and man was ready to take a giant leap.

The next one thousand years saw unprecedented growth in human population, from around 300 million to 6000 million. The industrial revolution boosted the growth of human population tremendously. The human population increased by 2000 million in a span of just 25 years between the years 1975 and 2000.

Terms frequently used with population growth are described below :

- **Birth rate (Natality) :** The number of live births per 1000 population in a given year.
- **Death rate (Mortality) :** The number of deaths per 1000 population in a given year.
- **Growth rate :** The number of persons added or subtracted from a population in a year due to natural increase and net migration.
- **Doubling time :** The number of years required for the population of an area to double its present size given the current rate of population growth.
- **Carrying capacity :** The maximum number of individuals of a species that an area can support. Many environmentalists, however believe that there are definite limits to growth and the earth's carrying capacity. The growing population has

affected the carrying capacity of the planet eventually resulting in a number of problems like inadequate resources, standard of living, unhygienic and improper sanitation facilities etc. Today, due to population pressures and human impact, the natural elements like air, water and soil have been polluted to a great extent.

- **Ecological balance :** The fine balance that exists between living and non-living things, food webs and environmental conditions of an ecosystem.
- **Population growth rate :** The net annual percentage increase in population.
- **Exponential growth :** The growth of a quantity with time in such a way that the curve is relatively flat in the beginning, but becomes steeper and steeper with time (see fig. 1.1)

Increase in world human population over time

The Fig 1.1 shows the growth of population over time.

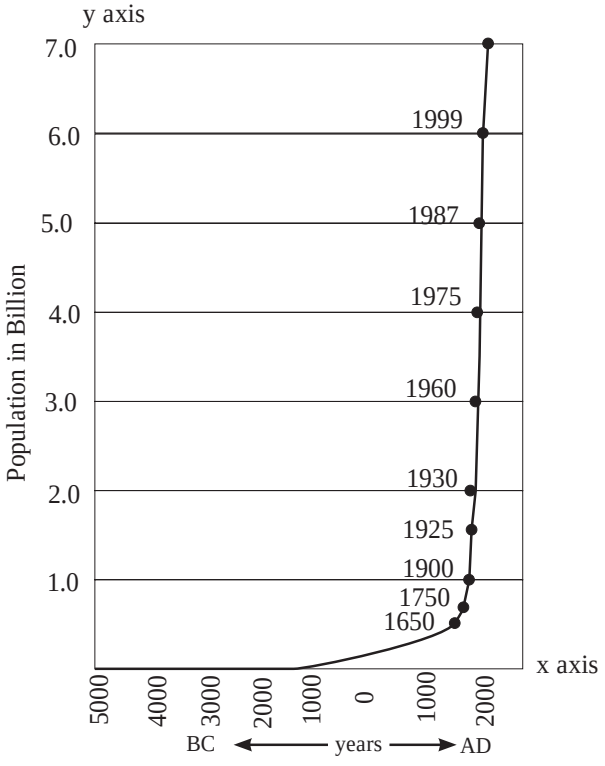


Fig 1.1 World Population Growth

It can be seen that curve was flat for a long time and from about 1650 C.E. it started spiking and became parallel to y axis.

Mathematically, this is called an exponential curve. The world population started increasing rapidly with the onset of the scientific and industrial revolution in Europe. Between 1850 and 1950 the population doubled to 2 billion. The 5 billion mark was reached in 1987 and 6 billion mark in 1999. Right now the world's population is 7.7 billon and India's population is approximately more than 1.25 billion.

Demographic Transition

There is a close relationship between population growth rate and economic development. Due to improvement in economic conditions, natality as well as mortality declined resulting in low population growth rate in developed countries. This process is known as demographic transition.

Demographic transition occurs in four stages due to development in industrialization and consequent urbanization.

1. **Pre-industrial Phase :** Harsh living conditions lead to a high birth rate (to compensate for high infant mortality) and a high death rate. Thus, there is little population growth
2. **Transitional Phase :** As Industrialization began, food production increased and health care improved. At the same time death rates dropped and birth rates remained high, so the population growth was rapid. Many countries such as India, Bolivia and Saudi Arabia were in this category.
3. **Industrial Phase :** Industrialization is wide-spread. The birth rate drops and the death rate also decreases. Reasons for this convergence of rates include better access to birth control, decline in the infant mortality rate, increased job opportunities for women

and increased investment in basic education for children and other social changes. Most developed countries are now in this third stage. This stage is characterized by sudden decline in birth rate and death rate. e.g. China and Indonesia.

4. **Post-industrial Phase** : The birth rate declined even further, equaling the death rate and thus reaching a stable population growth. Most of the European Countries are in this category.

Age and sex structure of a population in a country may be represented by age and sex pyramids through the proportion of males and females in a specific age groups

- **Population Pyramid :** The population pyramid is a plot of the number of people belonging to various age groups. Population pyramid is an important feature to understand a country's demographic situation. This information is very useful for the government to plan for improvement.

i) **Pyramid for Developing Countries :** In this type of population pyramid, there is large number of young population and the proportion of old people is less.

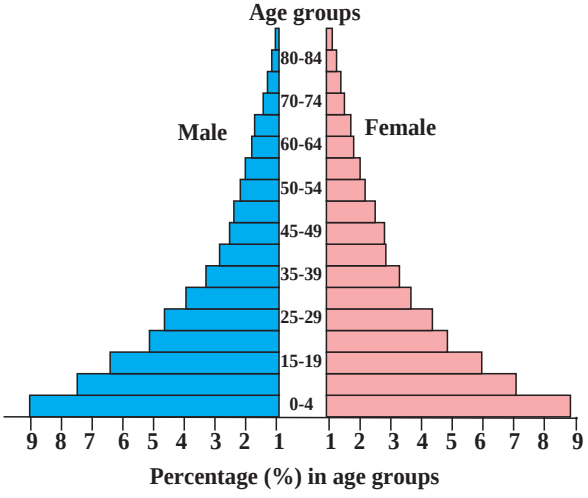


Fig 1.2 Pyramid for developing countries

ii) **Pyramid for Developed Countries :** In this type of pyramid, the birth rates and death rates are low.

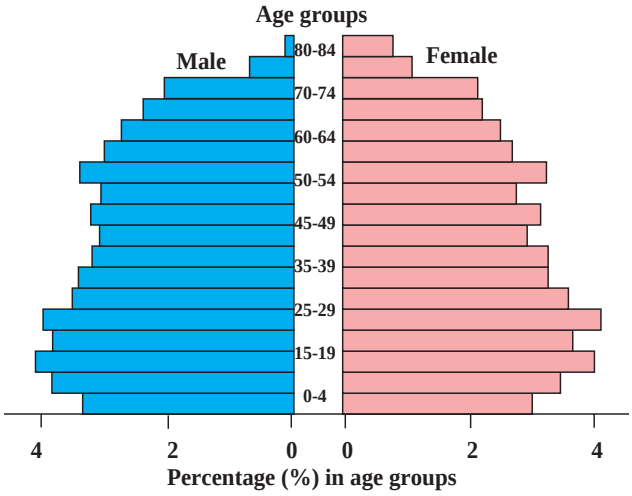


Fig 1.3 Pyramid for a developed countries

iii) **Urn shaped Population Pyramid:** In this type of pyramid, the proportion of pre-repoductive age group population is very small in comparison to people belonging to reproductive age group. This represents countries in the post industrial phase.

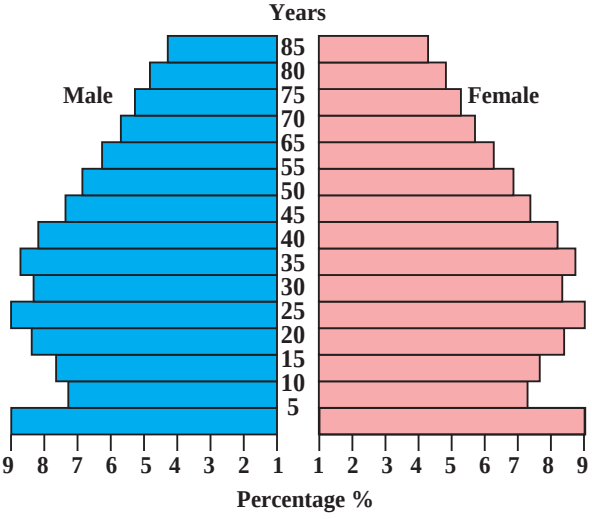


Fig 1.4 Urn shaped population pyramid

Do you know?

There is a big difference in the population growth pattern between the developing and the industrialized (developed) nations. Nearly 99 per cent of population increase takes place in developing countries. The population remains the same or even declines in the industrialized nations. By 2050, the population

of developing countries is likely to go up by 55 per cent. However, the total population of industrialized countries is expected to increase only by about 4 per cent.

Table 1.1 shows the ten most populous countries as of 2018.

Rank	Country	Population (crores)
1	China	142.8
2	India	135.3
3	US	32.7
4	Indonesia	26.8
5	Brazil	20.9
6	Pakistan	21.2
7	Russia	14.6
8	Bangladesh	16.1
9	Nigeria	19.6
10	Mexico	12.6

Source: United Nations (UN), 2018

- **Migration of people**

Migration is the movement of people from one place to another. It leads to increase/decrease in population of a place. Recently migration is becoming major issue all over the world.

- **Process of migration**
- **Emigration -** Movement of people out of certain area.
- **Immigration -** Entry of people in an area.
- **Factors affecting migrations**

Table 1.2 Factors affecting migration

Push factors	Pull factors
Unemployment and under employment	Better economic prospects
Economic underdevelopment	Higher salary and income
Low wage and salary	Better standard of living
Political instability, wars etc.	Good Governance
Disputes and conflicts	Safety and stability
Lack of freedom	Intellectual freedom
Discrimination based on religion and politics	No discrimination
Lack of medical care	Better medical care facilities

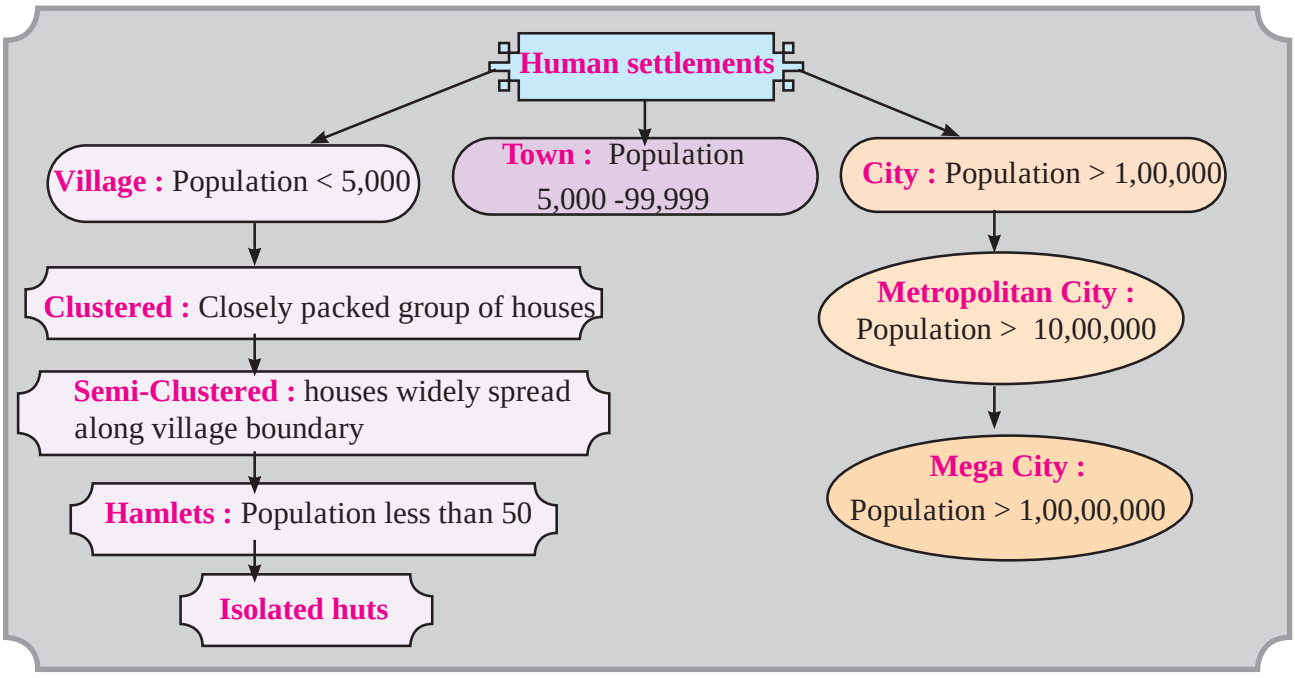
1.2 Rural and urban settlements

People build houses and develop their settlements to protect themselves from harsh weather conditions and to enjoy their social life. The physical components of settlements comprise of :

1. **Shelter :** It includes houses with different sizes, types and building materials that people make for security, privacy and protection.
2. **Infrastructure :** It includes networks such as roadways, railways, pipelines, cables; which are used for network for information, goods, water, entertainment and electricity etc.

Classification of human settlements

On the basis of the number of people and their activities, settlements are classified in two groups - rural and urban settlements in India.



Problems related to urban and rural settlements :

Urban areas have more environmental problems as compared to rural areas.

• Urban environmental problems

1. Land and Biodiversity

- Loss of cropland
- Loss of forests and grasslands
- Loss of wetlands
- Loss and fragmentation of wildlife habitats
- Increased wildlife roadkill
- Increased soil erosion

2. Human health and aesthetics of city

- Contaminated drinking water
- Environmental pollution
- Traffic congestion
- Reduction in aesthetic value of city due to waste

3. Water

- Increased surface runoff
- Increased surface water and groundwater pollution
- Decreased storage of surface water and groundwater
- Increased flooding
- Decreased natural sewage treatment

4. Energy, Air and Climate

- Increased energy use and waste
- Increased air pollution
- Increased greenhouse gas emissions
- Enhanced global warming
- Ozone depletion

5. Economic effects

- Higher taxes
- Decline of business
- Increased unemployment in city

• Rural environmental problems :

- Poor sanitation
- Conversion of farm land to residential lands
- Lack of drainage facilities
- Indiscriminate use of pesticides and fertilizers
- Salination, desertification and degradation of land.

1.3 Indigenous communities and traditions

Indigenous knowledge

Indigenous knowledge is the traditional and local knowledge held by the members of a given community. It is related to the environmental conditions of the community and enables the community to survive in those conditions. Indigenous Knowledge (IK) can be integrated in teaching, so that students can improve their awareness on environmental conservation and protection.

- Local crops that are used by the communities are protected. This helps to conserve the biodiversity in their area.
- Indigenous methods of seed storage help to conserve the genetic resources of crop plants.
- Some wild plants which serve as food crops are known to indigenous people. This helps during droughts when regular food crops cannot be grown.
- Indigenous people understand weather patterns and are therefore able to predict cyclones and storms.
- Sustainable natural resource management is driven by the beliefs and behavior of human communities and local cultures.

Tribal people not only in India but also in other parts of the world have been known for their unique cultural identities since time immemorial. They are very close to nature and know about plants and animals. Various plants and animals have religious as well as medicinal and economic importance among the whole tribal India.

Tribal people are keen to save these biological resources. Indigenous people and traditional communities have a growing interest in being more directly involved in recording, presenting and representing their own cultures to the public. They also wish to own, control and access cultural heritage materials held by cultural institutions.

Do you know?

The Warlis of Maharashtra

A group of forest tribal communities called the 'Warli's live around 100 km from Mumbai. They are a good example of the harmonious relationship that existed between many tribal communities and forests.

The 'Warli's worship forests and all of nature as the God Hirva (Green). They consider nature's produce as Hirva's gift and not as the fruit of their own labour. The 'Warli' culture conserves many plants and animals based on customs and religious beliefs. Sacred groves, which are maintained without any interference of human beings, by tradition and fear of God, are examples of 'Warli' conservation.

The 'Warli's act as the caretakers and not as exploiters of the forest. They take from the forest just enough for their immediate and basic needs. Trees are never destroyed, but twigs and dry fallen branches are collected. They cut branches only from those trees whose growth will be improved by such chopping.

The 'Warli's practice organic farming. They have evolved a complex system of multicropping, best suited to the short and irregular monsoon. They plant many traditional varieties of crops and are able to get some harvest even during droughts.

Tribal communities like the 'Warli's are now in trouble. Forest policies and displacement due to development project are changing their lives. When they leave the forest, their knowledge disappears with them!

Activity 1

- Visit your nearby vegetable market.
- Observe and indentify varieties of fruits and vegetables.
- Observe the difference between indigenous and hybrid varieties.
- Why are the indigenous varieties not cultivated on large scale as compared to hybrid varieties?
- What action is needed to conserve these local indigenous varieties?

Indigenous community practices

These include local practices of farming, natural resource conservation, environmental protection etc. which have been passed down from generation to generation.

These practices play a key role in the protection of biodiversity. A number of sacred groves thrive in India and its neighboring countries due to the efforts of the indigenous people. They practice their traditional beliefs that help them to live in harmony with nature. For example -

a) The Bishnois worship the Khejari tree and the Black Buck. The tree provides food, fodder and building material to these people.

b) Devrais in Maharashtra are the small patches of forests, conserved by local people in the name of local deities.

The indigenous people of India have played a vital role in preserving bio-diversity of several virgin forests and have conserved several flora and fauna in sacred groves of tribals.

These flora and fauna might have been disappeared from natural ecosystem. The sacred groves are the natural forests which are located in North - East, Central and Peninsular India including Maharashtra. The interference of all kind of human activities are prohibited in sacred groves.

Case studies : Beej Bachao Andolan (save the seed movement)

This movement began in the Himalayan foot-hills. The members have collected seeds of diverse crops in Garhwal. The movement has successfully conserved hundreds of local rice varieties, rajma, pulses, millets, vegetables, spices and herbs. Different varieties are being grown as an outcome of this programme in local farmer's fields. This has also been supported by local women's groups.

Activity 2

Make a group of students and prepare seed banks and seed balls of indigenous species.

Sacred groves

These are tracts of forests that are protected in the name of deity. They have religious significance and are, therefore, protected by certain local communities. Hunting, logging, grazing and collection of fire wood are usually strictly prohibited within these patches. The flora and fauna in these forest patches are worshipped by the local people.

Sacred groves play an important role as a gene bank for biodiversity conservation in many areas.

1) Some groves have ponds and streams which supply water to local communities and at the same time help to recharge ground water in the area.

2) They are considered as biodiversity areas, providing a refuge for a number of species of flora and fauna, which are otherwise affected by habitat destruction and hunting in surrounding area.

Threats to Sacred Groves in India :

Sacred groves are under threat due to -

a) Urbanization, over grazing and excessive fuel-wood collection

b) Environmental degradation by visitors to these groves who go there to perform religious practices.

c) The changing values, the cultural and religious attitude of the people, have created threats to sacred groves.

What can we do to protect the sacred groves :

- Locating sacred groves properly.
- Preparing a detailed inventory of the flora and fauna in such groves.
- Assessing the impacts of man-made activities on sacred groves.
- Assessing external threats to these groves such as cyclones, forest fires, floods etc.

Do you know?

Conservation of indigenous crops - A community movement

Seed mother, Rahibai Popre is an Indian farmer from village Kombhale, Ahmadnagar district and is a seed conservationist. She has no formal education, but she established a seed bank in her house for the conservation and revival of indigenous crop diversity.

She has conserved and muliplied about 43 'landraces' of 17 crop varities including paddy, hyacinth bean, millets, pulses, oil seeds etc.

She works with 3,500 farmers in Ahmadnagar district, sharing her traditional knowledge and experiments thus promoting agro-biodiversity. For this, she has been honoured by 'Padmashri' award.

Eco-friendly practices

- In India, eco-friendly and affordable bullock carts are used by rural folk. Such carts meet the transportation needs without any danger of greenhouse gases emissions.
- Rural women use cow-dung cakes to meet their energy requirements for cooking and heating.
- Use of insect-repellant plants, that suppress diseases and harmful pests.
- Indigenous plant materials that are more drought- and pest-resistant should be grown.
- Multi-cropping, planting of perennial crops, categorization of soil and planting of appropriate crops, planting of leguminous crops, allotting land for watershed.
- Preserving traditional seed varieties are found to be beneficial in conserving the environment.

1.4 Environment and health

Natural resources are gift to human life. Good conditions of air, water, soil and biodiversity enhances our health and wellbeing. When these resources degrade, it ultimately results into ill health, morbidity and shortening of life span.

World Health Organization (WHO) has defined, "Health as a state of complete, physical, mental and social wellbeing; not merely absence of disease or infirmity."

Unhealthy environment increases mental stress, anxieties, chances of cancer and other

diseases. It also increases the disabilities of body organs. It increases strain on physical capabilities and affects reproductive capacities also.

Industrialization and over consumerism are main causes of natural resources pollution. The destruction of natural habitat by pollution affects agriculture, animal husbandry, aquatic flora and fauna. Increasing malnutrition, poverty etc. changes environmental conditions resulting in outbreak of different diseases.

- **Water and Health**

The availability of water resources and quality of water is being degraded day-by-day in India. It results into harmful effects.

1. More than 50% of population of the country does not have access to potable water.
2. 80% diseases are water borne. Unclean and poor water conditions kill more than 13 million people per year.
3. Discharge of untreated sewage and organic load in water bodies increases chances of cholera, typhoid, diarrhea and hepatitis.
4. Different types of untreated toxic effluents, heavy metals are discharged in water by industries.
5. Leaching and seeping of agrochemicals such as pesticides, synthetic organic chemicals and persistent organic pollutants (POPs) get released in surface and ground water affecting human health.

- **Air and Health**

Air is mixture of different gases. The composition of air is altered by primary and secondary pollutants. It changes quality of air and causes harm to health of organisms and human being. Air is a movable entity, it affects global health.

Particulate matter (sizes 2.5 μm - 10 μm) (soot and dust), toxic gases and agrochemicals are responsible for degradation of air quality. It results into unwanted and unexpected situations.

1. Two weeks of office and school work was stopped in Delhi in 2018 due to air pollution.
2. More than 3 million deaths occur in India due to air pollution.
3. Inhalation of pariculate matter causes heart, respiratory and lung disorders, increased risk of cancer.
4. Global warming by green house gases increases commumicable and skin disease.
5. Vehicular pollution soot, CO_2, cause irritation of eye, nose and increased asthmatic condition and bronchitis.
6. Smog results in respiratory diseases, decreasing visibility and taking lives in accidents.
7. Congested overcrowded and unhygienic conditions increase microbial growth and air borne diseases such as T.B., pneumonia, polio, whooping cough etc in children.

The basic necessity of life is pure air. If its quality is degraded, it hits life of all organisms

Case study: Delhi pollution

It was in October 2016, Delhi faced one of its worst smog episodes. The Particulate Matter (PM) 2.5 levels rose to 750 micrograms/cubic mm; that is 12 times the permissible level. Very poor visibility, cancellation of flights, school closure were few of the features of this incidence. The smog is made up of particles and toxic chemicals. Merely breathing in this air was

like smoking 50 cigarettes in a day. Indian government declared this situation as an emergency.

As a part of the action plan, Delhi government planned to shift all petrol and diesel vehicles to clean fuels like compressed natural gas (CNG). It was the first time in India that CNG was introduced for public transport effectively. Delhi government also moved highly polluting industries out of Delhi region.

Burning of crop residues also intensified during the years between 2010 to 2019. Multiple new settlements and construction activities boomed. The population of Delhi and National Capital Region (NCR) increased from 16.6 million in 2001 to 46.1 million in 2011. The measures adopted to control air pollution mainly related to monitoring during this period were noteworthy.

Delhi government took steps to curb the number of private vehicles. The popular 'Odd – Even 'measure of private vehicles having odd vehicle numbers on odd dates and even numbers on even dates; was intended to reduce vehicular emission and traffic congestion. This lead to city wide discussion on air pollution and its sources. There were further restrictions brought e.g. ban on diesel generator sets in Delhi, the closure of brick kilns, stone crushers across NCR, and shut down of Badrapur power plant in winter were some of the steps taken after 2016 smog. Presently medium to long term measures are planned for pollution control with a detailed timeline for its implementation.

- **Soil and Health**

Health is deteriorated due to contaminated food which results due to inappropriate agricultural practices.

Non-biodegradable compounds, chemicals, POPs are entering in food and food chain resulting their bio magnification. Consumption of such contaminated food disturbs the various systems of the body causing diseases such as cancer and infertility.

Biomedical wastes added to soil, affect soil flora and fauna. Radioactive products, heavy metals mixed by e-waste, chemical waste causes various diseases in plants, animals and humans.

- **Radioactivity and Health**

Nuclear tests, the warfare in countries and accidents in radioactive nuclear plants destroy environment in that area.

Uranium - 235, Strontium - 90, Iodine - 131, Cesium - 137 are major radioactive pollutants released in the environment due to different activities.

Accumulation of radionuclides in human tissues leads to cancer, gene mutation, which also results in birth of abnormal babies with malformed organs.

1.5 Right to live, human rights and value education

- **Environmental ethics**

It studies the relation of human beings with the environment. It believes that humans are part of the environment along with other living creatures. It is important to understand that the health of humans is closely linked to ecosystem health.

Guiding Principles of Environmental Ethics

1. All species have equal right to all resources and also have right to compete for equal opportunities and comfort.
2. The right of the environment should take precedence over the right of individual as it is linked to the welfare of entire life.

• Right to Live

The different types of pollution are deteriorating environment. Some species have become endangered and few have become extinct due to loss of aquatic and terrestrial habitats. They are struggling for proper environment. Do they have right to live on earth or Not? Man is not only harvester of natural environment, he is one of the species amongst millions of species. All the creatures of nature have equal right to live and cherish it for whole span of life. Humans must realize and admit that they can not live on earth alone. All other biodiversity is the support system for them. So we need to think about rights of nature. We must accept these rights i.e. all organisms have right to live in a peaceful, good and clean environment, compassion to life and with, equal right to natural resources. We must think about right to biodiversity, right to protect culture of the creature. This will help to sustain the environment.

• Human Rights and Environment

United Nation (UN) has linked Human Rights and Environment in 1994 draft. It described to accept the rights of everyone to secure healthy and ecologically sound environment.

1. Human rights to healthy, safe and secure environment. It must be free from pollution and degradation of air, water and other environmental resources.
2. Right to enjoy natural ecosystems and their rich biodiversity in just and equitable manner.
3. Right of humans to lead dignified life and legitimate needs.
4. Right to take environmental information, education, participation in environmental discussion and create awareness.
5. Right of future generations to fulfill their own needs.

Do you know?

United Nations (UN) also mentioned the duties of human beings to cherish proper human rights such as -

1. Protection of environment.
2. Preservation of good status of environment.
3. Prevention of environmental harm.
4. Accept thresholds / limits of use of nature and natural resources.

• Value Education

Ancient India had developed values in human being by family and Gurukul education. The value education is the process of learning life principles which decides virtues of a person in the family and the society.

The character of a person is developed by having values like evironmental ethics, natural principles, truthfulness, honesty, peace, non-violence, integrity, righteousness, civic sense, respect to all nature's laws. The Indian constitution added more values as sovereighty, secularism, socialism, democracy, republican character, equal justice, unity, integrity of nation and dignity of all individuals.

Value education in reference to environment is expected to bring about a thinking for

sustainable lifestyle for everyone in the society . Environmental values need to be inculcated through a process of appreciating our environmental assets and act for conservation of these assets. We consider economic growth as most important and this mindset must change and everyone should think and act for sustainable development.

Every human being should have feelings and respect for different aspects of his or her surroundings. The values for the resources of nature should not be only utilitarian importance alone. The true environmental values go beyond valuing a river for its water, a forest for its timber and other resources , or the sea for its fish. Environmental values should have a feeling to bring about sensitivity for preserving nature as a whole. Our environmental values should have pro-conservation actions in day-to-day activities. Most of our actions have adverse environmental impacts unless we consciously avoid them.

Values lead to a process of decision making which leads to action. For value education in relation to the environment, this process is learned by an understanding and appreciation of nature's oneness and the importance of its conservation.

With the small human population in the past, throwing away a little household degradable garbage could not have been considered wrong. But with enormous numbers of people throwing away large quantities of non-degradable waste, it is indeed extremely damaging to the environment and our value system must prevent all this through a strong environmental value education system.

Appreciating the negative effects of our actions on the environment must become a part of our day-to-day thinking. While we do need economic development, our value system must change to one that makes people everywhere support a sustainable form of development so that we do not have to bear the cost of environmental degradation.

Each action by an individual must be linked to its environmental consequences in his/her mind, so that a value is created that strengthens pro-environmental behaviour and prevents anti-environmental actions. This cannot happen unless new educational processes are created that provide value education right from an early age.

At the community level, this occurs only when a critical number of people become environmentally conscious so that they constitute a pro-environment lobbying force that makes governments and other people accept good environmental behaviour as an important part of development.

Environmental values are linked to varied environmental concerns. While we value resources that we use as food, water and other products, there are also environmental services that we must appreciate. These include nature's mechanisms in cleaning up air by removal of carbon dioxide and addition of oxygen by plant life, recycling water through the water cycle of nature and maintaining climate regimes.

However, there are other aesthetic, ethical values that are equally important aspects of our environment that we do not appreciate consciously. The tiger's magnificence, the whale and elephant's giant size, , the graceful flight of a flock of cranes, are all parts of nature that we admire. The lush evergreen forest, the great power of the ocean's waves, and the tranquility of the Himalayan mountains are things that each of us value even if we do not experience it ourselves. We value its being there on earth for us. This is called its 'existence value'.

Environmental values must also stress on the importance of preserving ancient structures. The characteristic architecture, sculpture, artworks and crafts of ancient cultures are invaluable environmental assets. Unless we learn to value these landscapes and preserve them , they will disappear and our heritage will be lost.

Apart from valuing the diversity of life itself, we must also learn to value and respect diverse human cultures. Many of the tribal cultures of our country are vanishing and along with them the traditional knowledge that they have.

The equitable use of resources is an essential aspect of human well-being and must become a part of all socially and environmentally conscious individuals. Our environment has a major component that does not belong to any one individual. There are several commonly owned resources that all of us use as a community. The rivers, lakes ec are common property resources and they need to be protected and conserved for the society.

Exercise for Journal Assignment

1) Explain various factors, responsible for migration of peple.
2) Explain the importance of sacred groves.
3) Write down the eco friendly practices that you can follow in your day-to-day life.
4) How the population pyramid explains demography of a country?
5) What are different environmental factors, that affect human health?
6) Explain environmental ethics with the help of an example.
7) Suggest major improvements for sustainable future of human and environment.
8) Explain environmental problems of your locality.