

**19**

## CONCEPT OF SUSTAINABLE DEVELOPMENT

Humans have made a very impressive economic progress, specially during the past two centuries, in creating material and luxuries of life style. This progress has been achieved at a tremendous cost to the environment. Ever increasing exploitation of natural resources coupled with environmental degradation has reached a point that now threatens the well being and future of mankind. Environmentalist and even the common man around the world are seeking answers to these question like - can we keep up industrial and economic development without depleting or degrading our natural resources? Can forests be cleared endlessly for cultivation and habitation? Can agricultural land be regularly used up for building, cities, factories and shopping malls? Can intensive farming be carried out through the year? Can fossil fuels be pumped out in a never-ending manner? How long can our natural resources last at the increasing rate of exploitation and consumption? The answer to these questions will explain the “concept of sustainable development”. In this lesson we shall learn about the concept of sustainable development.



### OBJECTIVES

After completing this lesson, you will be able to:

- *explain the origin and concept of sustainable development;*
- *explain the concept of carrying capacity;*
- *distinguish between common and private resources;*
- *bring out the relationship between population growth and resource availability;*
- *describe the consequence of inequitable and exhortative use of resources;*
- *justify the need to conserve and manage resources for posterity;*
- *explain the need for just equitable sharing of resources; and*
- *justify the need for development without destruction.*

**Notes****19.1 ORIGIN OF THE CONCEPT OF SUSTAINABLE DEVELOPMENT**

In United Nations Conference on Environment and Development (the “Earth Summit”) held in Rio de Janeiro in year 1992, the world leaders signed Framework Convention on Climate Change and Biological Diversity. The “Rio Summit” adopted *Rio Declaration* for achieving *Sustainable Development* in the 21<sup>st</sup> Century. It is here that the concept originated.

**19.2 CARRYING CAPACITY CONCEPT**

Development requires resources for the production of goods and services. The resources are basically provided by nature and thus known as natural resources. We must learn to respect nature and use the resources in a judicious and responsible manner, failing which we will deprive our future generations from these natural resources thereby endangering their life on this planet.

Population growth coupled with unplanned and ruthless exploitation of natural resources in the name of development is the root cause of our present state of environment.

Economic development is absolutely necessary for the welfare of people even though it causes damage and destruction of our environment. With economic development increasing use of natural resources is inevitable. Also with the increasing population these are bound to be tremendous increase in the use of resources. But the million dollar question is how do we use our resources? Can we use them so efficiently that we are able to conserve them, save them, use alternate and non-conventional resources and allow them (resources) to regenerate so that we do not run out of their stock? We have to hand over the earth with its environment clean and intact to our future generations. We owe this responsibility to them. So it is binding in us not to exploit our environment beyond its **carrying capacity**.

The concept of carrying capacity will become clear, by using the familiar example of any transport vehicle like a car or a bus. What is the carrying capacity of a car? It is the maximum number of people, it can carry without breaking down in the middle of a journey. If the number of passenger or people travelling in a car become more than its capacity to carry, then it would run slowly and may even break down in the middle of the road. Thus carrying capacity is the maximum pressure or load that a system can with stand before breaking down.

Similarly environment also has a capacity to bear the pressure of continual use. Its carrying capacity would be in terms of maximum amount of natural resources drawn from it and maximum amount of pollution discharged into it. If too much resources are extracted or used up than it can afford to give or too much pollutants are discharged into it than it can absorb, then it is severely damaged. Once damaged and destroyed beyond repair, it loses its ability to get back to its pure or usable or harmless state. Thus the carrying capacity of



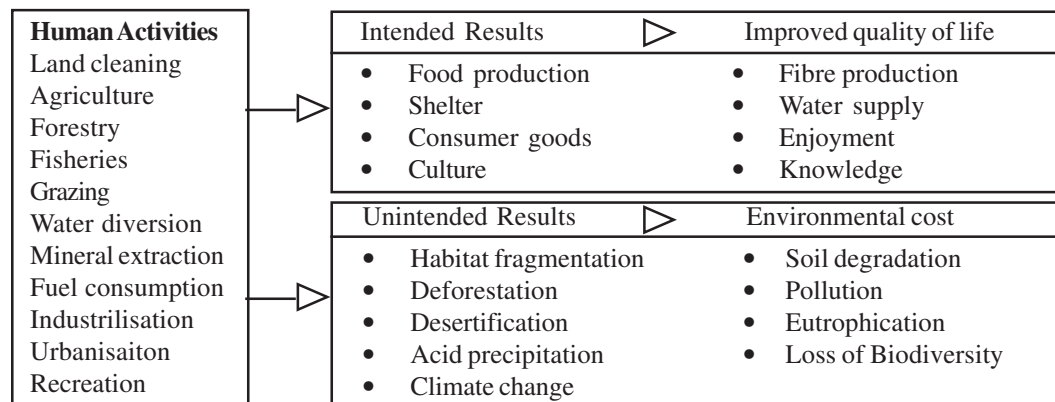
the environment may be defined as maximum load or pressure or use that the environment can withstand by economic or other human activities. Nature is finite and we have almost reached a critical point beyond which ecological decline would lead to disaster.

### 19.3 SUSTAINABLE DEVELOPMENT

Human greed must be controlled and human wants and needs must be restricted. We must treat our environment and resources with respect and stop their reckless exploitation of natural resources.

Sustainable development emphasizes that rate of consumption and use of natural resources must balance. The rate at which these resources can be either substituted or replaced. Economic and industrial development must go on in such a way that no irreparable damage be done to the environment. The World Commission on Environment and development defined sustainable development as **“Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.”**

This definition emphasizes two important points. **One**, the natural resources are important for our present day survival as for the survival of our future generations. **Two**, any present developmental activity or programme must take into account, its future consequences. The main cause of unsustainability is in ever increasing human population and over exploitation of resources. In developing countries, resource exploitation occurs mainly to meet the needs of human population for food, fodder, fuel, wood and shelter. Human activities affect the sustainability of biosphere. The various human activities meant to improve the quality of life are usually accompanied by environmental degradation. Such activities as overfishing, agriculture, over use of fresh water supply, deforestation and industrialization cause environmental degradation and social stress because of negative changes in the ecosystem.



*Fig. 19.1: Human activities affecting sustainability of the biosphere (based on Lubchenco et. al. 1991)*



**Notes**

Mahatma Gandhi’s principle of “enoughness” in his saying “the earth provides enough to satisfy every persons need but not for every person’s greed” is perhaps more relevant at present time than when it was said. We have been bitten by the bug “consumerisms”. We desperately want to possess all the goods and services, no matter what environmental price we have to pay for that. We must check our personal greed at some stage in life and promote a “community greed of providing a beautiful life for our posterity”.

An environmentally sustainable society meets the current needs of its people for food, clean air, clean water, shelter and other basic resources without compromising the ability of future generation to meet their needs.

**A Case Study**

A brazilian named Chico (born in 1944) lived happily in the rainforest of Amazon basin. His main income was from a hundred wild rubber trees, which he inherited from his father. He used to slash the trees carefully to collect the latex (rubber) taking care not to damage the trees. He used to collect nuts, fruits and other natural products from the forest. Soon land speculators and big ranching companies came in and made a quick profit by cutting down valuable trees to convert the forest to cattle pasture. Without any tree cover, the pasture land became vulnerable and heavy rains washed away nutrients from the soil making the soil so poor in nutrients that grasses stopped growing and could not support even a single cow. Brazil government came in and built highway in the cleared forest area with the help of international funds. Chico and other resisted this, went to higher government bodies and made the government declare this part of the forest as reserved and protected. But ultimately Chico was shot dead in 1988 by people of the ranch owners. Politics, economics and world trade played a role.



**INTEXT QUESTIONS 19.1**

1. Define sustainable development.  
\_\_\_\_\_
2. What are the two important factors or points that sustainable development should consider?  
\_\_\_\_\_
3. What did Mahatma Gandhi say about ‘enoughness’?  
\_\_\_\_\_
4. What do you understand about the ‘carrying capacity’ of the environment?  
\_\_\_\_\_

### 19.3 RELATIONSHIP BETWEEN POPULATION GROWTH AND RESOURCE AVAILABILITY



Notes

Rapid population growth coupled with demand of man for material comforts has put tremendous pressure on mother earth and its environment. In India human population has already crossed one billion. In a very short history of earth, humans and their activities are having significant impact on the natural dynamics of the earth system.

The various human activities such as food production, industrial development, international commerce, energy production and urbanization are transforming the earth system at various scales ranging from local to global. The destructive influence of some agricultural and animal husbandry practices on unsuitable land, the destruction of tropical rain forests and destruction of some ocean fisheries are all caused directly and indirectly, by human population growth pressure.

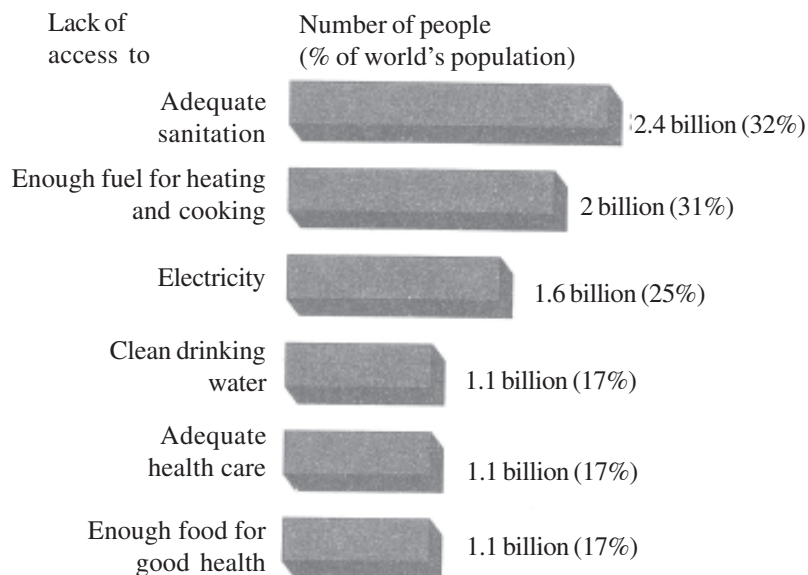
Human population and economic wealth of people (especially in the developed countries) have significantly increased the degradation of natural resources and threatened biodiversity. Thus the main cause of unsustainability is ever increasing human population which naturally leads to over exploitation of resources. With increasing human population leading to human domination on earth's ecosystem, natural resources are declining both in quantity and quality on global scale.

- Nearly half of the earth's surface has been transformed by human activities such as agriculture, industry, housing and commerce.
- Recent studies indicate that nearly 50% of natural vegetation on land has been transformed for developing crop lands, pastures, plantations and urban areas.
- Presently, all accessible fresh water and underground water resources are in a state of depletion in many areas.
- The aquatic environment and its productivity are also on the decline. Marine fisheries are being over exploited, world's coral reefs and fisheries are at risk from the adverse impact of human activities.
- During the last 15 years, the global ocean has lost more than 90% of predatory fishes due to intensive fishing technologies.
- Land is a precious resource which humans have used to produce various goods and services. There are diverse ways in which land has been exploited and altered. Land is being used for urban industrial purposes and for building houses, agricultural land for crops and grazing. Even pure and primitive remote forest areas have been changed by humans interference and exploitation of human beings.
- The most dangerous consequence of population explosion is poverty. Poverty is a major threat to human health and environment. Many of world's poor do not have access to the basic necessities, and lack of health, education facilities, productive and decent life (Fig 19.2 harmful results of poverty).



**Notes**

Their daily lives are focused on getting enough food, water and fuel to survive. Desperate for land to grow enough food and degrade forests, soil, grasslands and wildlife for short term survival. Poverty and environmental pollution are interlinked. Poor people often have many children as a form of economic security.



*Fig. 19.2: Natural capital degradations. Some harmful result of poverty (data from United Nations, World Bank and World Health Organization)*

**19.4 COMMON AND PRIVATE RESOURCES**

Resource is anything useful or can be made useful to humans to meet their needs and wants. Resources that are freely available to everyone and belongs to no one in particular that is every body's property is no body's property and hence one feels that it can be damaged and degraded. Thus common properties are prone to over exploitation. One of the major causes of environmental degradation is the over use of common property or free access to resources. No one owns these resources and they are available to users at little or no charge. Examples include, air, water, land, forests, oceans, rivers, mountains, migratory birds and wild life. Similarly roads, streets, gardens, parks, our heritage monuments are also public properties and we are generally apathetic and careless towards them or for their maintenance.

Privately owned industries, agricultural land, houses, buildings, offices, gardens etc. are cared for and looked after by the owners. Most of them are beautifully maintained. A change of mindset is needed to care for natural resources. Some examples will illustrate the problems faced by some of our common and public resources.



Notes

- Air is a precious resource and no one holds its ownership. As a result we have given ourselves the liberty to pollute the air in various ways like burning of wood, coal, garbage and dry leaves, emission of diesel and petrol fumes from automobile exhausts and release of harmful emission from industries.
- Nobody owns a sea and thus everybody has a right to harvest deep sea animals including fishes. One can send any number of trawlers for deep sea fishing which lead to over exploitation of endangering precious marine life like coral reefs, turtles etc. Common ownership of oceans makes it inexpensive for cities freely dump their waste in oceans and nobody feels responsible for polluting the oceans.
- Rivers are common property resource and they belong to no one in particular. All kinds of wastes including municipal wastes and industrial effluents are poured into them; hundreds of idols are immersed into the river after worshipping them. Many years of abuse has converted many rivers into dirty drains.
- Forests are our common property. Economics and politics are main causes of tropical deforestation and degradation. Poverty drives landless poor to tropical forests, where they try to grow enough food to survive. Government of Indonesia, Mexico and Brazil encourage the poor to colonize tropical forests by giving them ownership of land that they clear. This practice can help to reduce poverty but may lead to environmental degradation, unless the new settlers are taught how to use such forests more sustainable. Common ownership properties such as parks, roads and streets are littered and misused without any remorse. Degradation of common resources undermines the quality of life and affects all of us.

Thus apathetic and careless attitude towards resources which are available to all free of cost, must change. Each one of us must care for the common resources as much one cares for his own possessions.



**INTEXT QUESTIONS 19.2**

1. Name one major cause of environmental degradation and name six such common resources.  
\_\_\_\_\_
2. What is the most dangerous result of population explosion?  
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3. Name an important common property of your locality, state or city which has been completely damaged leading to water crisis to its people.  
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\_\_\_\_\_



**Notes**

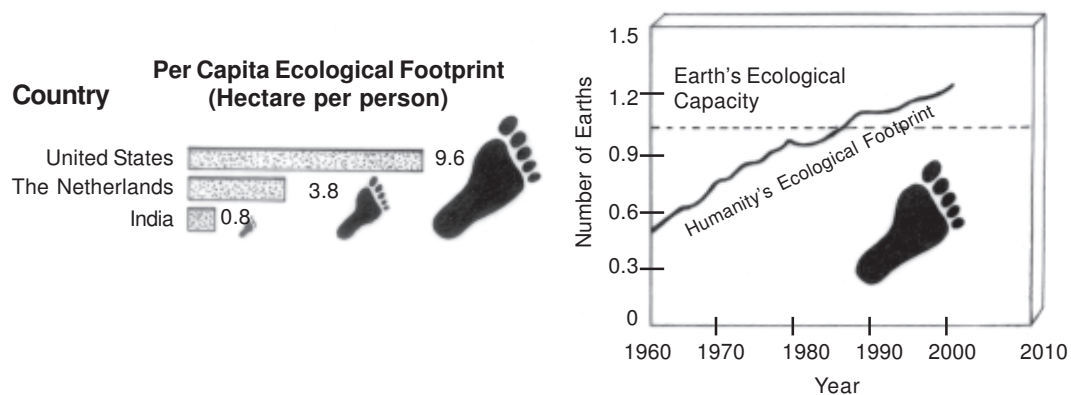
### 19.5 CONSEQUENCES OF INEQUITABLE (UNFAIR, UNJUST) AND EXHORTATIVE USE OF RESOURCES

These resources can be broadly classified into three categories namely perpetual (sunlight, winds and flowing water), renewable (such as fresh air and water, soils, forest products and food crops) and non-renewable (such as fossil fuel, metals and sand).

Solar energy, fresh air, wind, fresh surface water, fertile soil and wild edible plants are directly available for use. Solar energy represents perpetual resource, winds and flowing water indirect form of solar energy is renewed continuously. The solar energy is expected to last as long as the sun remains shining.

Other resources such as petroleum (oil), iron, ground water (water found underground) and cultivated crops are not directly available. These types of resources can be derived only after making considerable efforts and use of appropriate technology. For example, petroleum has to be drilled out, refined and processed then only the petroleum products can be made available for distribution in the market. In such cases, resources are obtained by an interaction between natural capital (natural resource) and human capital.

Renewable resources can be replenished fairly rapidly (hours to several decades) through natural processes as long they are not used up faster than they are replaced. Examples include forests, grasslands, wild animals, fresh water, fresh air and fertile soil. Our ecological foot prints –the amount of biologically productive area of the earth needed to produce the required resources as well as to absorb the wastes produced from such resources use.



**Fig. 19.3:** Natural capital use and degradation: Relative per capita ecological footprints of the United States, Netherlands and, India. (Left) By 2001, Humanity's ecological footprint was about 21% higher than the earth's ecological capacity.(right) (Data from World Wide Fund for Nature, UN Environmental Programme, and Global Footprint Network)

The numbers shown in the Fig. 19.3 show relative differences in resource use and waste production by different countries and geographical areas.





Humanity's ecological footprint exceeds the earth's ecological capacity to replenish its renewable resources and absorbs the waste. Humanity is consuming the renewable resources faster than the earth can renew them.

The ecological footprint of most people in developed countries is large because of their significantly high consumption of renewable resources.

According to the developers of ecological foot print concept- it would take the land area of about "four more planet earths" for the rest of the world to reach U.S. levels of consumption with existing technology.

### 19.5.1 Sharing of resources

There is a big scope of equitable (fair and just) sharing of resources. Ecological foot print data (Fig. 19.3) as well as the above description clearly demonstrate, the fact that there is inequitable sharing of resources in the world today. The result is that the developing and under developed parts of the world live in a state of deprivation and poverty.

When the resources are available in plenty one tends to use them generously without any consideration for others. Resources must be used wisely and judiciously. Responsibility lies with the have to make sure that enough resources are available to the have nots.

It is found that 20% of world population of developed countries use 80% resources of the world.

## 19.6 NEED TO CONSERVE AND MANAGE RESOURCES FOR POSTERITY

Natural resources are goods and services supplied by our environment. Earlier when people lived at subsistence level the exploitation of resources was limited to local scale but now spatial scale have become much larger, much beyond the local scale.

Tree bark (e.g. Taxus), forest fruits, resin, plant dyes, pulp for hand made papers, roots of many inconspicuous species of a region, lichens, all being commercially harvested and are marketed at distant places. Human beings have begun to degrade all kinds of natural resources because of increasing demand of the growing population, use of technology for resource use as well as increase in per capita resource consumption.

According to a world report, the global consumer class, mostly living in developing countries also increasing at a very high rate. Consumer and consumerisms is increasing at a very high rate therefore it becomes all the more necessary to conserve resources for posterity.

For the survival and well being of the human race biodiversity plays a very important role in controlling the stability and functioning of the ecosystem. Human activities and

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environmental degradation is resulting in fast depletion of biodiversity which is a matter of great worry and concern because we do not know what wealth we have and what we are losing biodiversity because it represents potential source of wealth in the form of (a) new crops; (b) medicinal plant; (c) petroleum substitutes (d) biocides and other products.

Organisms are required for proper functioning of the earth's ecosystems. Loss of biodiversity would check or stop the process of evolution and production of newer types of organisms cope up with the changed environmental situation.

Biologically rich unique habitats are being destroyed and degraded due to by increasing human population, resource consumption and pollution. Biodiversity loss is new world's most disturbing concern. May be we are losing plants which would give us relief from diseases like cancer and HIV. We need to save biodiversity for our posterity so that they are able to derive countless direct and indirect benefits from the living world. The ecosystems like forest, deserts, grasslands, oceans, seas must be kept intact and health for our future generations. They should have a chance to use the biodiversity as a source of food, medicine, fibres, timber which are already in use and also have a chance to get newer plants and animals which came continuously evolving for meeting their demands for survival.

Wild varieties of cultivated or commercial species have many good genes which can be used to improve the crops for cultivating in different areas for different uses e.g. wild plants have in them natural defense mechanisms (genes for killing diseases, germs and pests) i.e. disease resistant genes. Degradation of soil, air and water by human activities lead to damage of these resources which ultimately affect the various ecosystems. Which form the habitat of all organisms on earth including humans. We are not saving the habitats for other organisms on earth, let us not forget we are part of this ecosystem and it is our responsibility to check our activities to save the earth.

Environmental degradation means depletion or destruction of potentially renewable resource such as soil, grassland, forest or wildlife that is used faster than it is naturally replenished. If such use continues, the resource becomes non renewable (at least in our life time) or non existent (extinct). Thus our effort should be to use potentially renewable resources without reducing its available supply throughout the world or a in a particular area.

We must work towards development of a sustainable society that manages its economy and population size without doing irreparable environmental harm or damage by overloading, earth's ability to absorb environmental in and outs, replenish its resources and sustain human and other form of life for a long period of life (hundreds to thousands of years) During this period, the society should satisfy the needs of its people without depleting natural resources and thereby endangering the prospects of current and future generations of humans and other species.

We are ethically and morally responsible to care and manage the earth. Actually the earth does not need us managing it to go on where we do need the earth to survive.



We wrongly assume that we now have or can gain enough knowledge to become effective managers of the earth. We do not know how many species live on the earth, much less what their roles are and how they interact with one another their nonliving environment.

When we use the earth's natural resources we are borrowing from the earth and from future generation and have a moral responsibility to pay the debt by leaving the earth in atleast as good a condition as we now enjoy. Infact in all our activities we must consider the impact or effect of our decisions on the next seven generations.

### 19.7 DEVELOPMENT WITHOUT DESTRUCTION

The damage and destruction of the environment is so clearly visible now as never before. We see bald and barren slopes of mountains once covered by green forests, we find rivers choked with muddy water and garbage, we grasp for breath in the polluted air, we are incapable of handling our wastes and pay the price through our health.

In short we have damaged and destroyed our environment in the name of development. There is very little time left for talking and discussing the matter, we have to do and act now to recover the lost environment and conserve the natural resources.

#### Some steps in that direction are:

- adoption of energy and resource saving methods;
- new technology for minimization of wastes and toxins;
- biodegradable, renewable and recyclable products;
- education and awareness about environment in people.

#### Environmental problems must be approached at all three levels:

- Immediate local problems like water pollution and waste management can be taken up at community level.
- Regional problems like acid rain, floods, air pollution and deforestation can be dealt with at national or regional level.
- Global issues like climate change, depletion of ozone layer and the associated problems should involve world bodies for the participating of the nation around the world.

#### Think globally and act locally

Any environmental problem either local or regional can become a gigantic global issue if not addressed in time. If communities address their local problem (issues) then bigger problems get solved. Thus our motto should be think globally and act locally.

**Notes****The least we can do**

Each one of us can play our role, as a responsible member of the society to conserve the resources and protect or save the environment.

**Conserve fossil fuels**

- Switch off fans and lights when not needed.
- Let the breeze in by switching off the air-conditioning.
- Avoid the use of electrical gadgets as much as possible.

**Conserve water**

- Use only as much as you need.
- Repair leaking taps and pipes.
- Do not pollute water bodies like rivers, lakes, canals etc.
- Do not wash your cars everyday.
- Harvest rain water.
- Join river cleaning programmes like “Yamuna Bachao Andolan”.

**Save the trees**

- Reduce use of paper and paper products.
- Recycle used papers.
- Make full use of writing papers.
- Plant trees and care for trees.

**Keep the air clean**

- Stop smoking.
- Do not burn papers, dry leaves and other wastes.
- Drive vehicles with a catalytic converter.
- Keep your vehicle well maintained.
- Implement pollution control and treatment facilities in your factory.

**Reduce garbage**

- Buy goods with less/recyclable packaging.
- Reuse/recycle paper, metal, glass, plastic items.
- Carry your own shopping bag and say not to plastic bags.



- Convert kitchen and garden waste into compost.
- Use natural products for cleaning, fertilizing and getting rid of bugs and insects.

### Spread awareness

- Show your family and friends how to be eco-friendly or environment friendly.
- Support environmental issues like cleaning of rivers, cleaning of air etc.
- Write to government representatives demanding action on environmental issues.
- Set an example by following eco-friendly life style.



### INTEXT QUESTIONS 19.3

1. How does biodiversity represent potential source of health?  
\_\_\_\_\_
2. “Biodiversity loss is world’s most disturbing concern”. Because we do not know what we are losing” briefly explain the statement.  
\_\_\_\_\_
3. What are the main causes of biodiversity destruction? Mention any two.  
\_\_\_\_\_



### WHAT YOU HAVE LEARNT

- Economic development is necessary for the welfare of people but it should not be at the cost of environmental degradation.
- Carrying capacity is the maximum pressure or load that a system can withstand or take up before breaking down.
- Carrying capacity of the environment may be defined as maximum use of human activities that the environment can tolerate.
- Sustainable development is “development that meets the needs of the present taking care of the needs of future generations”.
- Human activities like agriculture, industrialization etc. affect sustainability of biosphere.
- Human activities meant to improve the quality of life are usually accompanied by environmental degradation.
- Rapid growth of population coupled with demand and needs of man for material comforts has put tremendous pressure on earth and its environment.

## MODULE - 6

### Sustainable Development



#### Notes

## Environmental Science Senior Secondary Course

- Most dangerous consequence of population is poverty. Poverty is a major threat to human health and environment.
- One method of eliminating poverty is by taking care of equitable i.e. far and just distribution of resources.
- Resource is anything useful or can be made useful to humans to meet their needs and wants.
- Resources that belong to no one in particular become common property. Examples air, water, rivers, forest, oceans, mountains etc.
- People are apathetic and careless for them or their maintenance.
- Each of us must treat the common natural resources with same amount of care as one treats the personal things.
- Privately owned industries, agricultural land, houses, building, offices, gardens etc. are cared for and looked after by the owners.
- Ecological foot print is a measure of area of earth required per person (to produce resources) and waste production.
- Ecological foot print of most people in developed countries is large because of the half amount of consumption of natural resources.
- There is need to conserve and manage the resources for posterity.
- In order to improve the environment it is important to act and encourage other for conservation of natural resources.



#### TERMINAL EXERCISE

1. Define and explain carrying capacity of environment.
2. “Economic and industrial development without damage and destruction of the environment.” What do you call this type of development?
3. What did Mahatma Gandhi say about the use of earth’s resources by its people?
4. Increase in human population is causing decline in natural resources on a global scale. Mention any three causes.
5. What is the difference between common and private properties? Give two examples for each.
6. Define a resource. Name one perpetual resource, a renewable resource and one non-renewable resource.
7. What is ecological foot-print?



8. Name three major environmental damages that have already occurred in our country.
9. Suggest any three methods to record damaged environment.
10. Suggest any five methods to conserve water.



## ANSWER TO INTEXT QUESTIONS

### 19.1

1. Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.
2. The two factors are :
  - i. the natural resources are important for our present day survival as far as the survival of future generations;
  - ii. any present developmental programme must take into account, its future consequences.
3. The earth provides enough for every person's need but not for every person's greed.
4. Environment has a capacity to bear the pressure of continual use, that is the maximum amount of natural resource drawn from it and the maximum amount of pollution discharged into it.

### 19.2

1. Over use or over exploitation of common property or free access of resources like air, water, land, forest, rivers, mountains.
2. Poverty is the most dangerous result of population explosion.
3. River Yamuna has been exploited in such a way that it has ceased to exist. It has turned into a dirty drain.

### 19.3

1. Wealth in the form of (a) new crops (b) medicinal plants (c) petroleum substitute or any other (any two)
2. May be we are losing useful plants, animals or other organisms, which would have provided us medicine against HIV and cancer etc.
3. Main causes of degradation are- increasing human resource consumption and pollution.