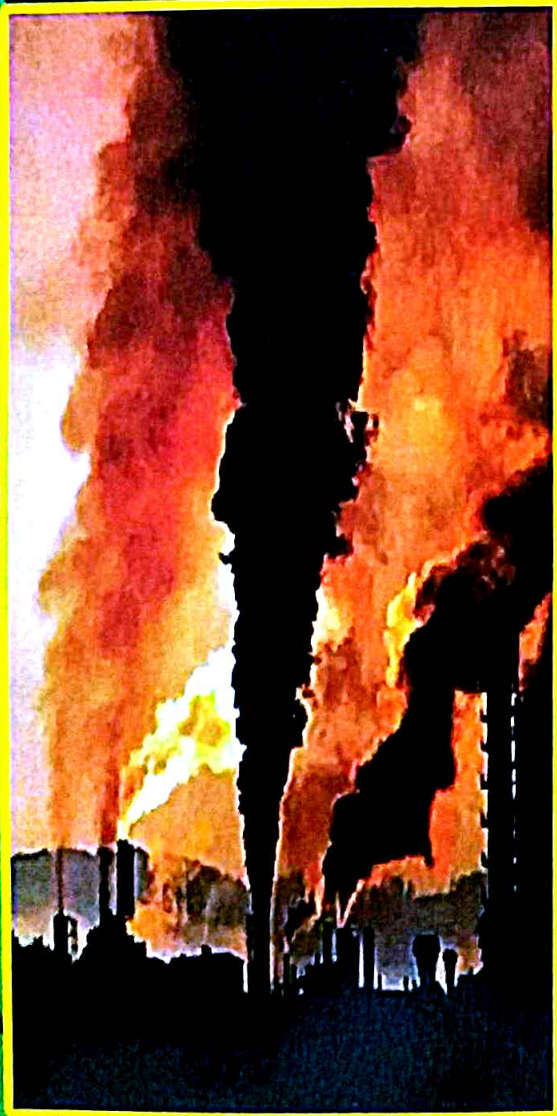
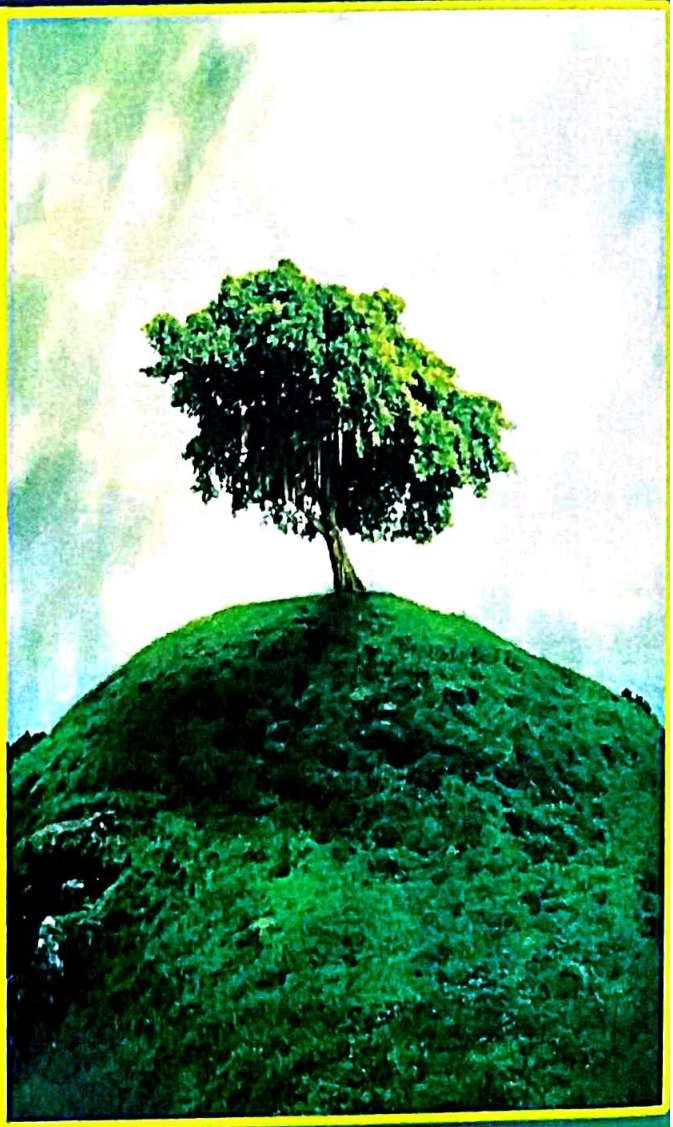
पर्यावरण अवनयन एवं प्रबन्धन

Environmental Degradation and Management

डॉ. अनिल कुमार सिन्हा

डॉ. अजीत कुमार यादव





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16

Environmental Problems and Sustainable Development

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Introduction

At present scenarios 'Sustainable Development' is a very important and most essential approach to prevent the environmental degradation. Sustainable economic development is taken to mean development without damaging the environment and not compromising future generation's needs. Sustainable development can be defined as an approach to the economic development of a country without compromising with the quality of the environment for future generations. In the name of economic development, the price of environmental damage is paid in the form of land

degradation, soil erosion, air pollution, water pollution and deforestation etc. this damage may surpass the advantages of having more quality output of goods and services. Sustainable development aims at promoting the kind of development that minimizes environmental problems and meets the needs of the present generation without compromising the ability of the future generation to meet their own essential needs. Environmental degradation is the main factor reducing the sustainability. This book chapter introduces the environmental degradation (environmental problems) processes like acid rain, pollution, ozone depletion, deforestation, global warming, land degradation, waste disposal, ocean acidification, desertification and water scarcity etc. and their relationships to the environmental sustainability.

Meaning and Concept of Environment

The word 'Environment' is derived from the French word 'Environed' which means that - 'To encircle or to surround'. Environment means what surrounds us. It may be living or non-living things. It includes physical, chemical and other natural forces. Living things live in their environment. They constantly interact with it and adapt themselves to conditions in their environment. Environment which surrounds us, i.e. environment literally means surrounded from all sides.

- Environment can be defined as a sum total of all the living and non-living elements and their effects that influence human life.
- All the living and non-living factors affecting an organism and ultimately determining its form and survival is known as Environment.
- All the external factors influencing the life and activity of people, plant and animals.

- All the things (i.e. Object and Circumstances) surrounding us is known as Environment.

Environmental Problems

The environmental problem refers to a state in which the order and law of the ecosystem are collapsed as the ecological function it originally had is destroyed due to the influence of human activities. These environmental problems arise from conflicts between nature and humans. The environmental problems are also defined as harmful effects to earth and its natural systems due to the actions of humans. Pollution of the air, water and soil caused by toxins such as plastics, heavy metals and nitrates caused by factors such as toxins and gases released by factories, combustion of fossil fuels, acid rain, oil spill and industrial waste. The basic causes of environmental problem is population expansion, overconsumption, overexploitation, pollution and deforestation are some of the human activities that harm the environment on a global scale (either directly or indirectly). Major current environmental issues or problems may include acid rain, pollution, ozone depletion, global warming, waste disposal, ocean acidification, desertification and water scarcity etc. Human impact on the environment or anthropogenic environmental impact refers to changes to biophysical environments and to ecosystems, biodiversity and natural resources caused directly or indirectly by humans. Environmental degradation is the deterioration of the environment through depletion of resources such as quality of air, water & soil, the destruction of ecosystems, habitat destruction, the extinction of wildlife and pollution. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.

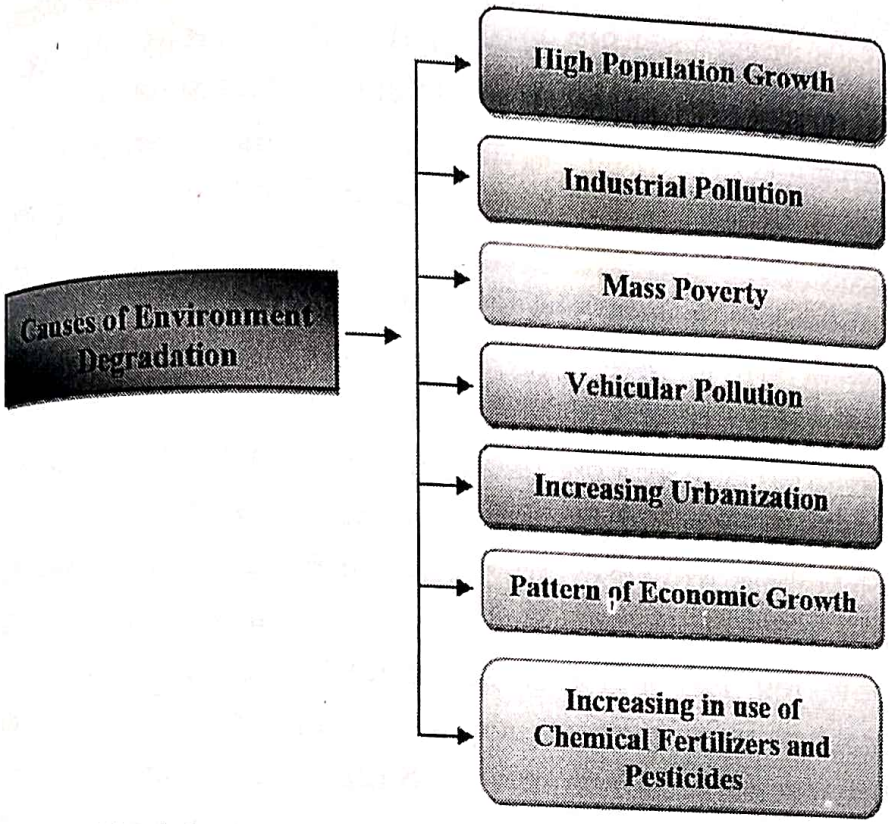

Fig. 1: Major causes of Environmental Degradation.

MAJOR ENVIRONMENTAL PROBLEMS

Are you concerned about the state of our environment and wondering what the biggest environmental problems are? As we continue to industrialize and consume at unprecedented rates, our environment is facing numerous environmental challenges that threaten the health and well-being of all living things. So, through this book chapter, we will try to understand better the environmental problems we are currently facing and try to analyze what can be done to save our environment as well as to achieve Sustainable Development. When there is a change in the quantity or quality of an environmental factor that has an impact on everything on earth, whether directly or indirectly, that is when an environmental problem arises. Our entire world is currently affected by a multitude of environmental problems. Acid rain, air pollution, global warming, hazardous wastes, ozone depletion, smog, water

pollution, waste disposal, overcrowding, forest loss, ocean acidification, desertification and water scarcity are some of the world's biggest environmental issues right now. It is relevant to everyone on earth, not just the environment. It has an impact on every nation, animal and person on earth. Some of the biggest environmental problems are discussed in this book chapter which are given bellow&

Acid Rain

Any type of precipitation that contains acidic elements like sulfuric or nitric acid that falls from the atmosphere in wet or dry forms on the ground is referred to as acid rain and it is also known as acid deposition. Rain, snow, fog, hail and even acidic dust might fall under this category. Infrastructure, aquatic life and vegetation may all suffer negative consequences. Sulfur dioxide and nitrogen oxide emissions cause acid rain by reacting with the water molecules in the atmosphere to create acids

Pollution

Pollution is the unwanted addition of substances to water, land or air that have a negative impact on human existence, other animals, living circumstances and our natural resources. It happens on a local as well as a global scale. Major problems arising from air pollution are the release of carbon monoxide, which lowers the amount of fresh oxygen in the atmosphere and leads to respiratory ailments. Lead release from industries and incinerators leads to nervous and cardiovascular disorders in people. Similarly water pollution leads to the death of aquatic species and also gives birth too many waterborne diseases

Ozone Layer Depletion

The upper atmosphere's ozone layer gets thinned due to

ozone layer depletion. This occurs when ozone molecules come into an interface with chlorine and bromine atoms in the atmosphere and are broken down. Ozone molecules can be destroyed by one chlorine molecule. It doesn't get made as quickly as it gets destroyed. When exposed to intense ultraviolet radiation, some substances emit chlorine and bromine, which then adds to the ozone layer's thinning. Chlorofluorocarbons, carbon tetrachloride, hydrochloroflurocarbons and methyl chloroform are examples of chemicals that deplete the ozone layer. The most prevalent chemical that depletes the ozone layer is Chlorofluorocarbons (CFC). Ozone layer depletion is responsible factor for skin cancer and other skin related diseases in humans.

Global Warming

The extremely quick rise in the planet's average temperature over the past century is known as Global Warming, and it is mostly caused by greenhouse gases (Carbon dioxide, methane, nitrous oxide, various synthetic chemicals and industrial gases like HFCs, PFCs, SF6, NF3) that are emitted when people burn fossil fuels. When greenhouse gases like carbon dioxide (CO2) and other air pollutants grow in the atmosphere, they absorb sunlight and solar radiation that has already been reflected off the surface of the earth. Ordinarily, this radiation would escape into space, but because these pollutants may prevail in the atmosphere for many years, they trap the heat, making the planet hotter, thus called the Greenhouse Effect. Global warming arises due to both natural and man-made factors. Natural being the eruption of volcanoes and man-made being the burning of fossil fuels for industries, mining and deforestation. The foremost effect of global warming is the melting of polar ice caps, which will lead to a rise in sea

levels and the polar species will lose their habitats due to the changing environmental conditions.

Table 1: Top ten all Greenhouse Gas Emissions Countries as of 2011

Serial No.	*Name of the Country*	*Greenhouse Gas Emissions*	
		Million Tons (MT) / Year	*Percentages (%)*
01.	China	7216	16.40
02.	US	6931	15.70
03.	Brazil	2856	6.50
04.	Indone-sia	2046	4.60
05.	Russia	2028	4.60
06.	India	1870	4.20
07.	Japan	1387	3.10
08.	Germany	1005	2.30
09.	Canada	808	1.80
10.	Mexico	696	1.60

Source: **https://www.theguardian.com**

Table 02: Top five Carbon polluters countries as of 2023

Serial No.	*Name of the Country*	*CO_2 Emissions (Million Tons / Year)*
01.	China	More than 14
02.	United States (US)	6
03.	India	3.5
04.	European Union	3.4
05.	Russia	2

Source: https://climatetrade.com

Waste Disposal:

The collection, processing and dumping of human society's waste materials are known as waste disposal. The sources and composition of waste are categorized. The components of waste materials can either be harmful or inert in terms of their effects on human health and the environment, and they can be either liquid or solid in form. Broken glass, used cell phones, used battery cells and used plastic bags are all examples of products that need to be properly disposed of in order to minimize environmental damage. Solid waste, sewage, hazardous waste and electronic trash are all commonly referred to as waste. The major source of waste is municipal waste, agricultural waste, industrial waste, construction waste and demolition waste.

Ocean Acidification

The continuing lowering of the pH of the seas due to the absorption of carbon dioxide (CO2) from the atmosphere is known as Ocean Acidification. When seawater has a pH above 7, Ocean Acidification results in a shift toward pH - neutral conditions rather than acidic conditions (pH 7). Ocean Acidification is a result of carbon dioxide emissions from burning fossil fuels dissolving in seawater and producing carbonic acid, which lowers the pH value of the ocean's water. Due to ocean acidification coral reefs are lost, the food chain is disturbed, a decline in the local economy occurs due to a lack of fish and marine products and human health is also impacted.

Desertification

Desertification is a form of land degradation that occurs in dry places where biological production is lost as a result of biotic processes or as a result of human activity, making fertile areas more and more arid. It is the expansion

of dry regions brought on by a number of variables, including climate change and excessive soil exploitation due to human activity. The various causes of desertification are deforestation, farming practices, excessive use of fertilizers and pesticides, overgrazing and over drafting of groundwater. Desertification affects farming and leads to flooding, biodiversity loss, extinction of specie and migration of the fauna.

Water Scarcity

Water scarcity is the absence of adequate water resources to meet regional water usage demands. More than 1.2 billion people do not have access to clean water for drinking. Water crises, shortages, deficits and stress are all examples of water scarcity. Physical and economical water shortages are both possible causes of water scarcity. Physical water scarcity occurs when a region's natural water resources cannot keep up with demand, whereas economic water scarcity is a result of inadequate water management. Water scarcity occurs due to overuse of water, pollution of water, global warming, illegal dumping and natural disasters. Due to water scarcity, many issues are arises like lack of access to drinking water, hunger, poverty, disease & sanitation issues, destruction of habitats and biodiversity loss.

Table no. 03

Category - wise distribution of land degradation in different states (top five) of India (Reference Year: 2015 - 16)

Sl. No.	Name of States	State Area in Km²	(Area in hectares)						
			Water Erosion	Wind Erosion	Water Logging	Salinization /Alkalization	Acidification	Anthropogenic	Total Area under land degradation
01	Andhra Pradesh	160229	4773702	15556	4399	365639	-	59452	5510756
02	Arunachal Pradesh	83743	442920	-	35033	-	336881	-	982961
03	Assam	78438	359168	-	268671	-	73885	11703	741417
04	Bihar	94163	345027	-	711112	113918	-	4787	1191678
05	Chhattisgarh	135191	3236127	-	-	-	94	37451	3629953

Source: Environmental Statistics - 2023, Social Statistics Division, National Statistical Office (Ministry of Statistics and Programme Implementation, Government of India).

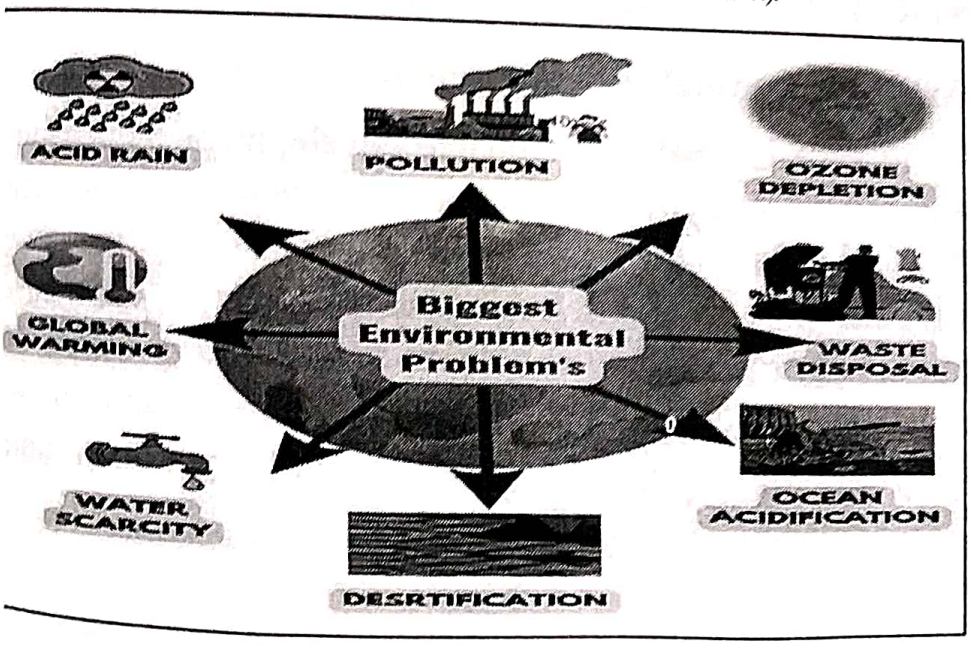

Fig. no. 02: Major Environmental Problems.

How can Environmental Problems be Resolved

We as individuals have the most important role to play in protecting our environment. Our small steps and awareness can lead toward sustainable development; use reusable things instead of disposable ones, avoid using paper whenever possible, conserve electronic and water, encourage eco-friendly behaviors and to preserve natural resources, recycle

garbage. Environmental problems are a sign of an impending catastrophe. There won't be any life on earth in the near future if these problems are not resolved. The environment is in a really bad state right now, something that our ancestors could never have imagined. By misusing the resources of our environment, we have continuously harmed it. We can see that pollution is spreading swiftly around the globe every day, whether it be through deforestation, acid rain or other catastrophic natural calamities brought on by human-caused technological growth. It is important to execute and implement the use of natural resources wisely in order to give our future generation a better, healthier existence

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

What is Sustainable Development

In easy language, sustainable development means our economic development should not damage the environment so much that our future generations have to face environmental problems. It means development which meets need of present generation without compromising ability of future generation to meet their own needs (Definition by UNCEF – United Nation Conference on Environment and Development.).

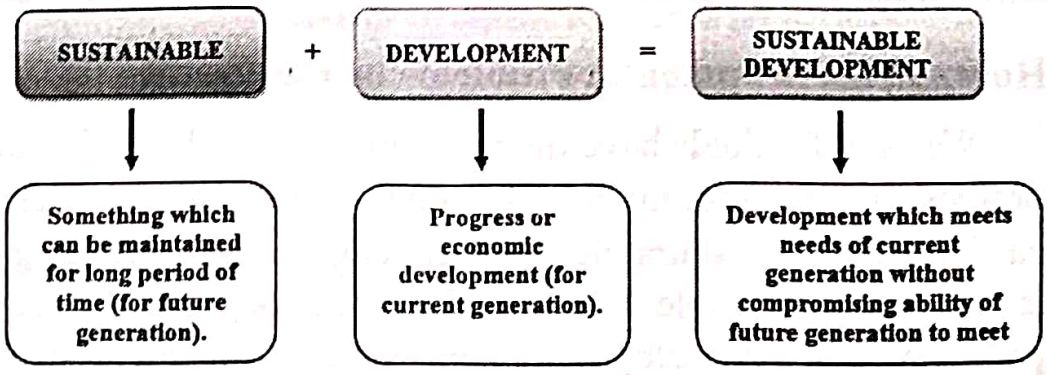

Fig. no. 03: Meaning of Sustainable Development.

So, sustainable development defines Maintained for long term economic development. Hence, sustainable development is a development which –

- Allows the future generation to have a quality life that is a least as high as the quality being enjoyed by the current generation.
- Meets the basic requirements of people (such as food, water, energy, housing etc.), especially the poor people.
- Ensures that the manufacturing, agriculture and service sector grows to meet these needs

Objectives of Sustainable Development:

Sustainable development aims at -

(i) Meeting the needs of the present and future generations through sustainable and equitable use of resources, without causing any damage to the environment.

(ii) Preventing further damage to the life-support systems.

(iii) Conserving and nurturing biodiversity and other resources for food security for a long time.

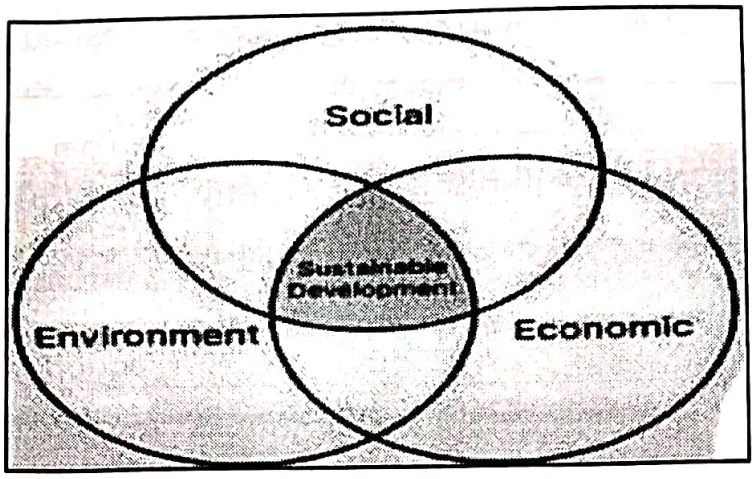

Fig. no. 04: Components of Sustainable Development.

Why Sustainable Development needed

Sustainable development needed because our economic development should not damage the environment, so much that our future generations have to face environmental problems.

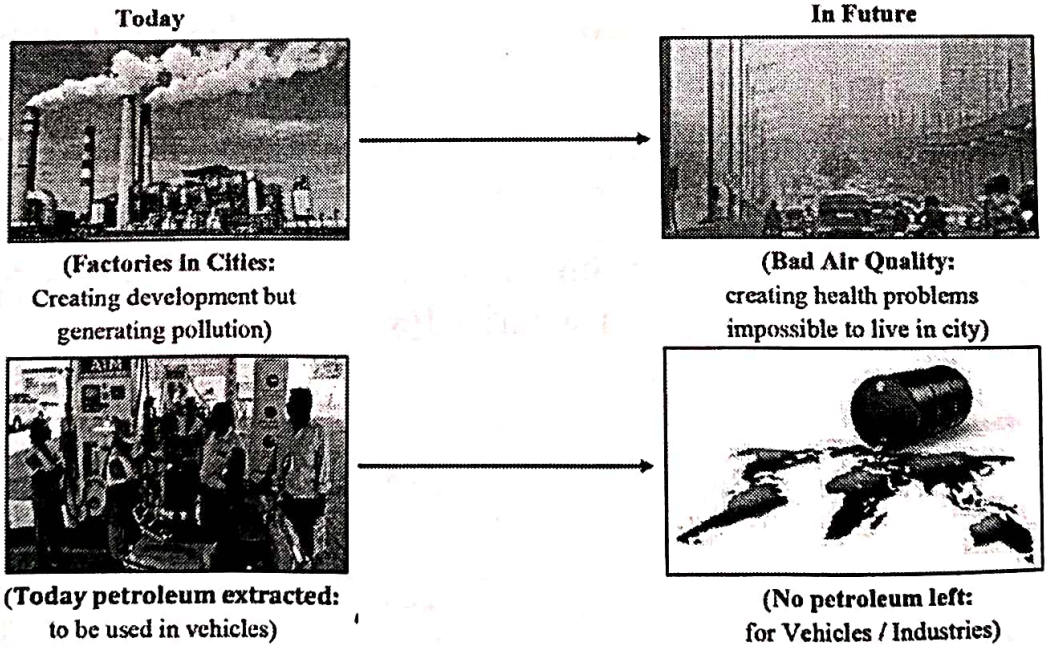

Fig. no. 05: Necessity of Sustainable Development.

How can we Achieve Sustainable Development

(1) Limiting the human population lesser the population,

less will be burden on environment (Example - less trees to be cut, less water is polluted, less garbage produced).

(2) Technological progress should be input efficient, not input consuming (we should develop new technologies which use those inputs which are environment friendly and available in large amount).

(3) Rate of extraction of renewable resources should not be more than rate of generation (Example - tree is a renewable resources, if 1000 trees are cut; more than 10,000 should be planted in its place).

(4) Controlling pollution (air and water pollution should be controlled, so that our future generation have clean air to breathe and clean water to drink). For non-renewable resources, rate of depletion should not exceed rate of creation of renewable substitutes (Example - we are using coal and petroleum which are depleting fast, in its place we should develop alternatives like wind energy and solar energy).

Sustainable development can be achieved if we follow the following guideline:

- It can be achieved by restricting human activities.
- Technological development should be input effective and not input utilizing.
- The rate of consumption should not surpass the rate of salvation.
- For renewable resources, the rate of consumption should not surpass the rate of production of renewable substitutes.
- All types of pollution should be minimized.
- It can be achieved by sensible use of natural resource

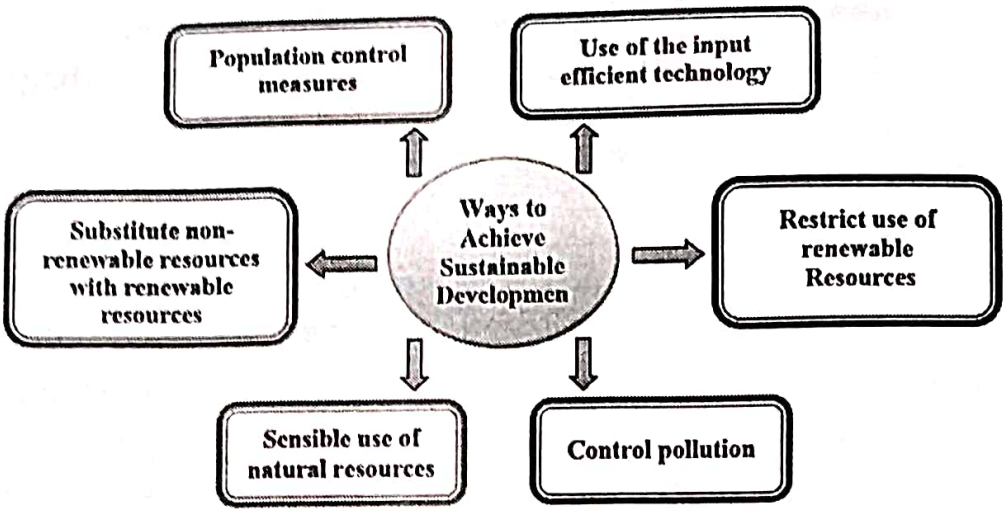

Fig. no. 06: Ways to Achieve Sustainable Development

Renewable Resources (Energy) are replenishable resources. These are pollution-free and environment friendly (Examples - Geothermal energy, Solar energy, Wind energy, Hydropower energy and Biomass energy.). They take a short time for renewal. On the other hand, non-renewable Resources (Energy) are Non-replenishable resources that pollute and damage the environment. Millions of years are needed for the formation of these resources (Examples - Nuclear energy, Coal, Natural Gas and Fossil fuel oil).

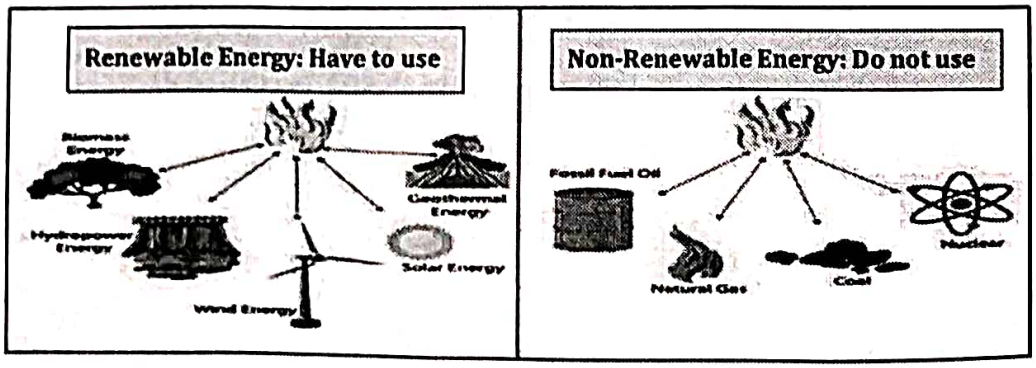

Fig. no. 07: Sources of Renewable and Non-renewable Resources (Energy).

The Role of Brundtland Commission

The Brundtland Commission, formerly the World Commission on Environment and Development (WCED),

was a sub-organization of the United Nations (UN) that aimed to unite countries in pursuit of Sustainable Development. The Brundtland Commission officially dissolved in 1987 after releasing Our Common Future, also known as the Brundtland Report. The document popularized the term "Sustainable Development". The report by the Brundtland Commission developed the most widely used definition of sustainable development as "Development which meets the needs of current generations without compromising the ability of future generations to meet their own needs". The main principles of Brundtland Commission are economic growth, environmental protection and social equality. Brundtland Report, publication released in 1987 by the World Commission on Environment and Development (WCED) that introduced the concept of sustainable development and described how it could be achieved. The Brundtland Report included chapters covering, among other topics within sustainable development, the role of the international economy, population & human resources, food security, species and ecosystems, energy, industry and proposed legal principles for environmental protection.

The Brundtland Report also highlighted the Global Population Growth that could not continue indefinitely. It predicted that in the 21st century the world population would stabilize somewhere between 7.7 billion and 14.2 billion people and that more people would live in cities than in rural areas. The aim of the Brundtland Commission is to help direct the nations of the world towards the goal of sustainable development. One of the main products of the Brundtland Commission was the report known as Our Common Future. This report coined the term 'sustainable development' as a concept, stating that economic growth in the present should not impact the ability of future populations to satisfy their own economic needs.

Strategies for Sustainable Development

Strategies for sustainable development in future are very essential to promote the kind of development that minimizes the environmental problems as well as to meet the needs of the existing generation without compromising with the quality of the environment for future generations.

(i) Use of Non-conventional sources for energy:

India relies heavily on thermal and hydroelectric plants to satisfy its power demands. Thermal power plants release large amounts of carbon di-oxide, a green house gas as well as fly as which harms water, land and the environment. Non-conventional sources of energy such as wind power and solar energy (pollution free and environment friendly) are cleaner and greener methods for producing electricity that can successfully substitute thermal and hydropower without harming the environment.

(ii) Establishing / installing Mini - hydel plants

Streams can be found almost anywhere in mountainous areas. The majority of such streams are perpetual, perennial or flow all year around mini-hydel plants which are set up to use the energy of such streams to propel tiny turbines, which generate electricity / power. Such power plants are environmentally friendly

(iii) Cleaner fuel use in both Rural and Urban areas

Households in rural areas generally rely on wood, waste from animals and other biomass as fuel. This consumption of fuel has a number of negative effects, including deforestation, a decrease in green cover, waste of cattle dung and air pollution etc. LPG and Gobar gas are eco-friendly and cleaner fuels that contribute significantly to pollution reduction.

(iv) Utilization of Bio - compost

After the green revolution, Indian farmers shifted to the use of chemical fertilizers while ignoring the use of compost to improve agricultural output and production. A rise in the use of chemical fertilizers or excessive use of chemical fertilizers , has not only harmed land fertility / productivity but has also contaminated water sources, including groundwater. For this reasons every farmers should utilized the bio-compost (compost made from organic wastes) through which the productivity of land can be improved.

(v) Biopest Control

With the advent of the green revolution, the use of chemical pesticides for higher yields has increased which not only contaminates food items but also pollutes soil and water bodies, including groundwater. For biopest control, the use of plant-based pesticides is being promoted.

(vi) Traditional practices and Knowledge

Traditionally, Indian people have been connected to their environment. All agricultural, healthcare, housing and transportation practices were environmentally friendly. However, we have drifted / gone far away from the traditional system as a result of modernization. It has caused damage to the ecosystem and our rural heritage.

(vii) Awareness among the individuals

Environmental degradation is a threat to India's ecosystem that can only be solved with people's participation. People do their best to safeguard assets for future generations at the micro-level / family level, but at the macro-level / national level, they do not consider the protection of natural wealth / resources for future generations. There is an urgent need to

raise the public's awareness about the dangers of population growth or environmental degradation as well as the rational use of natural resources.

(viii) Recycling

The industrial and household wastes should be accumulated on daily basis. These wastes should be distinguished as bio-degradable and non-biodegradable wastes. The bio-degradable wastes are those wastes that can be decomposed and can be used as manure for organic farming. The non-biodegradable wastes like plastic etc. can be recycled and re-used

(ix) Use of the input efficient technology

The input efficient methods and technologies should be devised, so that more production is possible at per unit of input. This efficient utilization of the natural resources leads to lesser exploitation of the natural resources.

Sustainable Development Goals (SDGs):

The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. The Sustainable Development Goals also known as the Global Goals were adopted by the 'United Nations' in 2015 as a universal call to action to end poverty, protect the planet and ensure that by 2030 all people enjoy peace and prosperity.

The following 17 SDGs are integrated - they recognize that action in one area will affect outcomes in others and that development must balance social, economic and environmental sustainability.

(1) *No Poverty*: - Economic growth must be inclusive to provide sustainable jobs and promote equality.

(2) *Zero Hunger*: - The food and agricultural sector offers key solutions for development, and is central for hunger and poverty eradication.

(3) *Good health and Well-being*: - Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

(4) *Quality Education*: - Obtaining a quality education is the foundation to improving people's lives and sustainable development.

(5) *Gender Equality*: - Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

(6) *Clean water and Sanitation*: - Clean, accessible water for all is an essential part of the world we want to live in.

(7) *Affordable and Clean energy*: - Energy is central to nearly every major challenge and opportunity.

(8) *Decent work and Economic growth*: - Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs.

(9) *Industry, innovation and infrastructure*: - Investments in infrastructure are crucial to achieving sustainable development.

(10) *Reduced inequalities*: - To reduce inequalities, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations.

(11) *Sustainable Cities and Communities*: - There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.

(12) *Responsible Consumption and Production*: - Responsible production and consumption is required for the sustainable development.

(13) *Climate Action*: - Climate change is a global challenge that affects everyone, everywhere.

(14) *Life below Water*: - Careful management of this essential global resource is a key feature of a sustainable future.

(15) *Life on land*: - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

(16) *Peace, Justice and Strong institutions*: - Access to justice for all, and building effective, accountable institutions at all levels.

(17) *Partnerships*: - Revitalize the global partnership is very essential for the sustainable development

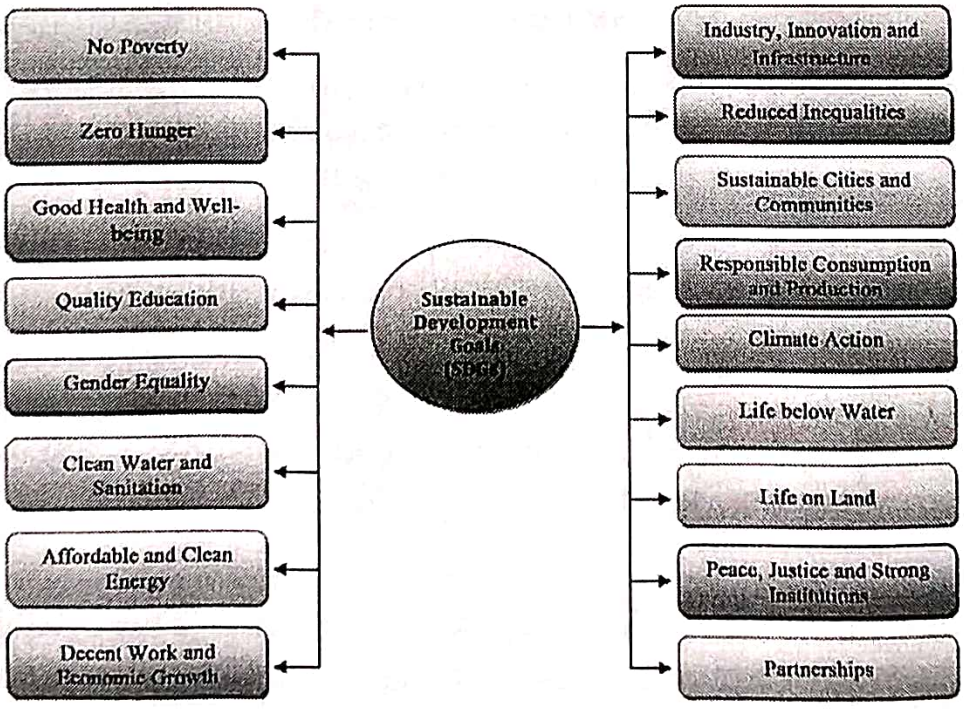

Fig. no. 08: Sustainable Development Goals (SDGs)

The Role of Remote Sensing and GIS in Environmental Problems and Sustainable Development

Remote Sensing (RS) and Geographical Information System (GIS) play a pivotal role in environmental problems (environmental degradation) such as acid rain, pollution, ozone depletion, global warming, waste disposal, ocean acidification, desertification and water scarcity etc. as well as in effective monitoring of such problems and its digital mapping for sustainable development. Remote sensing has served as an efficient method of gathering data or information regarding environmental problems through the satellite data and imagery. The recent advent of GIS and GPS has created an effective means by which the acquired data are analyzed for the effective monitoring and mapping of temporal dynamics of different environmental problems. At present time remote sensing is widely used to continuous monitoring the environmental degradation. GIS is a powerful tool for environmental data analysis and planning. GIS stores spatial information in a digital mapping environment. A digital base map can be overlaid with data for change detection as well as to view spatial information and interrelationships. By analyzing remotely sensed data, such as aerial imagery or satellite photographs, GIS mapping helps identify land cover changes, monitoring the environmental degradation and assessment the impact of human activities on the environment. This technique enables us to gather insights and make well-informed decisions in future. The remote sensing and GIS provides hands on tools to continuous monitoring, digital mapping, change detection, estimate, evaluate management of environmental problems and responsible controlling factors the environmental degradation to save the life and

society for achieving the sustainable development. In recent time, a large number of researchers have taken advantages of remote sensing and GIS in their studies of environmental problems.

Conclusion

As a concluding remark, we can say that sustainable development aims at promoting the kind of development that minimizes the different environmental problems and meets the needs of the present generation without compromising the ability of the future generation to meet their own needs. Sustainable development is a dynamic process which enables all people to realize their potential and improve their quality of life in ways which simultaneously protect and enhance the earth's life support systems. At the environmental level, sustainability prevents nature from being used as an inexhaustible source of resources and ensures its protection and rational use. The sustainable solution of environmental problems is that, implementing the recycling habits into our daily life is one of the most effective ways to help lessen landfill waste, conserve natural resources, save habitats, reduce pollution, cut down on energy consumption and slow down the global warming.

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