Environment and Sustainable Development:

Perspectives and Issues

Edited by :
Dr. Rohit Kumar Bargah
Dr. Praveen Kumar Sahu
Mr. Bodh Ram Chaohan

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PREFACE

The title of the book "Environment and Sustainable Development: Perspectives and Issues" itself represents that the book is having topics related to current environmental problems and its possible solutions. This edition of book focuses on the issues related to sustainable use and management of natural resources and e-waste management. Several methods to handle a wide spectrum of environmental issues are taken into account in numerous chapters. Climate change is one of the greatest challenges of the 21st century. Climate is changing across our planet, largely, as a result of human activities. Some of the book chapters also provide a holistic coverage of the climate change policies and role of India. Climate change and various infectious diseases, proposes a comprehensive set of solutions to resolve various issues related to environment. The chapter on genetically modified crops and organisms, e-waste, cell tower radiation and its effects, methods to control of pollution and importance of green marketing etc. are clearly related to the current environmental issues, while the sustainable management of water resources and need for a comprehensive legislation for water subject is tackled by the chapter on water resource management and right to water respectively. Finally, a general analysis on green marketing, nano- structured/organic materials for energy, as well as a chapter on chemicals solvating nature and environment are well discussed and fulfil the objective of the book. There are few books currently exist that cover such a wide spectrum of topics. This book would be beneficial for researchers, policy makers, academicians, environmentalists, college and university students.

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About the Editor

Dr. Rohit Kumar Bargah, (M.Sc., M. Phil, Ph. D) is an Assistant Professor in the Department of Chemistry and Research Centre, Govt. S.P.M. College Sitapur Surguja Chhattisgarh. He has over 10 years of Teaching and research experience in phytochemistry and Medicinal Chemistry. He has published over 15 research papers in national and international journals with high impact factors. He has participated and delivered lectures at various national & international seminar, conference and workshop. Currently Four Ph.D. Students are working under him. He is also presented his paper outside India in countries like Malaysia, Indonesia and Philippines. He is not only active in the field of academics but has also received Indra Gandhi national award (2016-17) by Ram Nath Kovind, President of India for his outstanding work for society through NSS. He is also a member of several academic & professional societies. Previously he has held the administrative positions like Chairman, Board of study (Chemistry), Sant Gahira Guru Vishwavidyalaya Ambikapur and Member, Central Board of Chhattisgarh Higher Education. He has written many books including books titled "Research Methodology & Statistical Techniques (2021), Human Rights and Environment (2022), Intellectual Property Rights Act (2021), Research: Principal & Process (2021), Recent Trends in Herbal Medicine (2023), Environmental Studies (2021), Applied Chemistry (2023), Environment and Disaster Management (2023) and Polymer Chemistry (2024) for PG and UG students. His Fields of interest are organic chemistry, Natural products, Phytochemistry, Pure and Applied Chemistry, Medicinal chemistry and Biochemistry.

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Health and Environmental Effects of Air Pollution: An Indian Scenario

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Abstract:

Air pollution is a major concern of new civilized world, which has a serious toxicological impact on human health and the environment. It has a number of different emission sources, but motor vehicles and industrial processes contribute the major part of air pollution. According to the World Health Organization, six major air pollutants include particle pollution, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Long- and short-term exposure to air suspended toxicants has a different toxicological impact on human including respiratory and cardiovascular diseases, neuropsychiatric complications, the eyes irritation, skin diseases, and long-term chronic diseases such as cancer. Several reports have revealed the direct association between exposure to the poor air quality and increasing rate of morbidity and mortality mostly due to cardiovascular and respiratory diseases. Air pollution is considered as the major environmental risk factor in the incidence and progression of some diseases such as asthma, lung cancer, ventricular hypertrophy, Alzheimer's and Parkinson's diseases, psychological complications, autism, retinopathy, fetal growth, and low birth weight. In addition to exposure from breathing air toxics, some toxic air pollutants such as mercury can deposit onto soils or surface waters, where they are taken up by plants and ingested by animals and are eventually magnified up through the food chain. Like humans, animals may experience health problems if exposed to sufficient quantities of air toxics over time. This paper deals with the causes, effects, present status and the remedial measures to counter the existing problem of air pollution, so as to create quality atmosphere in existence.

Keywords: Air pollution, Cardiovascular diseases, Environment, Human health, Respiratory tract diseases, Toxicology

1. Introduction

Every year, air pollution prematurely kills about seven million people worldwide. It is also one of the biggest threats to human health, increasing the risk of chronic heart and pulmonary diseases, lung cancer, stroke, and respiratory infections. Pollution is defined as the introduction into the environment of substances harmful to humans and other living organisms. Pollutants are harmful solids, liquids, or gases produced in higher than usual concentrations that reduce the quality of our environment. Human activities have an adverse effect on the environment by polluting the water we drink, the air we breathe, and the soil in which plants grow. Although the industrial revolution

was a great success in terms of technology, society, and the provision of multiple services, it also introduced the production of huge quantities of pollutants emitted into the air that are harmful to human health. Without any doubt, the global environmental pollution is considered an international public health issue with multiple facets. Social, economic, and legislative concerns and lifestyle habits are related to this major problem. Clearly, urbanization and industrialization are reaching unprecedented and upsetting proportions worldwide in our era. Anthropogenic air pollution is one of the biggest public health hazards worldwide, given that it accounts for about 9 million deaths per year [1].

Air pollution is determined as the presence of pollutants in the air in large quantities for long periods. Air pollutants are dispersed particles, hydrocarbons, CO, CO_2, NO, NO_2, SO_3, etc. Air pollution mainly affects those living in large urban areas, where road emissions contribute the most to the degradation of air quality. There is also a danger of industrial accidents, where the spread of a toxic fog can be fatal to the populations of the surrounding areas. The dispersion of pollutants is determined by many parameters, most notably atmospheric stability and wind.

2. Sources of Exposure

It is known that the majority of environmental pollutants are emitted through large-scale human activities such as the use of industrial machinery, power-producing stations, combustion engines, and cars. Because these activities are performed at such a large scale, they are by far the major contributors to air pollution, with cars estimated to be responsible for approximately 80% of today's pollution [2].

Some other human activities are also influencing our environment to a lesser extent, such as field cultivation techniques, gas stations, fuel tanks heaters, and cleaning procedures [3], as well as several natural sources, such as volcanic and soil eruptions and forest fires.

The classification of air pollutants is based mainly on the sources producing pollution. Therefore, it is worth mentioning the four main sources, following the classification system: Major sources, Area sources, Mobile sources, and Natural sources [4].

3. *Major sources* include the emission of pollutants from power stations, refineries, and petrochemicals, the chemical and fertilizer industries, metallurgical and other industrial plants, and, finally, municipal incineration.
4. *Indoor area sources* include domestic cleaning activities, dry cleaners, printing shops, and petrol stations.
5. *Mobile sources* include automobiles, cars, railways, airways, and other types of vehicles.
6. Finally, *natural sources* include, as stated previously, physical disasters such as forest fire, volcanic erosion, dust storms, and agricultural burning.

The World Health Organization (WHO) reports on six major air pollutants, namely particle pollution, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Air pollution can have a disastrous effect on all components of the environment, including groundwater, soil, and air. Additionally, it poses a serious threat to living organisms. In this vein,

our interest is mainly to focus on these pollutants, as they are related to more extensive and severe problems in human health and environmental impact. Acid rain, global warming, the greenhouse effect, and climate changes have an important ecological impact on air pollution [5].

3. Effects of Air Pollution on Health

Pollutants in the air cause health defects ranging from unnoticeable chemical and biological changes to troubled breathing and coughing. The ill effects of air pollution primarily attack the cardiovascular and respiratory systems. However, the severity of health to pollution depends on a number of factors including the composition of the pollution, degree and length of exposure and genetics.

Air pollution can harm us when it accumulates in the air in high enough concentrations. Millions of Americans live in areas where urban smog, particle pollution, and toxic pollutants pose serious health concerns [6]. People exposed to high enough levels of certain air pollutants may experience:

1. Irritation of the eyes, nose, and throat.
2. Wheezing, coughing, chest tightness, and breathing difficulties.
3. Worsening of existing lung and heart problems, such as asthma.
4. Increased risk of heart attack.

In addition, long-term exposure to air pollution can cause cancer and damage to the immune, neurological, reproductive, and respiratory systems. In extreme cases, it can even cause death [7].

Air pollution is a problem for all of us. However, some groups of people are especially sensitive to common air pollutants such as particulates and ground-level ozone. Sensitive populations include children, older adults, people who are active outdoors, and people with heart or lung diseases, such as asthma. If you are sensitive to air pollution, you need to be aware of steps you can take to protect your health. Thus, in the present section, we report the more common short- and long-term health effects but also general concerns for both types of effects, as these effects are often dependent on environmental conditions, dose, and individual susceptibility.

Short-term effects are temporary and range from simple discomfort, such as irritation of the eyes, nose, skin, throat, wheezing, coughing and chest tightness, and breathing difficulties, to more serious states, such as asthma, pneumonia, bronchitis, and lung and heart problems. Short-term exposure to air pollution can also cause headaches, nausea, and dizziness. These problems can be aggravated by extended long-term exposure to the pollutants, which is harmful to the neurological, reproductive, and respiratory systems and causes cancer and even, rarely, deaths.

The long-term effects are chronic, lasting for years or the whole life and can even lead to death. Furthermore, the toxicity of several air pollutants may also induce a variety of cancers in the long term [8]. As stated already, respiratory disorders are closely associated with the inhalation of air pollutants. These pollutants will invade through the airways and will accumulate at the cells. Damage to target cells should be related to the pollutant component involved and its source and dose. Health effects are also closely dependent on country, area, season, and time. An extended

exposure duration to the pollutant should incline to long-term health effects in relation also to the above factors.

Particulate Matter (PMs), dust, benzene, and O_3 cause serious damage to the respiratory system [10]. Moreover, there is a supplementary risk in case of existing respiratory disease such as asthma [11]. Long-term effects are more frequent in people with a predisposing disease state. When the trachea is contaminated by pollutants, voice alterations may be remarked after acute exposure. Chronic obstructive pulmonary disease (COPD) may be induced following air pollution, increasing morbidity and mortality [12]. Long-term effects from traffic, industrial air pollution, and combustion of fuels are the major factors for COPD risk [13]. Multiple cardiovascular effects have been observed after exposure to air pollutants. Changes occurred in blood cells after long-term exposure may affect cardiac functionality. Coronary arteriosclerosis was reported following long-term exposure to traffic emissions [14], while short-term exposure is related to hypertension, stroke, myocardial infracts, and heart insufficiency. Ventricle hypertrophy is reported to occur in humans after long-time exposure to nitrogen oxide (NO_2) [15]. Neurological effects have been observed in adults and children after extended-term exposure to air pollutants. The various categories of air pollutants and their harmful effects are summarized in the given Table 1.

Table 1. Harmful effects of the pollutants in air

S.No Pollutant	Source/Cause	Effect
1. Sulphur dioxide	Industries, burning of fossil fuels, forest fires, electric generation plants, smelting plants, intestinal boilers, petroleum refineries and volcanic eruptions.	Respiratory problems, severe headache, reduced productivity of plants, yellowish and reduced storage time for paper, yellowing and damage to limestone and marble, damage to leather, increased rate of corrosion of iron, steel, zinc and aluminum.
2. Carbon dioxide	Carbon Burning of fossil fuels, depletion of forests (that remove excess carbon dioxide and help in maintaining the oxygen-carbon dioxide ratio).	Global warming as it is one of the greenhouse gases.
3. Nitrogen Oxides	Automobile exhausts, burning of fossil fuels, forest fires, electric generation plants, smelting plants, industrial boilers, petroleum refineries and volcanic eruptions	Forms photochemical smog, at higher concentrations causes leaf damage or affects the photosynthetic activities of plants and causes respiratory problems in mammals.

4. Carbon monoxide	Automobile exhaust, photochemical reactions in the atmosphere, biological oxidation by marine organisms, etc.	Affects the respiratory activity as hemoglobin has more affinity for Co than for oxygen. Thus, CO combines with HB and thus reduces the oxygen-carrying capacity of blood. This results in blurred vision, headache, unconsciousness & death due to asphyxiation (lack of oxygen).
5. Chloro fluoro carbons (CFCs)	foam shaving cream, spray cans and cleaning solvents.	Destroy ozone layer which then permits harmful UV rays to enter the atmosphere.
6. Hydrocarbons Polynuclear Aromatic Compounds (PAC) & Polynuclear Aromatic Hydrocarbons (PAH)	Automobile exhaust and industries, leaking fuel tanks, leaching from toxic waste dumping sites and coal tar lining of some water supply pipes. Refrigerators, air conditioners,	Carcinogenic (may cause leukemia)
7. Particulate matter Lead halides (lead pollution)	Combustion of leaded gasoline products	Toxic effect in man.
8. PAN - peroxyacetyl -nitrate	Photochemical reactions of hydro- carbons and nitrogen oxides.	Irritation of eye, throat and respiratory tract, damage to clothes, paint and rubber articles, damage to leaves and stomatal tissue in plants.
9. Asbestos particles	Mining activities	Asbestosis - a cancerous disease of the lungs
10. Fungal spores, bacteria, virus, etc	Microbes	Infectious diseases
11. Biological matter like the pollen grains	Flowers	Allergy
12. Silicon dioxide	Stone cutting, pottery, glass manufacturing and cement industries.	Silicosis, a cancerous disease.

Psychological complications, autism, retinopathy, fetal growth, and low birth weight seem to be related to long-term air pollution. The etiologic agent of the neurodegenerative diseases (Alzheimer's and Parkinson's) is not yet known, although it is believed that extended exposure to air pollution seems to be a factor. Specifically, pesticides and metals are cited as etiological factors, together with diet. The mechanisms in the development of neurodegenerative disease include oxidative stress, protein aggregation, inflammation, and mitochondrial impairment in neurons (Figure 1).

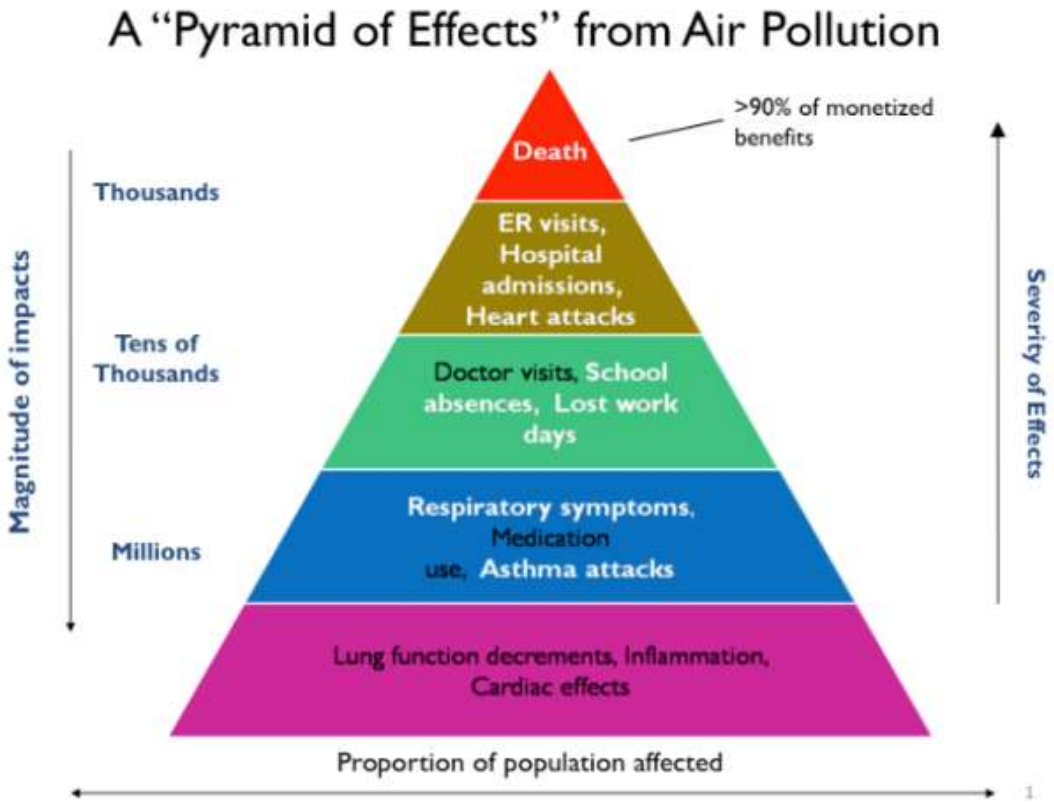

Fig1. Research by the USEPA finds that certain health conditions, such as the respiratory effects of air pollution exposure, can be directly linked to their economic consequences, such as the costs associated with doctor visits, lost school and work days, hospital visits, and, ultimately, deaths. Such research helps to provide a rubric by which we can evaluate the vast amounts of human health damage that come from air pollution, in terms of the exact costs suffered by society and the economy at large. (Image source: USEPA)

Air pollution is the major environmental driver associated with a multitude of diseases, including respiratory conditions such as asthma and lung cancer; neurological diseases like Alzheimer's and Parkinson's disease; a variety of psychological conditions; and a slew of other outcomes, including disrupted fetal growth, autism, retinopathy, and low birth weight[16]. With this myriad of air pollution-associated health outcomes, many studies have looked to quantify the impacts that air pollution has on the general population — one methodology employed by the USEPA is provided as an example below.

Particulate Matter (PM) and Health

Studies have shown a relationship between particulate matter (PM) and adverse health effects, focusing on either short-term (acute) or long-term (chronic) PM exposure [17]. Particulate matter (PM) is usually formed in the atmosphere as a result of chemical reactions between the different pollutants. The penetration of particles is closely dependent on their size. Particulate Matter (PM) was defined as a term for particles by the United States Environmental Protection Agency. Particulate matter (PM) pollution includes particles with diameters of 10 micrometers (μm) or smaller, called PM_{10}, and extremely fine particles with diameters that are generally 2.5 micrometers (μm) and smaller.

Particulate matter contains tiny liquid or solid droplets that can be inhaled and cause serious health effects. Particles <10 μm in diameter (PM_{10}) after inhalation can invade the lungs and even reach the bloodstream. Fine particles, $PM_{2.5}$, pose a greater risk to health (Table 2).

Table 2 Penetrability according to particle size.

Particle size	**Penetration degree in human respiratory system**
>11 μm	Passage into nostrils and upper respiratory tract
7–11 μm	Passage into nasal cavity
4.7–7 μm	Passage into larynx
3.3–4.7 μm	Passage into trachea-bronchial area
2.1–3.3 μm	Secondary bronchial area passage
1.1–2.1 μm	Terminal bronchial area passage
0.65–1.1 μm	Bronchioles penetrability
0.43–0.65 μm	Alveolar penetrability

Moreover, respiratory diseases and affection of the immune system are registered as long-term chronic effects. It is worth noting that people with asthma, pneumonia, diabetes, and respiratory and cardiovascular diseases are especially susceptible and vulnerable to the effects of PM. $PM_{2.5}$, followed by PM_{10}, are strongly associated with diverse respiratory system diseases, as their size permits them to pierce interior spaces. The particles produce toxic effects according to their chemical and physical properties. The components of PM_{10} and $PM_{2.5}$ can be organic (polycyclic aromatic hydrocarbons, dioxins, benzene, 1-3 butadiene) or inorganic (carbon, chlorides, nitrates, sulfates, metals) in nature .

Particulate Matter (PM) is divided into four main categories according to type and size [19] (Table 3).

1. *Gas contaminants* include PM in aerial masses.
2. *Particulate contaminants* include contaminants such as smog, soot, tobacco smoke, oil smoke, fly ash, and cement dust.
3. *Biological Contaminants* are microorganisms (bacteria, viruses, fungi, mold, and bacterial spores), cat allergens, house dust and allergens, and pollen.

Types of Dust include suspended atmospheric dust, settling dust, and heavy dust.

Table 3 Types and sizes of particulate Matter (PM).

Type		**PM diameter [µm]**
Particulate contaminants	Smog	0.01–1
	Soot	0.01–0.8
	Tobacco smoke	0.01–1
	Fly ash	1–100
	Cement Dust	8–100
Biological Contaminants	Bacteria and bacterial spores	0.7–10
	Viruses	0.01–1
	Fungi and molds	2–12
	Allergens (dogs, cats, pollen, household dust)	0.1–100
Types of Dust	Atmospheric dust	0.01–1
	Heavy dust	100–1000
	Settling dust	1–100
Gases	Different gaseous contaminants	0.0001–0.01

Finally, another fact is that the half-lives of PM_{10} and $PM_{2.5}$ particles in the atmosphere is extended due to their tiny dimensions; this permits their long-lasting suspension in the atmosphere and even their transfer and spread to distant destinations where people and the environment may be exposed to the same magnitude of pollution [20]. They are able to change the nutrient balance in watery ecosystems, damage forests and crops, and acidify water bodies. Particle pollution is linked to a long list of respiratory outcomes, such as:

1. Cough, phlegm, wheezing
2. Development of asthma
3. Airway and lung inflammation
4. Respiratory infection
5. Decreased lung function and growth in children
6. Emergency room and hospital visits due to respiratory symptoms
7. Premature death

The size of the particles which make up particulate matter affects how detrimental pollution exposure is to respiratory health.

WHO's main function is to identify and monitor those air pollutants with the greatest impact on people's health. This helps the WHO Member States to focus their actions on the most effective way to prevent, or reduce health risks [21]. WHO's task is to review and analyze the accumulated

scientific evidence, and use expert advice to draw conclusions on how much different air pollutants affect health as well as identify effective measures to reduce the air pollution burden. WHO Member States adopted in 2015 a resolution to "address the adverse health effects of air pollution". The following year, Member States agreed on a road map for "an enhanced global response to the adverse health effects of air pollution". WHO is working on four pillars:

1. Expanding the knowledge base
2. Monitoring and reporting
3. Global leadership and coordination
4. Institutional capacity strengthening,

1. Environmental Impact of Air Pollution

The environment is made up of the world around us, including both living organisms and non-living material. The atmosphere contains many gases necessary for life. However, human activities release pollutants into the atmosphere that contribute to air pollution. Air pollution is harming not only human health but also the environment in which we live.

The most important environmental effects are as follows.

1. Acid rain

Acid rain is precipitation containing harmful amounts of nitric and sulfuric acids. These acids are formed primarily by nitrogen oxides and sulfur oxides released into the atmosphere when fossil fuels are burned. These acids fall to the Earth either as wet precipitation (rain, snow, or fog) or dry precipitation (gas and particulates). Some are carried by the wind, sometimes hundreds of miles. In the environment, acid rain damages trees and causes soils and water bodies to acidify, making the water unsuitable for some fish and other wildlife. It also speeds the decay of buildings, statues, and sculptures that are part of our national heritage. Acid rain has damaged Massachusetts lakes, ponds, rivers, and soils, leading to damaged wildlife and forests. In plants, ozone penetrates through the stomata, inducing them to close, which blocks CO_2 transfer and induces a reduction in photosynthesis [21]**.**

2. Eutrophication

Eutrophication is a condition in a water body where high concentrations of nutrients (such as nitrogen) stimulate blooms of algae, which in turn can cause fish kills and loss of plant and animal diversity. Although eutrophication is a natural process in the aging of lakes and some estuaries, human activities can greatly accelerate eutrophication by increasing the rate at which nutrients enter aquatic ecosystems. Air emissions of nitrogen oxides from power plants, cars, trucks, and other sources contribute to the amount of nitrogen entering aquatic ecosystems [22].

3. Effects on wildlife

Toxic pollutants in the air, or deposited on soils or surface waters, can impact wildlife in a number of ways. Like humans, animals can experience health problems if they are exposed to sufficient concentrations of air toxics over time. Studies show that air toxics are contributing to birth defects, reproductive failure, and disease in animals. Persistent toxic air pollutants (those that break down slowly in the environment) are of particular concern in aquatic ecosystems. These pollutants accumulate in sediments and may bio magnify in tissues of animals at the top of the food chain to concentrations many times higher than in the water or air [23-24].

4. Ozone depletion

Ozone is a gas that occurs both at ground-level and in the Earth's upper atmosphere, known as the stratosphere. At ground level, ozone is a pollutant that can harm human health. In the stratosphere, however, ozone forms a layer that protects life on earth from the sun's harmful ultraviolet (UV) rays. But this "good" ozone is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydrochlorofluorocarbons, and halons. These substances were formerly used and sometimes still are used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants. Thinning of the protective ozone layer can cause increased amounts of UV radiation to reach the Earth, which can lead to more cases of skin cancer, cataracts, and impaired immune systems. UV can also damage sensitive crops, such as soybeans, and reduce crop yields [25-26].

5. Crop and forest damage

Air pollution can damage crops and trees in a variety of ways. Ground-level ozone can lead to reductions in agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased plant susceptibility to disease, pests and other environmental stresses (such as harsh weather). As described above, crop and forest damage can also result from acid rain and from increased UV radiation caused by ozone depletion [27].

6. Global climate change

The Earth's atmosphere contains a delicate balance of naturally occurring gases that trap some of the sun's heat near the Earth's surface. This "greenhouse effect" keeps the Earth's temperature stable. Unfortunately, evidence is mounting that humans have disturbed this natural balance by producing large amounts of some of these greenhouse gases, including carbon dioxide and methane. As a result, the Earth's atmosphere appears to be trapping more of the sun's heat, causing the Earth's average temperature to rise - a phenomenon known as global warming. Many scientists believe that global warming could have significant impacts on human health, agriculture, water resources, forests, wildlife, and coastal areas. People living in poorly constructed buildings in warm-climate countries are at high risk for heat-related health problems as temperatures mount [28-30].

7. Photochemical smog

Smog is formed when pollutants like hydrocarbons and nitrogen oxides combine in the presence of sunlight. It is a mixture of gases mainly composed of ozone (O_3), peroxyacetyl nitrate (PAN) and NOx and it is formed by photochemical reactions hence the name photochemical smog. The word 'smog' is derived from the two words - smoke and fog. Smog forms a yellowish-brown haze especially during winter and hampers visibility. It is also known as brown air when solar radiation is intense. In addition, during seasons of lesser solar radiation or areas, smog formation is incomplete and the air is referred to as grey air. Smog is known to cause many respiratory disorders and allergies as it contains polluting gases [31].

8. Haze

Haze is caused when sunlight encounters tiny pollution particles in the air. Haze obscures the clarity, color, texture, and form of what we see. Some haze-causing pollutants (mostly fine particles) are directly emitted to the atmosphere by sources such as power plants, industrial facilities, trucks and automobiles, and construction activities. Others are formed when gases emitted to the air (such as sulfur dioxide and nitrogen oxides) form particles as they are carried downwind [32-33].

9. Air Pollution Control

A control strategy related to air quality is a set of specific techniques and measures identified and implemented to achieve reductions in air pollution to attain an air quality standard or goal [34]. Now that we have an overall idea of sources of air pollution, it is easier to take measures to minimize air pollution. Following are some of the basic ways to control and check air pollution:

1. Using public transport instead of using vehicles individually.
2. Introducing rules to upgrade engines of old vehicles.
3. Using CNG and other gasses has less carbon content than fuels.
4. Efficient and frequent use of electric vehicles.
5. Laying down strict emission regulations.
6. Giving instructions to factories and industries to lower the number of pollutants in their release.
7. Using LPG in domestic chores instead of kerosene and burning wood.
8. Switching and using more renewable energy.
9. Avoiding unnecessary biomass burning.
10. Organizing and setting up committees with the involvement of maximum countries all over the world.

Air Pollution Prevention Strategies

While we know much about the causes and effects of air pollution, there is still much to be done in terms of prevention. To understand how governments can tackle the problem, it is useful to have a look at the main sectors contributing to global greenhouse gas emissions. Indeed, the only ways to drastically reduce air pollution are to adopt a wide range of policies that regulate all polluting industries – from energy production to transportation and agriculture – as well as to reflect on broader solutions such as carbon tax systems Table 4 [35].

Table 4

Control Methods for Air Pollution

Pollutant	Prevention and Control
1. Ozone (0)	Reduce motor vehicle, reactive organic gas (ROG) and nitrogen oxide emissions through emissions standards, reformulated fuels, inspection programs and reduced vehicle use, Limit ROG
2. Respirable Particulate	emissions from commercial operations and consumer products and
3. Matter (PM)	from industrial sources such as power plants and refineries.
	Control Dust Sources, Industrial Particulate Emissions, Wood
4. Fine Particulate	Burning Stoves and Fireplaces, Reduce secondary pollutants which
5. Matter (PM25)	react to form PM10.
6. Carbon Monoxide (CO)	Reduces Combustion Emissions from Motor Vehicles, Industries, Agriculture and Residential Burning. Precursor controls, like those for ozone, reduce fine particle formation in the atmosphere.
7. Nitrogen Dioxide (NO)	Control motor vehicle and industrial emissions. Use oxygenated gasoline during winter months.
	Controls motor vehicle and industrial combustion emissions.
8. Lead	Control metal smelters, unleaded gasoline. Replace leaded paint
9. Sulfur Dioxide (SO)	with non-lead substitutes.
	Reduces the use of high sulfur fuels (e.g., use low sulfur
10. Hydrogen Sulfide	reformulated diesel or natural gas).
11. Prevention and Control	Control emissions from geothermal power plants, petroleum production and refining, sewers, sewage treatment plants.
Source: (Vehicular Pollution Control in Delhi, India)	

i. Cut Down Emissions from Power Plants

One obvious but effective strategy to cut down emissions is to phase out fossil fuels immediately, yet it has proven to be difficult to implement. As the latest IPCC climate report clearly stated, in the race to reach net-zero emissions, there is no room for any fossil fuel developments. Shifting to other energy sources like nuclear and renewables is a long and complicated process that requires global coordination and collaboration. Yet, not all countries are on board and while some are slowly making the transition, others have no intentions of phasing out fossil fuels[36].

In the meantime, countries like the US are implementing strategies to hold power plants accountable for their pollution. For example, in March 2022, the Environmental Protection Agency (EPA) unveiled the "Good Neighbor" plan to cut interstate smog pollution from power stations by requiring them to operate their pollution control equipment and keep their daily emissions under a pre-established limit.

ii. Decarbonise the Global Transport Sector

Transport accounts for 8 billion tonnes – or approximately one-fifth – of global carbon dioxide emissions. These are expected to grow significantly over the next 30 years as a result of increasing transport demand. This is based global transport emissions in 2018, which totaled 8 billion tonnes CO_2. Transport account for 25.5 % of CO_2 emission from energy and 74.5 % transport emission come from road vehicles. (***Data source:*** *Our world in data based International Energy Agency-IEA and International Council of Clean Transport -ICCT)*

According to the EPA, there are three methods to reduce greenhouse gas emissions from transportation. The first is to increase the efficiency of vehicle technology. A good start – according to a report by the United Nations – is developing weight reduction and improvements to engines and tires that can make vehicles more fuel-efficient, reduce their reliance on oil, and cut expenses[37] .

One of the most important technologies we have to decarbonise the transport sector is electric vehicles (EV). Significant progress has been made in this industry and costs of batteries have declined by 90% in recent years. Despite EVs being a much better alternative than fossil fuel vehicles, as the latter generate much higher emissions over their lifetime, the electrification of the transportation sector has a dark side.

iii. Adopt a More Sustainable Approach to Agriculture

Recent data from the Food and Agriculture Organization (FAO) shows that 31% of human-caused GHG emissions originate from the world's agri-food systems. From the 16.5 tonnes generated in 2019, the largest share – 7.2 billion tonnes – came from within the farm gate, 5.8 billion tonnes from the supply-chain processes, while 3.5 billion tonnes from land use change [38].

Thus, efforts to address the exploitation of resources like land and water as well as the promotion of sustainable agriculture are among the most crucial steps in air pollution prevention. A big issue related to soil depletion is the excessive use of fertilisers. Switching to nitrate-based solutions can be one of the easiest fixes in reducing farms' impact on air pollution. Israel has made incredible technological advances and managed to reduce the overconsumption of water through drip irrigation, a system that delivers water and nutrients directly into the plant's root through pipes.

iv. Introduce a Carbon Tax System

A carbon tax is an instrument of environmental cost internalisation, imposed on producers of raw fossil fuels based on the relative carbon content of those fuels. Governments usually set a fixed price that emitting companies must pay for each ton of greenhouse gas emissions they emit.

So far, 27 countries have implemented a carbon tax system as a way to incentivise polluters to lower emissions or switch to more efficient processes and cleaner fuels. At the same time, the carbon tax is a great way to reduce air pollution and greenhouse gases generated from the same human activities [39].

v. Improving Air Quality While Fighting Climate Change

Last but not least, air pollution can be prevented by tackling climate change. These two phenomena are closely intertwined and neither can be seen exclusively as the cause or the effect. While deteriorating air quality is a consequence of climate change, air pollution also contributes to worsening global warming. That is why the climate crisis cannot be left out of the equation. Effective efforts to tackle climate change would significantly reduce deforestation and wildfires, two of the main sources of air pollution. Air quality and climate change are just one example of causes and effects overlapping. Therefore, the best shot for governments around the world to reduce air pollution is to implement broader policies that aim at tackling all aspects of the looming climate crisis [40].

Governments getting started in managing air quality should focus first on obvious sources of air pollution and the quickest means of controlling air emissions. More sophisticated and comprehensive strategies can be developed over time. The goal for all control strategies is to achieve real and measurable air emission reductions. Control strategies to meet and maintain the national ambient air quality standards are developed by state governments. State governments adopt control measures through their legislative process and include them in state implementation plans, which need to be submitted and approved by EPA. The control measures are described and included in the plan. Control measures that are part of an approved state implementation plan can be enforced by either the state or the national government.

2. Conclusion

Hence, air pollution has deleterious effects on both soil and water. Concerning PM as an air pollutant, its impact on crop yield and food productivity has been reported. Its impact on watery bodies is associated with the survival of living organisms and fishes and their productivity potential. Sulfur and nitrogen oxides are involved in the formation of acid rain and are harmful to plants and marine organisms. Last but not least, as mentioned above, the toxicity associated with lead and other metals is the main threat to our ecosystems (air, water, and soil) and living creatures. Technologies to reduce air pollution at the source are well established and should be used in all new industrial development. The principles and practices of sustainable development, coupled with local research, will help contain or eliminate health risks resulting

from air pollution. International collaboration involving both governmental and nongovernmental organizations or can guide this highly interdisciplinary and intersectional area of pollution control.

3. Recommendation

Air pollutions have major impacts on human health, triggering, and inducing many diseases leading to high morbidities and mortalities, particularly in the developing countries such as India. Therefore, air pollutions control is vital and should be on the top of priority list of the governments. The policy makers and legislators in these countries must update all laws and regulations related to air pollutions. Coordination between different departments involving in air pollutions must be leaded by a powerful environmental protection organization. An effective environmental protection organization should have enough budgets for administration, research, development, monitoring, and full control of the environment including air pollution.

4. Conflicts of interest

The authors have no conflicts of interest.

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Leveraging Wireless Sensor Networks for Environmental Monitoring and Sustainable Development: A Review of Current Trends and Future Directions

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Abstract : - Wireless Sensor Networks (WSNs) have emerged as a valuable technology for environmental monitoring and promoting sustainable development practices. This research paper provides an in-depth analysis of the applications of WSNs in environmental monitoring within the context of sustainable development. It explores how WSNs can be utilized to monitor air quality, water quality, biodiversity, climate change, and other critical environmental factors essential for sustainable development. The paper also discusses challenges and opportunities in deploying WSNs for sustainable environmental monitoring and presents successful case studies where WSNs have been effectively employed to support sustainable development initiatives. Additionally, the paper outlines future research directions to enhance the use of WSNs for environmental monitoring and sustainable development.

Keywords: Wireless Sensor Networks, Environmental Monitoring, Sustainable Development, Air Quality, Water Quality, Biodiversity, Climate Change.

I. Introduction Wireless Sensor Networks (WSNs) play a crucial role in environmental monitoring by providing real-time and continuous data collection from the physical environment. Some of the key roles of WSNs in environmental monitoring include [1-6]:

1. **Real-time Data Collection:** WSNs enable the collection of real-time data on various environmental parameters such as temperature, humidity, air quality, water quality, and sound levels. This continuous monitoring allows for early detection of environmental changes and events.
2. **Remote Monitoring:** WSNs can be deployed in remote or hard-to-reach areas, allowing for monitoring of environmental conditions in locations that are otherwise difficult to access. This is particularly valuable for monitoring wildlife habitats, forests, and remote ecosystems.
3. **Data Accuracy and Precision:** WSNs provide high-resolution data with a level of accuracy and precision that was not previously possible with traditional monitoring methods. This enables more informed decision-making and better understanding of environmental processes.

4. **Environmental Impact Assessment:** WSNs can be used to assess the impact of human activities on the environment, such as monitoring air and water pollution near industrial sites or tracking changes in ecosystems due to urbanization or deforestation.
5. **Early Warning Systems:** WSNs can be used to develop early warning systems for natural disasters such as floods, landslides, and forest fires. By detecting changes in environmental conditions, WSNs can help in issuing timely alerts and mitigating potential risks.
6. **Biodiversity Conservation:** WSNs can aid in monitoring and conserving biodiversity by tracking animal movements, population dynamics, and habitat conditions. This information is essential for effective conservation efforts.
7. **Sustainable Resource Management:** WSNs enable the monitoring of natural resources such as water, soil, and forests, supporting sustainable management practices and helping to prevent overexploitation.
8. **Climate Change Research:** WSNs contribute to climate change research by providing data on temperature trends, precipitation patterns, and other climate-related variables. This information is vital for understanding the impacts of climate change and formulating adaptation strategies.
9. Overall, WSNs play a pivotal role in environmental monitoring by providing a wealth of data that can inform policies, management practices, and conservation efforts aimed at promoting sustainable development and preserving the natural environment.

I.B. Applications of WSNs in environmental monitoring within the context of sustainable development:

Wireless Sensor Networks (WSNs) have a wide range of applications in environmental monitoring within the context of sustainable development. Some of the key applications include [7-12]:

1. **Air Quality Monitoring:** WSNs can be used to monitor air quality in urban areas, industrial sites, and other locations to detect pollutants such as carbon monoxide, nitrogen oxides, and particulate matter. This data can help authorities take timely action to reduce pollution and improve air quality.
2. **Water Quality Monitoring:** WSNs can be deployed in rivers, lakes, and other water bodies to monitor parameters such as pH, dissolved oxygen, temperature, and turbidity. This information can help in detecting water pollution sources, ensuring safe drinking water, and protecting aquatic ecosystems.
3. **Forest Fire Detection:** WSNs can be used to detect and monitor forest fires in real-time by deploying sensors in forested areas. Early detection of fires can help in timely intervention to minimize damage and protect biodiversity.
4. **Agricultural Monitoring:** WSNs can be used in precision agriculture to monitor soil moisture levels, temperature, and other parameters to optimize irrigation, fertilization, and pest control practices. This can help in reducing water usage, improving crop yields, and minimizing environmental impact.

5. **Wildlife Monitoring:** WSNs can be deployed in natural habitats to monitor wildlife populations, track animal movements, and study their behavior. This information can help in conservation efforts, habitat restoration, and mitigating human-wildlife conflicts.
6. **Disaster Management:** WSNs can play a crucial role in disaster management by providing real-time data on environmental conditions such as temperature, humidity, and seismic activity. This information can help in early warning systems, evacuation planning, and post-disaster recovery efforts.

Overall, the applications of WSNs in environmental monitoring contribute to sustainable development by promoting resource efficiency, reducing environmental impact, and enhancing resilience to climate change and natural disasters.

II. Literature Review

II.A. Previous studies on the use of WSNs for environmental monitoring and sustainable development:

Several studies have been conducted on the use of Wireless Sensor Networks (WSNs) for environmental monitoring and sustainable development. A study by Li et al. [13] explored the use of WSNs for monitoring air quality in urban environments. The researchers developed a WSN-based system that collected real-time data on air pollutants such as PM2.5 and NO2, enabling better understanding of air quality trends and informing policy decisions for sustainable urban development. In a study by Zhang et al. [14], WSNs were deployed to monitor soil moisture levels in agricultural fields. The researchers demonstrated how WSN data could optimize irrigation practices, reduce water usage, and improve crop yields, contributing to sustainable agricultural practices and resource conservation. Research by Gao et al. [15] focused on using WSNs for monitoring water quality in rivers and lakes. The study showed how WSN-based sensors could detect pollutants, track water flow patterns, and provide early warnings of contamination events, supporting efforts to protect water resources and promote sustainable water management strategies

A study by Wang et al. [16] investigated the use of WSNs for monitoring biodiversity in natural ecosystems. The researchers deployed sensor nodes to collect data on species diversity, habitat conditions, and ecosystem health indicators, highlighting the potential of WSNs to support conservation efforts and sustainable ecosystem management practices. In a review by Al-Karaki and Kamal 17], the authors summarized various applications of WSNs in environmental monitoring, including air quality monitoring, water quality assessment, biodiversity conservation, and disaster management. The review highlighted the importance of WSN technology in advancing sustainable development goals and addressing environmental challenges.

Overall, these studies demonstrate the diverse applications of WSNs in environmental monitoring and sustainable development, showcasing the potential of this technology to support data-driven decision-making, promote resource conservation, and enhance resilience to environmental changes. Continued research in this field will further advance the use of WSNs for achieving sustainable development goals and safeguarding the environment for future generations.

II.B. Case studies where WSNs have been effectively employed to support sustainable development initiatives:

1. **Smart Water Management in Barcelona, Spain [18-19]:** In Barcelona, a WSN-based smart water management system was deployed to monitor water quality, usage, and distribution in real-time. The system utilized sensor nodes placed in water infrastructure such as reservoirs, pipelines, and treatment plants to collect data on water parameters. By analyzing the data, authorities were able to optimize water supply, detect leaks, and reduce water wastage, leading to improved water resource management and sustainability.
2. **Precision Agriculture in California, USA [20]:** In California's agricultural region, WSNs were used to monitor soil moisture levels, temperature, and crop health in vineyards. The sensor nodes provided farmers with real-time data on environmental conditions, enabling them to adjust irrigation schedules, fertilization practices, and pest control measures based on precise information. By implementing precision agriculture techniques with WSN technology, farmers were able to increase crop yields, conserve water resources, and minimize environmental impact.
3. **Wildlife Conservation in Kenya [21]:** In Kenya's national parks and reserves, WSNs were deployed to monitor wildlife habitats, track animal movements, and study biodiversity patterns. The sensor nodes collected data on species distribution, population dynamics, and habitat changes, helping conservationists to identify key conservation areas and protect endangered species. By leveraging WSN technology for wildlife monitoring, conservation efforts were strengthened, and sustainable development practices were promoted in ecologically sensitive areas.
4. **Air Quality Monitoring in Beijing, China [22]:** In Beijing, a WSN-based air quality monitoring network was established to track pollution levels, particulate matter concentrations, and atmospheric conditions in urban areas. The sensor nodes were installed across the city to provide real-time data on air quality indicators, enabling authorities to implement pollution control measures, issue public health advisories, and improve environmental regulations. By utilizing WSN technology for air quality monitoring, Beijing was able to address environmental challenges, enhance public health outcomes, and promote sustainable urban development.
5. **Disaster Management in Japan [23]:** In Japan, WSNs were used to create early warning systems for natural disasters such as earthquakes, tsunamis, and typhoons. The sensor nodes were deployed in high-risk areas to detect seismic activity, oceanic disturbances, and extreme weather events, triggering alerts and evacuation procedures in advance of disasters. By integrating WSN technology into disaster management strategies, Japan improved its resilience to natural hazards, minimized loss of life and property, and supported sustainable development initiatives in disaster-prone regions.

These case studies demonstrate how WSNs have been effectively employed to support sustainable development initiatives across various sectors such as water management, agriculture, wildlife conservation, air quality monitoring, and disaster management. By harnessing the capabilities of WSN technology for environmental monitoring applications, stakeholders can enhance

sustainability practices, promote resource efficiency, and foster resilience in the face of environmental challenges.

II.C. Current state of the art in WSN technology:

The current state of the art in Wireless Sensor Network (WSN) technology is characterized by several advancements and innovations that have significantly enhanced the capabilities, performance, and applicability of WSNs. Some of the key developments in WSN technology include [24-27]:

1. **Energy-Efficient Protocols and Algorithms:** Energy efficiency remains a critical focus in WSN research and development. State-of-the-art WSNs utilize advanced protocols and algorithms to minimize energy consumption, extend network lifetime, and optimize resource utilization. This includes techniques such as duty cycling, data aggregation, and energy-aware routing protocols.
2. **Low-Power Hardware and Sensor Nodes:** The development of low-power microcontrollers, energy-efficient radio transceivers, and ultra-low-power sensors has enabled the creation of sensor nodes with extended battery life and reduced power consumption. These advancements have contributed to the deployment of long-lasting WSNs for various applications.
3. **Integration of Edge Computing and Machine Learning:** WSNs are increasingly incorporating edge computing capabilities to perform data processing, analysis, and decision-making at the network's edge. Additionally, machine learning algorithms are being integrated into WSNs to enable intelligent data analytics, anomaly detection, and predictive modeling directly within the sensor network.
4. **Multi-Sensor Fusion and Heterogeneous Networks:** State-of-the-art WSNs often integrate multiple types of sensors to capture diverse environmental parameters, leading to richer and more comprehensive data collection. Furthermore, the integration of heterogeneous networks, including different communication technologies (e.g., WiFi, LoRa, Zigbee), enables WSNs to adapt to various deployment scenarios and communication requirements.
5. **Security and Privacy Enhancements:** With the increasing deployment of WSNs in critical applications, such as healthcare, industrial monitoring, and smart cities, there has been a heightened emphasis on improving security mechanisms within WSNs. Advanced cryptographic techniques, secure communication protocols, and privacy-preserving mechanisms are being integrated into WSN solutions to safeguard data integrity and protect against cyber threats.
6. **Self-Organizing and Self-Healing Networks:** State-of-the-art WSNs are designed to be self-organizing and self-healing, enabling autonomous network reconfiguration, fault tolerance, and adaptive operation in dynamic environments. Self-organization allows sensor nodes to autonomously form networks and adapt to changing conditions, while self-healing mechanisms enable the network to recover from node failures or communication disruptions.

7. **Standardization and Interoperability:** Efforts to establish common standards and interoperability frameworks for WSNs have gained momentum, promoting compatibility between different WSN solutions and facilitating seamless integration with existing infrastructure and systems.
8. **Application-Specific Customization:** WSN technology has evolved to offer greater customization and tailoring to specific application domains, such as environmental monitoring, precision agriculture, industrial automation, smart buildings, and healthcare. This trend involves the development of specialized sensor nodes, communication protocols, and data processing techniques optimized for specific use cases.

Overall, the current state of the art in WSN technology reflects a convergence of advancements in hardware, software, networking protocols, and data analytics, paving the way for more robust, efficient, and intelligent sensor networks capable of addressing a wide range of environmental monitoring and IoT applications.

III. Potential of WSNs for environmental monitoring and their role in advancing sustainable development goals

Wireless Sensor Networks (WSNs) have the potential to significantly contribute to advancing sustainable development goals through their application in environmental monitoring. Some of the key ways in which WSNs can support sustainable development goals include [28-29]:

1. **Environmental Conservation:** WSNs can help monitor and protect natural ecosystems by providing real-time data on parameters such as air and water quality, biodiversity, and habitat conditions. This information can support conservation efforts and the sustainable management of natural resources.
2. **Climate Change Mitigation and Adaptation:** WSNs can contribute to climate change mitigation and adaptation efforts by monitoring greenhouse gas emissions, temperature trends, and other climate-related parameters. This data can inform policies and initiatives aimed at reducing emissions and building resilience to climate impacts.
3. **Sustainable Resource Management:** WSNs can be used to monitor water resources, soil conditions, and agricultural practices, supporting sustainable land use and resource management. By providing insights into resource availability and usage patterns, WSNs can help optimize resource allocation and promote sustainable practices.
4. **Disaster Risk Reduction:** WSNs can play a crucial role in disaster risk reduction by providing early warning systems for natural disasters such as floods, landslides, and forest fires. Timely and accurate data from WSNs can support preparedness, response, and recovery efforts, ultimately reducing the impact of disasters on communities and ecosystems.
5. **Public Health and Well-being:** WSNs can monitor environmental factors that impact public health, such as air pollution levels, water contamination, and disease vectors. By providing early warnings and data for informed decision making, WSNs can contribute to improving public health outcomes and enhancing community well-being.

6. **Data-Driven Policy Making:** The data collected by WSNs can inform evidence-based policy making in environmental management and sustainability. By providing accurate and comprehensive information, WSNs support policy development that is grounded in scientific understanding and responsive to environmental challenges.
7. **Community Engagement and Empowerment:** WSNs can engage local communities in environmental monitoring and decision making, fostering a sense of ownership and responsibility for environmental stewardship. Citizen science initiatives and participatory monitoring programs can leverage WSN technology to empower communities to contribute to sustainable development efforts.

Overall, the potential of WSNs for environmental monitoring aligns closely with the goals of sustainable development, including those outlined in the United Nations Sustainable Development Goals (SDGs). By leveraging the capabilities of WSN technology, stakeholders can work towards achieving environmental sustainability, resilience, and improved quality of life for present and future generations.

III.A. WSNs to monitor air quality:

Wireless Sensor Networks (WSNs) can be effectively utilized to monitor air quality by deploying a network of sensors in strategic locations to collect real-time data on air pollutants. Here are some ways in which WSNs can be used for air quality monitoring [30-31]:

1. **Sensor Deployment:** WSNs consist of a large number of small, low-cost sensors that can be deployed in various locations such as urban areas, industrial sites, traffic intersections, and near sources of pollution. These sensors can measure pollutants such as carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter (PM), ozone (O3), and volatile organic compounds (VOCs).
2. **Data Collection:** The sensors in the WSN continuously collect data on air quality parameters at regular intervals. The data is transmitted wirelessly to a central database or server for storage and analysis.
3. **Data Processing and Analysis:** The collected data is processed and analyzed to generate real-time air quality maps, trends, and alerts. Advanced algorithms can be used to detect pollution hotspots, identify sources of pollution, and predict air quality levels based on historical data and meteorological conditions.
4. **Environmental Monitoring:** WSNs can provide valuable information for environmental monitoring agencies, local authorities, and public health officials to assess air quality levels, compliance with air quality standards, and the impact of pollution on human health and the environment.
5. **Early Warning Systems:** WSNs can be integrated with early warning systems to alert the public and authorities about high pollution levels, health risks, and the need for preventive measures such as reducing emissions, implementing traffic restrictions, or issuing health advisories.

6. **Data Visualization:** The data collected by WSNs can be visualized through interactive maps, dashboards, and mobile applications to make it accessible to the general public, researchers, policymakers, and other stakeholders. This helps in raising awareness about air quality issues and promoting community engagement in environmental protection.

Overall, WSNs play a vital role in air quality monitoring by providing accurate, timely, and localized data that can support decision-making processes, improve air quality management strategies, and protect public health and the environment.

III.B. WSNs to monitor water quality:

Wireless Sensor Networks (WSNs) can also be effectively utilized to monitor water quality by deploying a network of sensors in water bodies such as rivers, lakes, reservoirs, and oceans. Here are some ways in which WSNs can be used for water quality monitoring [32-33]:

1. **Sensor Deployment:** WSNs consist of a large number of small, low-cost sensors that can be deployed in various locations within water bodies to measure parameters such as temperature, pH, dissolved oxygen (DO), turbidity, conductivity, total dissolved solids (TDS), nutrients (e.g., nitrogen and phosphorus), heavy metals, and other pollutants.
2. **Data Collection:** The sensors in the WSN continuously collect real-time data on water quality parameters at different depths and locations. The data is transmitted wirelessly to a central database or server for storage and analysis.
3. **Spatial and Temporal Monitoring:** WSNs enable spatial and temporal monitoring of water quality by providing detailed information on variations in water parameters across different locations and over time. This helps in identifying pollution sources, tracking pollutant dispersion, and assessing the impact of human activities on water quality.
4. **Event Detection:** WSNs can detect sudden changes or anomalies in water quality parameters, such as spikes in pollutant levels or the occurrence of harmful algal blooms. Early detection of such events allows for timely response measures to protect aquatic ecosystems and public health.
5. **Water Quality Modeling:** The data collected by WSNs can be used to develop predictive models for water quality assessment, forecasting water quality trends, and simulating the effects of different scenarios on water quality. This helps in improving water management practices and decision-making processes.
6. **Integrated Monitoring Systems:** WSNs can be integrated with other monitoring technologies such as remote sensing, unmanned aerial vehicles (UAVs), and satellite imagery to provide a comprehensive view of water quality at different scales. This integrated approach enhances the accuracy and efficiency of water quality monitoring efforts.
7. **Stakeholder Engagement:** The data collected by WSNs can be shared with stakeholders, including water resource managers, policymakers, researchers, and the public, through interactive platforms and visualization tools. This promotes transparency, collaboration, and informed decision-making for sustainable water resource management.

Overall, WSNs offer a cost-effective and scalable solution for monitoring water quality in real-time, enabling proactive measures to protect water resources, support ecosystem health, and ensure safe drinking water for communities.

III.C. WSNs to monitor biodiversity:

Wireless Sensor Networks (WSNs) can be effectively utilized to monitor biodiversity by deploying a network of sensors in natural ecosystems such as forests, wetlands, grasslands, and marine environments. Here are some ways in which WSNs can be used for biodiversity monitoring [34-35]:

1. **Species Detection and Identification:** WSNs can be equipped with various sensors, including cameras, microphones, and environmental sensors, to detect and identify different species of plants, animals, and insects in their natural habitats. Machine learning algorithms can be used to analyze the sensor data and classify species based on their unique characteristics.
2. **Habitat Monitoring:** WSNs can monitor environmental parameters such as temperature, humidity, light levels, soil moisture, and vegetation cover to assess the quality of habitats for different species. Changes in habitat conditions can impact biodiversity, and continuous monitoring with WSNs helps in understanding these dynamics.
3. **Species Behavior and Interactions:** WSNs can capture data on the behavior and interactions of species within ecosystems, such as movement patterns, foraging activities, mating behaviors, and predator-prey relationships. This information provides insights into the ecological processes that influence biodiversity.
4. **Population Dynamics:** WSNs can track changes in population sizes and distributions of species over time by monitoring factors such as breeding success, survival rates, migration patterns, and population densities. This data is essential for assessing the health and resilience of biodiversity in ecosystems.
5. **Ecosystem Health Assessment:** WSNs can be used to assess the overall health and functioning of ecosystems by monitoring indicators of biodiversity, such as species richness, diversity, and abundance. Changes in these indicators can signal ecosystem disturbances or degradation that require conservation interventions.
6. **Invasive Species Monitoring:** WSNs can help in early detection and monitoring of invasive species that pose a threat to native biodiversity. By continuously monitoring species composition and interactions, WSNs can support efforts to control invasive species and protect native ecosystems.
7. **Connectivity and Corridor Monitoring:** WSNs can be deployed along wildlife corridors and habitat connectivity pathways to monitor the movement of species between fragmented habitats. This information is crucial for conservation planning and maintaining genetic diversity within populations.
8. **Citizen Science Engagement:** WSNs can engage citizen scientists in biodiversity monitoring by involving them in data collection, analysis, and interpretation. Citizen science projects using WSNs can enhance public awareness about biodiversity conservation and foster community participation in environmental stewardship.

Overall, WSNs offer a powerful tool for biodiversity monitoring by providing real-time data on species presence, habitat conditions, population dynamics, and ecosystem health. By integrating technology with ecological research and conservation efforts, WSNs contribute to our understanding of biodiversity patterns and processes, supporting sustainable management of natural ecosystems.

III.D. WSNs to monitor climate change:

Wireless Sensor Networks (WSNs) can play a crucial role in monitoring climate change by collecting real-time data on various environmental parameters and trends. Here are some ways in which WSNs can be utilized for climate change monitoring [36-37]:

1. **Temperature Monitoring:** WSNs can be equipped with temperature sensors to continuously monitor changes in temperature patterns across different regions. By collecting high-resolution temperature data, WSNs can help in detecting temperature anomalies, heatwaves, and long-term trends associated with climate change.
2. **Precipitation Monitoring:** WSNs can include rain gauges and weather sensors to measure rainfall intensity, duration, and frequency. By monitoring precipitation patterns, WSNs can provide valuable data on changes in rainfall distribution, extreme weather events, and the impact of climate change on water resources.
3. **Humidity and Dew Point Monitoring:** WSNs can measure humidity levels and dew point temperatures to assess moisture content in the air. Changes in humidity patterns can influence weather conditions, ecosystem dynamics, and the spread of diseases, making it essential for climate change monitoring
4. **Wind Speed and Direction Monitoring:** WSNs can incorporate anemometers and wind vanes to measure wind speed and direction in real time. By monitoring wind patterns, WSNs can help in understanding local wind regimes, atmospheric circulation patterns, and the influence of climate change on wind behavior.
5. **Carbon Dioxide (CO2) Monitoring:** WSNs can include CO2 sensors to measure atmospheric carbon dioxide levels in different environments. Monitoring CO2 concentrations is crucial for assessing greenhouse gas emissions, carbon sequestration, and the impact of human activities on the global carbon cycle.
6. **Ocean and Sea Level Monitoring:** WSNs can be deployed in marine environments to monitor sea level rise, ocean temperatures, salinity levels, and ocean acidification. These measurements provide insights into the impact of climate change on marine ecosystems, coastal communities, and vulnerable habitats.
7. **Glacier and Ice Cap Monitoring:** WSNs can be used to monitor changes in glacier mass balance, ice melt rates, and snow cover extent in polar regions and mountainous areas. By tracking glacial retreat and ice loss, WSNs contribute to understanding the effects of climate change on the cryosphere.
8. **Remote Sensing Integration:** WSNs can be integrated with remote sensing technologies such as satellites, drones, and ground-based sensors to enhance climate change monitoring at different spatial scales. Combining data from multiple sources provides a comprehensive view of environmental changes and trends.

9. **Data Analysis and Modeling:** WSNs generate large volumes of data that require advanced analytics and modeling techniques to extract meaningful insights about climate change impacts. Machine learning algorithms, statistical methods, and simulation models can be used to analyze WSN data and predict future climate scenarios.
10. **Early Warning Systems:** WSNs can support the development of early warning systems for extreme weather events, natural disasters, and climate-related hazards. By monitoring environmental conditions in real time, WSNs help in issuing timely alerts and mitigating risks associated with climate change impacts.

Overall, WSNs offer a valuable tool for monitoring climate change by providing continuous data on key environmental variables, trends, and impacts. By leveraging the capabilities of WSN technology, researchers, policymakers, and stakeholders can enhance their understanding of climate change dynamics and develop effective strategies for adaptation and mitigation efforts.

IV. Challenges in deploying WSNs for sustainable environmental monitoring:

Deploying Wireless Sensor Networks (WSNs) for sustainable environmental monitoring comes with several challenges that need to be addressed to ensure the effectiveness and reliability of the monitoring system. Some of the key challenges include [4, 38]:

1. **Power Supply:** One of the major challenges in deploying WSNs is ensuring an adequate and reliable power supply for the sensor nodes. Many environmental monitoring applications require long-term operation in remote or harsh environments, making it challenging to provide continuous power to the sensor nodes. Solutions such as energy harvesting techniques, low-power design, and efficient battery management systems can help overcome this challenge.
2. **Communication Range and Connectivity:** WSNs rely on wireless communication to transmit data between sensor nodes and the base station. The limited communication range of sensor nodes, interference from other wireless devices, and signal attenuation in complex environments can affect the connectivity and data transmission reliability of the network. Deploying efficient routing protocols, optimizing antenna designs, and using mesh networking techniques can improve communication range and connectivity in WSNs.
3. **Data Quality and Accuracy:** Ensuring the quality and accuracy of data collected by sensor nodes is crucial for reliable environmental monitoring. Environmental factors such as temperature variations, humidity levels, and physical obstructions can impact the performance of sensors and introduce errors in the data. Calibrating sensors, implementing data fusion algorithms, and conducting regular maintenance checks are essential to maintain data quality and accuracy in WSNs.
4. **Scalability and Network Management:** As the number of sensor nodes in a WSN increases, managing network scalability, data aggregation, and resource allocation becomes more complex. Designing efficient network topologies, optimizing data routing algorithms, and implementing robust network management strategies are essential for scaling up WSN deployments for sustainable environmental monitoring.

5. **Security and Privacy:** Protecting the data transmitted by sensor nodes from unauthorized access, tampering, or cyber-attacks is critical for maintaining the integrity and confidentiality of environmental monitoring data. Implementing encryption techniques, authentication mechanisms, and secure communication protocols can enhance the security and privacy of WSNs deployed for sustainable environmental monitoring.
6. **Environmental Sustainability:** Deploying WSNs for environmental monitoring should not contribute to environmental degradation or resource depletion. Minimizing the environmental footprint of sensor nodes, using eco-friendly materials, and adopting energy-efficient practices are important considerations for ensuring the sustainability of WSN deployments in environmental monitoring applications.
7. **Data Storage and Processing:** Managing the large volumes of data generated by sensor nodes in WSNs requires efficient data storage, processing, and analysis capabilities. Designing scalable data storage systems, implementing real-time data processing algorithms, and leveraging cloud computing technologies can help handle the data processing requirements of sustainable environmental monitoring applications.

Addressing these challenges requires a multidisciplinary approach involving expertise in sensor technology, wireless communication, data analytics, environmental science, and sustainability practices. By overcoming these challenges, WSNs can be effectively deployed for sustainable environmental monitoring to support informed decision-making, resource management, and conservation efforts.

V. Opportunities in deploying WSNs for sustainable environmental monitoring:

Deploying Wireless Sensor Networks (WSNs) for sustainable environmental monitoring presents several opportunities for enhancing environmental conservation, resource management, and decision-making processes. Some of the key opportunities in deploying WSNs for sustainable environmental monitoring include [4, 39]:

1. **Real-time Monitoring:** WSNs enable real-time monitoring of environmental parameters such as air quality, water quality, soil moisture levels, and biodiversity. By providing continuous and high-resolution data, WSNs allow for timely detection of environmental changes, pollution events, and natural disasters, enabling prompt response and mitigation actions.
2. **Data-driven Decision Making:** The data collected by WSNs can be used to analyze trends, patterns, and correlations in environmental variables, facilitating evidence-based decision-making in environmental management and policy formulation. By leveraging data analytics techniques, stakeholders can gain valuable insights into environmental processes, identify areas of concern, and optimize resource allocation for sustainable development.
3. **Early Warning Systems:** WSNs can be deployed to create early warning systems for natural disasters such as floods, wildfires, and landslides. By monitoring environmental conditions in real-time and detecting anomalies or critical thresholds, WSNs can provide advance warnings to communities, authorities, and emergency responders, reducing the impact of disasters and saving lives.

4. **Precision Agriculture:** WSNs can be used in precision agriculture applications to monitor soil conditions, crop health, and weather patterns. By optimizing irrigation schedules, fertilizer usage, and pest control strategies based on real-time data from sensor nodes, farmers can improve crop yields, reduce resource wastage, and minimize environmental impact.
5. **Habitat Monitoring:** WSNs can be deployed for monitoring wildlife habitats, tracking animal movements, and studying biodiversity patterns. By collecting data on species distribution, population dynamics, and habitat changes, WSNs can support conservation efforts, ecosystem restoration projects, and wildlife protection initiatives.
6. **Environmental Compliance Monitoring:** WSNs can be used to monitor industrial emissions, water discharges, and waste management practices to ensure compliance with environmental regulations and standards. By providing continuous monitoring and remote data access, WSNs can help regulators enforce environmental laws, detect violations, and hold polluters accountable.
7. **Citizen Science Initiatives:** WSNs can engage citizens in environmental monitoring efforts through participatory sensing projects. By involving local communities in data collection, analysis, and interpretation, WSNs can raise awareness about environmental issues, empower citizens to take action, and foster a sense of ownership and stewardship towards the environment.
8. **Sustainable Development Planning:** WSNs can support sustainable development planning by providing data-driven insights into land use changes, urban growth patterns, and natural resource exploitation. By monitoring environmental indicators over time, WSNs can inform policymakers, urban planners, and developers about the impacts of human activities on the environment and guide sustainable development strategies.

Overall, deploying WSNs for sustainable environmental monitoring offers a wide range of opportunities to improve environmental sustainability, enhance resilience to climate change, and promote responsible stewardship of natural resources. By harnessing the potential of WSN technology in environmental monitoring applications, stakeholders can work towards achieving a more sustainable and resilient future for our planet.

VI. Conclusion:

Future research directions to enhance the use of WSNs for environmental monitoring and sustainable development:

1. **Integration of Artificial Intelligence (AI) and Machine Learning (ML) Algorithms:** Future research could focus on developing AI and ML algorithms to analyze the vast amount of data collected by WSNs more effectively. These advanced algorithms can help in predicting environmental trends, identifying anomalies, and optimizing resource management strategies for sustainable development.
2. **Energy-Efficient Sensor Node Design:** Research can be conducted to design sensor nodes that are more energy-efficient, have longer battery life, and are environmentally friendly.

This can help in reducing the maintenance costs of WSNs and making them more sustainable in the long run.

3. **Development of Wireless Power Transfer Technologies:** Investigating wireless power transfer technologies can help in overcoming the limitations of battery-powered sensor nodes. By enabling energy harvesting or wireless charging capabilities, WSNs can operate continuously without the need for frequent battery replacements, enhancing their reliability and sustainability.
4. **Interoperability and Standardization:** Research efforts can be directed towards developing standards and protocols that ensure interoperability among different WSN systems. This will facilitate data sharing, integration, and collaboration among stakeholders, leading to more comprehensive and efficient environmental monitoring solutions.
5. **Privacy and Security Considerations:** Future research should address privacy and security concerns associated with WSNs, especially when collecting sensitive environmental data. Developing robust encryption techniques, authentication mechanisms, and data protection protocols will help in safeguarding the integrity and confidentiality of information gathered by WSNs.
6. **Scalability and Deployment Strategies:** Investigating scalable deployment strategies for WSNs in large-scale environmental monitoring projects can help in optimizing coverage, connectivity, and data collection efficiency. Research on cost-effective deployment methods, network optimization techniques, and scalability considerations will be crucial for expanding the use of WSNs in sustainable development initiatives.
7. **Citizen Science and Community Engagement:** Future research can explore ways to involve citizens and local communities in environmental monitoring efforts using WSN technology. Engaging stakeholders in data collection, analysis, and decision-making processes can enhance community resilience, promote environmental awareness, and foster sustainable development practices at the grassroots level.

By focusing on these research directions, the use of WSNs for environmental monitoring and sustainable development can be further enhanced, leading to more effective resource management, improved resilience to environmental challenges, and a more sustainable future for our planet [40-41].

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Potentiality analysis of Soil and Environment for Coffee(genus)

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Abstract: -The soil endows nutrients to the plants over it. Natural composition of minerals present in soil and local environment are potent factors, on which growth of plant depends. The aim of the present work was to analyze soil and environment around the Mainpat hill, Surguja division of Chhattisgarh. During field visit, it has been observed that the temperature, elevation range, tropical and subtropical climatic condition of some hilly area of Mainpat Surguja division are similar to north east and south India. Samples were collected from study area and analyzed for pH, soil type and composition mineral elements. This study would be helpful in acquiring scientific knowledge of soil and environment among local authorities, investors, coffee(genus) growers and local farmers. Coffee is the second most traded commodity in the world and, in India. As this is cash crops therefore it will take upward the economic graph of the locality and state.

Keywords: - Coffee, potent , crops , tropical, economic.

Introduction

Soil quality is the degree of suitability to the specific functions that soils perform in a given system. It can be defined as "the capacity of the soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and to promote plant and animal health (Doran and Parkin, 1994). The history of the coffee began in ancient Ethiopia in 15th Century. The top leading five countries of coffee production are 1. Brazil 2. Vietnam 3.Colombia 4. Indonesia. 5. Ethiopia. Although India is the 8th leading country for coffee production in the world, out of 29 states only south and north east states play major role in coffee production. Some of the central India states and other states have also suitable potential, scientific efforts need to accelerate and explore them. In order to achieve higher productivity, there have been many changes in soil, environment and land use and management practices, which have led to deterioration of soil and environmental quality. However, such changes and associated impacts are not uniform across the region. Therefore, to determine the sustainability of the land management systems prevalent in a region, quantitative assessment of soil quality on a regional scale is necessary.

Coffee plant growth depends upon multifactor such as prospective soil composition, soil pH, climatic condition, slope terrains, seasonal temperature etc. Prospective earth soil is one of the key factors. Before taking a big risk to crop coffee plant garden in any region as it is a long-term

investment, it prerequisite to investigate the earth soil attributes of that specific climatically enabled area very carefully. Micro mineral elements on soil composition vary coffee plant growth rate, a required ratio of the composition of elements as micronutrients boost the coffee plant growth and production. Carbon, hydrogen and oxygen are available in air and water, remaining elements are present in soil.

The selection of coffee plantation area incorporates with the deviation of the minimum required micronutrient and validation. Foliage is harvested periodically from coffee hence shoots be as strong to bear physically imposed stress. The Energy Dispersive X-ray (EDX) is a powerful micro analyzer tool used in elements analysis, due to its high sensitivity in detecting the different elements with their weight and atomic percentage in composition (Scimeca et al.,2018).

Literature Survey

Soil organic carbon influences a wide range of physical, chemical and biological properties and is considered as the most important indicator of soil quality (Larson and Pierce 1994). Generally, coffee plants receiving a balanced nutrition, in which the required elements are supplied in appropriate amount share capable of producing quality beans. Coffee plant prospers well in slightly acid soils with a pH of 5.5-6.5 (Mitchell, 1988; Snoeck and Lambot, 2004). When the pH level is less than 4.0, the levels of aluminium and manganese can be high, and this requires liming to correct the toxicity effects (Snoeck and Lambot, 2004). pH is a determined value based on a defined scale(Dewagan and Chaohan, 2022). Nutrients are required for both vegetative growth of coffee trees and production of high quality beans and hence nutrient imbalances can affect coffee quality (Njoroge, 1998). Nitrogen and potassium are the two dominant nutrients required for coffee, K being more important in fruit development and N for vegetative growth. Phosphorus is essential for root, flower bud and fruit development, and it plays an important role in energy storage and transfer in crop plants (Fageria, 2009). Calcium, magnesium and other major and micro nutrients are essential for a balanced nutrition of the coffee plant although the required quantities are usually small to minimal in coffee (Willson, 1985b; Mitchell,1988). When plants are grown without adequate essential nutrients, characteristic deficiency symptoms result (Nagao et al., 1986). For instance, the balance between K, Mg and Ca is very important for coffee quality because K is antagonistic to Mg and Ca (Snoeck and Lambot, 2004). The characterization process will involve the analysis of various physical, chemical, and biological parameters (Dewagan and Chaohan, 2023). Electrical resistivity of the soil is an intrinsic parameter that varies the flow of electrical current. The electrical resistivity method used in the geophysical testing and agriculture during last many years.

Electrical conductivity of soil leads the soil to be acidic. Soil has become an inherent part of the Earth that forms different landscape by variation in their attributes and matrix. Therefore, the relationship between the electrical property and soil strength are important to assign the differences (Chaohan et al., 2019).

Study Region

Proposed study region for the possibility of coffee (genus) plantation is nestled amongst the rolling hills of the south eastern Vindhyachal-Baghelkhand mountain part of peninsular India. It is situated at the extreme north of the Chhattisgarh state of India, This area is densely forested along with slope terrain as a whole is a mesa land form. The elevation range is more than 3560 ft above sea level, length about 28 km, width about 13 km. At present it comes under Mainpat division Surguja of Chhattisgarh. Soil samples are collected from the study region (fig.1).

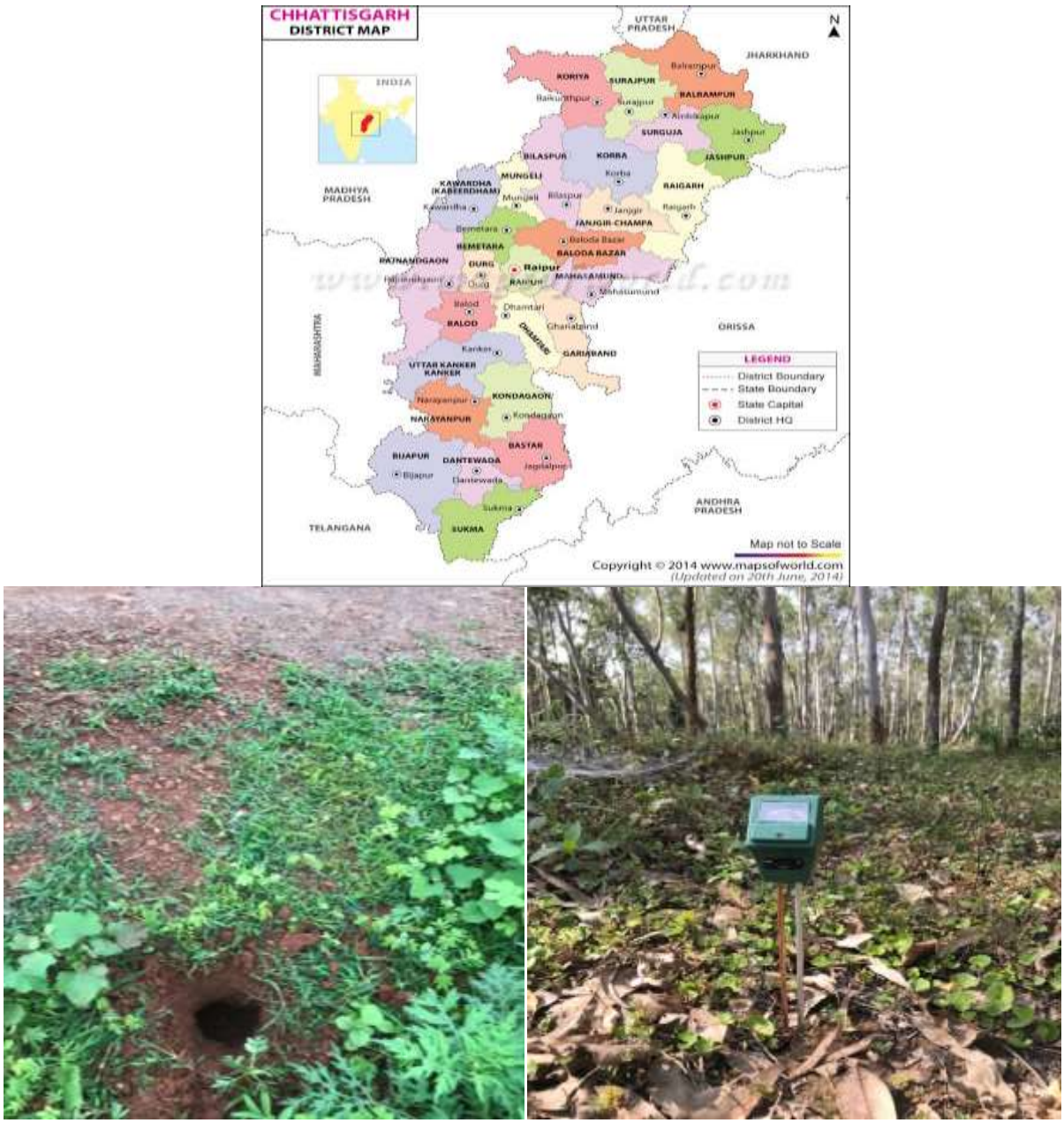


Fig 1. Location of Mainpat "Study area"

Reference Region

Reference soil samples are collected from Anantagiri coffee plantation garden. It is situated at Anantagiri hills, Araku Valley, Visakhapatnam, Andhra Pradesh, India. (Fig 2).

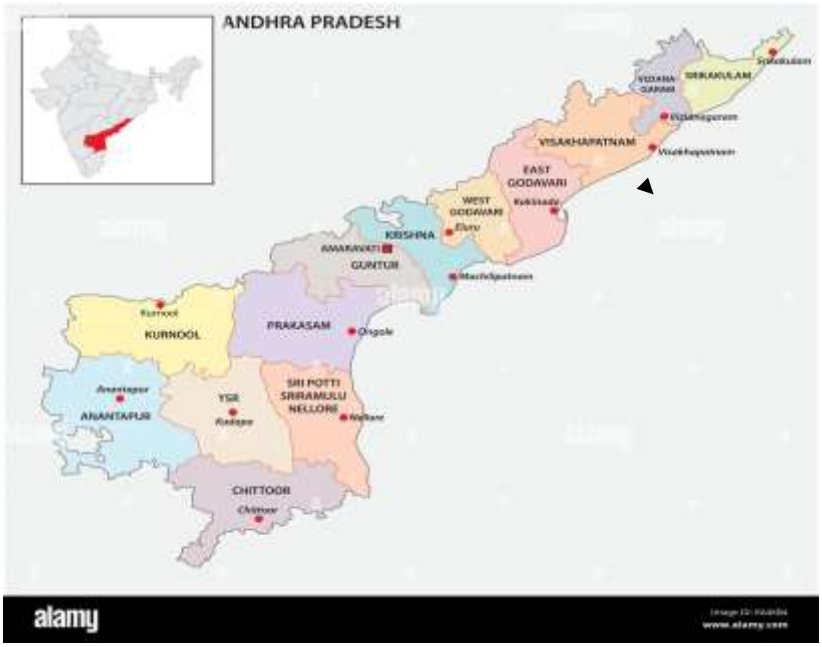


Fig 2. Location of Anantagiri coffee plantation.

Fig. 3 Coffee Museum and Processing Unit

Materials and Methods

Sample Collection and Preparation

Sample (S1) is collected from mainpat, division Surguja in Chhattisgarh, India. Reference region, sample (S2) is collected from the existent Anantagiri coffee plantation garden, Anantagiri hills, Araku Valley, Visakhapatnam, Andhra Pradesh, India. Hygienic poly bags were used for sampling the soils. The collected samples were initially gently sundried for 12 days followed by hot air oven dried for 2 days. The dried samples were crushed and grinded by high quality ceramic mortar pestle. Sieve analysis process is done for 120 micron and soil powder samples were stored in glass vessels.

Experimental

To make the soil samples conductive anterior to place the sample in testing holder dried samples were coated by gold coater (Quorum-SC7620 Sputter Coater). The SC7620 is a compact, SEM sputter coater. The sample was examined by Oxford- EDX system (INCA 250 EDS with X-MAX 20mm Detector). It is non-destructive analyser and the concentration of the elements in the composition are quantified accurately. The microstructure photographs of the sample recorded using ZEISS EVO Series SEM Model EVO 18.

Result and Discussion

Determination of element concentrations

SEM-EDX is used to evaluate the samples at Metallurgical and Materials Engineering laboratory NIT Raipur, (C.G), India. The SEM -EDX analysis was done by using computer-controlled field emission SEM (ZEISS EVO 18) equipped with an Oxford- EDX system (INCA 250 EDX with X-MAX 20 mm Detector). Samples were held on holder for gold embrocating. A skinny layer of Gold was poured on samples with the help of the vacuum coating unit (QuorumSC7620 Sputter Coater). samples were enabled electrically conductive by gold coating. Qualitatively and quantitatively analysis of micronutrients in the samples were recorded by Energy Dispersive X-ray Spectroscope.

Table 1. Reference

Element	Compounds	Reference date, time
Si	SiO_2	01.06.1999, 12:00 AM
Al	Al_2O_3	-do-
Mg	MgO	-do-
K	MAD-10Feldspar	-do-
Ca	Wollastonite	-do-
Fe	Fe	-do-
Ti	Ti	-do-

Table 2. EDX data of mainpat soil sample S1

Elements	Weight %	Atomic %
Mg	1.36	1.54
Al	21.35	24.48
Si	54.48	59.58
K	5.82	4.60
Ca	0.53	0.43
Ti	1.63	0.98
Fe	16.02	9.27

Table 3. EDX data of Anantagiri coffee plantation garden sample S2

Elements	Weight %	Atomic %
Mg	2.12	2.78
Al	20.09	23.09
Si	55.73	60.73
K	5.79	4.82
Ca	0.18	0.16
Ti	1.60	0.88
Fe	19.50	11.34

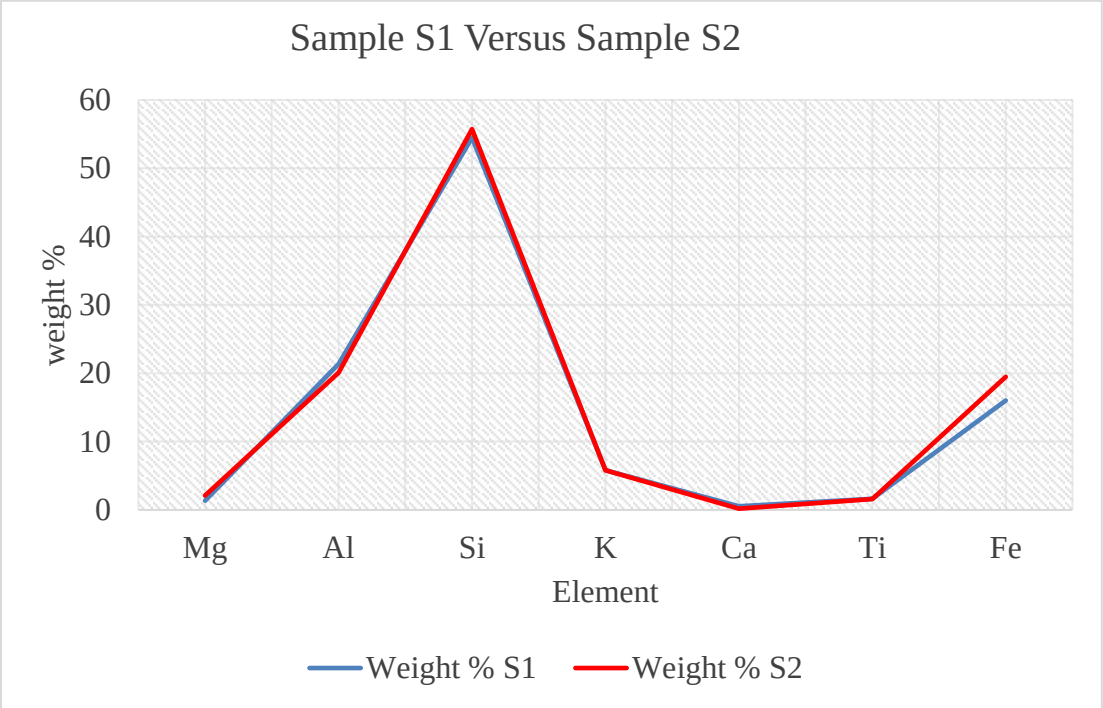


Fig 4. Graph is plotted between S1 vs S2 Sample according to weight percentage

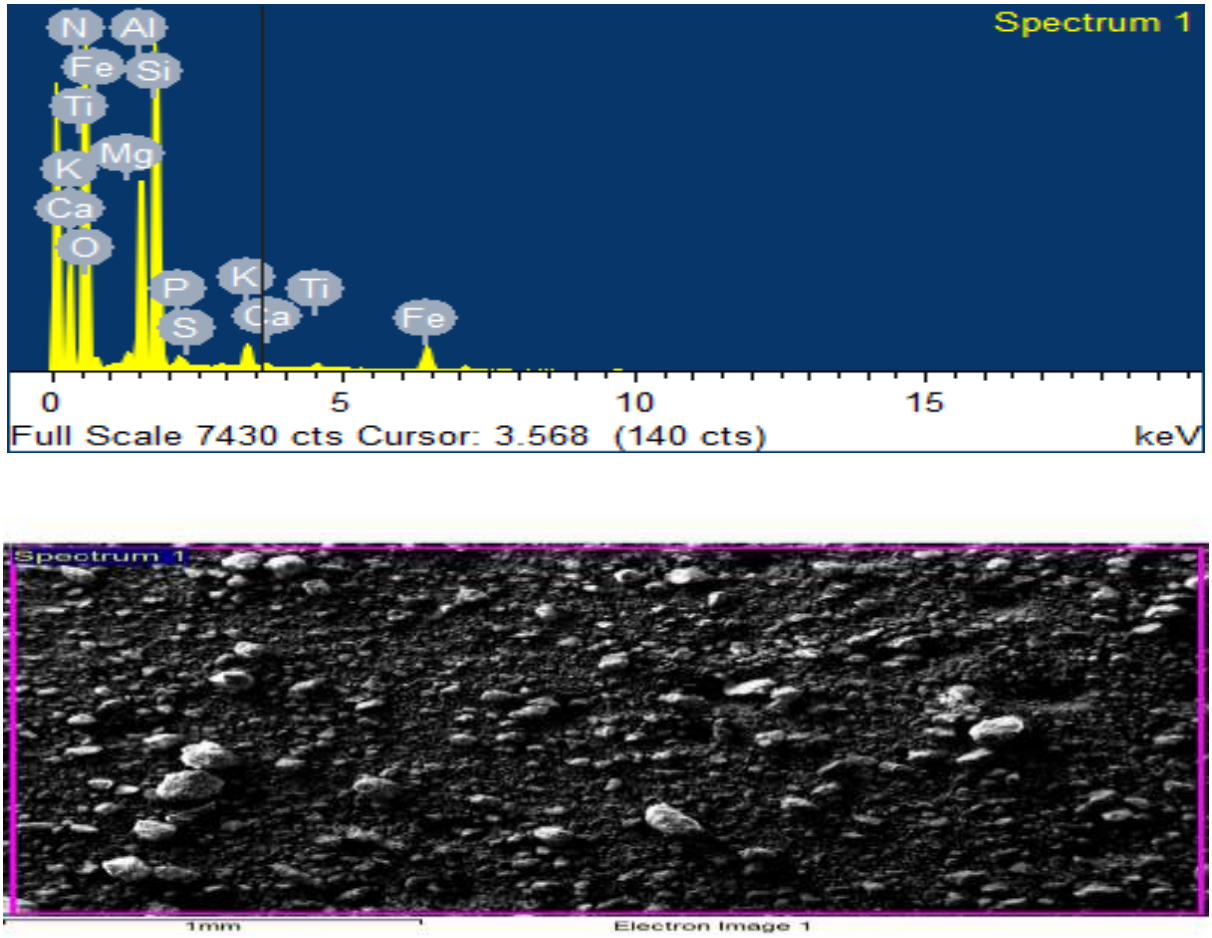
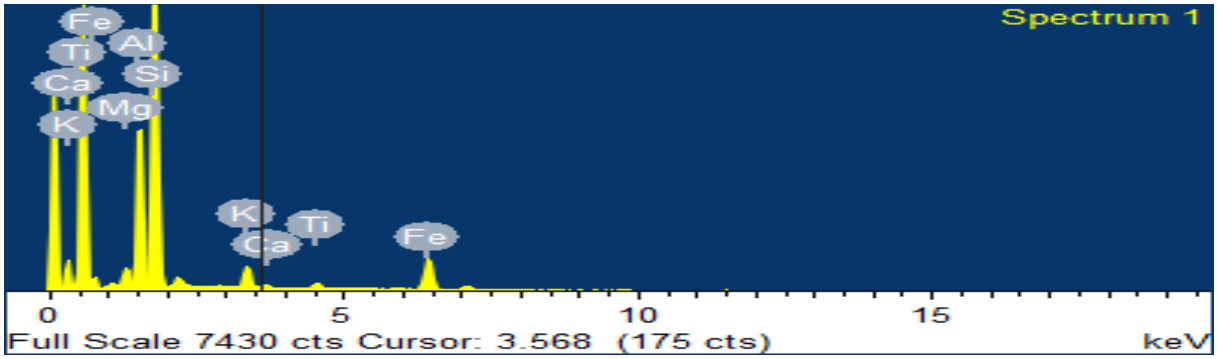


Fig 5. EDX Spectrum of mainpat soil sample S1



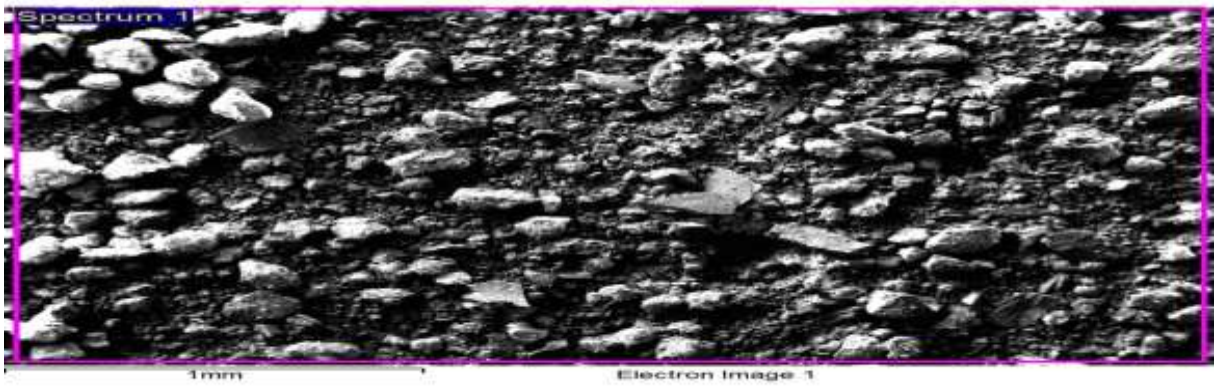


Fig 6. EDX Spectrum of Anantagiri coffee plantation garden sample S2

Determination of pH

5 gm of 120µ particle size soil samples were dissolved in 50 ml of distil water. pH of soil was measured by digital pH meter. pH of mainpat soil was recorded 5.66. pH of Anantagiri coffee plantation garden soil was recorded 4.97.

Fig 7. pH set up

Discussion

It is recorded that weight percentage of micronutrient potassium (K) in sample S1 is 5.82 that is more than the sample S2. Weight percentage of micronutrient Aluminium (Al) in sample S1 is 21.35 that is more than in sample S2. weight percentage of micronutrient Silicon (Si) in sample S1 is nearly equal to Sample S2. Weight percentage of Calcium (Ca) in sample S1 is 0.53 is nearly equal to 0.50 that is good. Presence of Mg and Fe is also as per requirement in sample S1. pH value in sample S1 5.66 that is slightly acidic, under standard range 5.5 – 6.5 for coffee plant growth . No presence of heavy metal like Cu, Ni, Zn, As, Cr, Pb, V and Cd indicates that soil is non toxic.

Conclusion

Sample composition elements like Fe, Na, Mg, Al, Si, Cl, K, Ca, Mn, Co, Se, including heavy metals Cu, Ni, Zn, As, Cr, Pb, V and Cd are simply investigated by SEM-EDX technique. pH of the soil sample is simply measured with the help of digital pH meter accurately. As per result found, soil of study area is rich micronutrients K, N, S, Al, Si, Fe, Mg, and less in Ca. The SEM-EDX analysis mentioned in table 2 and table 3 shows that there is a significant value of micronutrients in sample S1 for coffee plant growth.

As per SEM-EDX analysis heavy metals like Ni, Cu, Zn, As, Cr, Pb, V and Cd are not present in both samples i.e. nontoxic area. Elevation range of some specific area of Surguja district is more than 3000 ft that is climatically suitable for coffee plant growth. As the study area is quite non polluted and naturally blessed, quality of coffee would be sharp good.

As per conclusion of the work, study region is agro-physically and climatically similar, somehow better to the reference region (existent coffee garden region). This study will be helpful in acquiring scientific exploration among researchers, local authorities, investors, coffee growers and local farmers.

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A Survey of Wild Edible Plants Used by The Tribal People of Bastar District.

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Abstract

The goal of the current study was to record the availability, diversity, and traditional applications of wild food plants in South Chhattisgarh. The food and other necessities for the tribes in this area are mostly derived from wild resources. The area has an abundance of edible wild plants. In the research region, a total of 57 species from d 40 families were identified. Of the species included in the records, 11 were climbers, 8 were shrubs, and 22 were herbs. Of the plants that have been identified, 15 are common, 44 are abundant, and 21 are uncommon in this area. Plant components used for food include leaves, shoots, young twigs, roots, rhizomes, tubers, flowers, fruits, seeds, and so on.

Keywords: Wild food plants, Tribes, Bastar, Chhattisgarh.

Introduction

The geographical coordinates of Chhattisgarh state span between 80°15' and 84°24' E longitude and between 17°46' and 24° 5' N latitude, creating a diverse landscape of hills and plains. With an average annual rainfall of 60 inches, Chhattisgarh boasts a thriving agricultural sector, primarily focused on rice cultivation. Recognized as an herbal state, Chhattisgarh is renowned for its abundant flora and fauna, with approximately 44% of the state covered by forests, prominently featuring Sal forests, Teak, Bamboo, Saja, Sarai, Haldi, and more.

This study specifically delves into the southern region of Chhattisgarh, with a focal point on Bastar district. Positioned between 19° 16′ N latitude and 81° 44′ E longitude, Bastar district covers an expansive area of 6,596.90 square km. According to the 2011 census, the district's population stands at 1,413,199, with 698,487 males and 714,712 females. Geographically enclosed by Kondagaon, Dentewada, Sukma, and Narayanpur, Bastar is characterized by its unique demographics and topography.

Chhattisgarh, home to a diverse tribal population, sees 70% of its tribes contributing around one-third of the state's total population, making up approximately 10% of India's tribal communities. The demographic landscape has witnessed changes since the 2001 census, with Scheduled Castes (SC) and Scheduled Tribes (ST) now constituting 12.8% and 30.62% of the state's population, respectively. The region is inhabited by Gond, Maria, Muriya, Bhatra, Halba, and Dhruva tribes.

Agriculture forms the primary occupation for tribal communities, supplemented by the essential role of forests and their products in sustaining their livelihoods. Tribals and local communities rely on forests for various needs such as food, medicine, and fiber. While agriculture predominantly satisfies their food requirements, the collection of roots, tubers, leaves, flowers, and fruits from the forest serves as supplementary sustenance. This paper specifically explores the collection and consumption of wild plant species by these communities for edible purposes.

Materials and Methods

A number of tribal village in Bastar have undergone ethnobotanical surveys between January and December of 2023. Firsthand knowledge of food plants was gathered from knowledgeable tribal people. There was a lengthy list of plants; however, only 57 are included here. Plants are arranged alphabetically by their botanical name, which is followed by the name of the locality, family, edible portion, tribes that use the plant, and lifeform. Brief descriptions of plants' culinary uses are provided wherever particular cultures eat them.

Result and Discussion

Tribal people in the state generally work in agriculture as their primary source of food. Their primary food source is rice. In addition to rice, they eat vegetables, wheat, lentils, and millets. In addition to these crops and the seasonal vegetables that grow there, the tribe also depends on the 57 plant species that grow wild in the area for additional sustenance. Of these, 32 species are used as vegetables, 18 as fruits, and 8 species are used for other purposes like sauces, condiments, and spices. Additionally, some species are consumed in many ways.

Table-1 Wild edible plants Used by tribals of Baster District.

S. N.	Botanical Name	Common Name	Family	Plants Part use	Life For m
1	*Abelmoschus moschatus medic*	Jangli bhindi	Malvaceae	Tuberous roots are edible.	S
2	*Adhatoda zeylanica medikus*	Adusa	Acanthaceae	Young shoots and leaves are cooked as **Vegetable**	S
3	*Aegle marmelos* (L) Correa.	Bel	Rutaceae	Ripe **Fruit** pulp is eaten.	T
4	*Alangium salvifolium* (L.f.) Wang.	Ankol	Alangiaceae	Flowers and fruits are eaten as **Vegetable**	T
5	*Amaranthus caudatus* L.	Kedar chua	Amaranthaceae	Young twigs and leaves are cooked as **Vegetable**	H

6	*Ampelocissus tomentosa (Heyne ex Roth) Planch.*	Bakri-dhoto	Vitaceae	**Fruits** are edible.	Cl
7	*Angelica glauca* Edgew.	Choru	Apiaceae	Dry seed and root is used as Spice.	H
8	*Annona squamosa* L.	Sitaphal	Annonaceae	Ripe **Fruits** are eaten	S
9	*Anthocephalus indicus (Lam.) A.Rich.ex.Walp.*	Kadam	Rubiaceae	**Fruits** are eaten	T
10	*Antidesma acidum* Retz.	Derango	Euphorbiaceae	Leaves used as **Vegetable** and dried leaves as khatai. **Fruits** are eaten.	S
11	*Asparagus racemosus Willd.*	Satawar	Liliaceae	Roots are eaten.	Cl
12	*Bacopa monnieri* (L.) Pennell	Brahmi	Scrophulariaceae	Leaves are eaten as **Vegetable**.	H
13	*Bambusa arundinacea Willd.*	Bans	Gramineae	Young shoots are eaten as **Vegetable**.	H
14	*Basella rubra* L.	Poin	Basellaceae	Leaves are eaten as **Vegetable**.	Cl
15	*Bauhinia purpurea* L.	Kachnar	Caesalpiniaceae	Young leaves are used as **Vegetable**.	T
16	*Begonia picta* Sm.	Pathar-chati	Begoniaceae	Leaves are eaten as **Vegetable**.	H
17	*Boerhavia diffusa* L.	Kha-prailbhaji	Nyctaginaceae	Young leaves are eaten as **Vegetable**.	H
18	*Bombax ceiba* L.	Semal	Bombacaceae	Young fruits are eaten as **Vegetable**.	S
19	*Buchanania lanzan* Spreng.	Char	Anacardiaceae	Ripe **Fruits** and seeds are edible	S
20	*Butomopsis latifolia* Kunth.	Chanti	Butomaceae	Leaves are eaten as **Vegetable**	H

21	*Caesulia axillaries* Roxb.	Muchri	Asteraceae	Leaves are eaten as **Vegetable**	H
22	*Cajanus scarabaeoides* (L.) du Petit-Thou.	Banhirwa	Fabaceae	Cooked seeds are eaten as **Vegetable**.	S
23	*Canscora diffusa* (Vahl.) R.Br.	Khakhab haji	Gentianaceae	Whole plant are eaten as **Vegetable**	H
24	*Careya arborea* Roxb.	Pindar	Barringtoniaceae	**Fruits** are cooked and eaten	T
25	*Carissa carandes* L	Kaa-raunda	Apocynaceae	**Fruits** are eaten and also used for pickle.	S
26	*Cassia fistula* L.	Amaltas	Caesalpiniaceae	Flowers are eaten as **Vegetable.**	T
27	*Cassia mimosoides* L.	Jirhul	Caesalpiniaceae	Leaves are used as **Vegetable**.	T
28	*Cassia tora* L.	Chakora	Caesalpiniaceae	Young leaves are used as **Vegetable**.	H
29	*Catunaregam spinosa (Thunb) Tiru*	Kharhar	Rubiaceae	Young **Fruits** are eaten as **Vegetable**.	T
30	*Celastrus paniculata* Willd.	Kujur	Celastraceae	Flowers are used as **Vegetable**.	Cl
31	*Celosia argentea* L.	Silyari	Amaranthaceae	Leaves used as **Vegetable**.	H
32	*Centella asiatica L.*	Brahmi	Apiaceae	Leaves are eaten as **Vegetable**.	H
33	*Chenopodium album* L.	Baithu	Chenopodiaceae	Leaves used as pot **Vegetable**	H
34	*Citrullus colocynthis Schrad.*	Jangli Kundru	Cucurbitaceae	Ripe **Fruits** are eaten.	Cl
35	*Cleome viscose* L.	Jakhiya	Cleomaceae	Seeds are used as condiments	H
36	*Cocciniagrandis* (L.) Voigt	Kandaroi	Cucurbitaceae	Young shoots made into **Vegetable**	Cl

37	*Commelina attenuate Koin.*	Kana	Commelinaceae	Leaves are eaten as **Vegetable.**	H
38	*Corchorus capsularis L.*	Chench	Tiliaceae	Leaves are used as **Vegetable**.	H
39	*Cosmostigma racemosum* L.	Chota-Konga	Asclpiadaceae	Flowers are edible.	Cl
40	*Crotalaria incana* Rottl.	Jangli sun	Fabaceae	Flowers are cooked as vegetable.	H
41	*Cucumismelo* L.	Dimbo	Cucurbitaceae	**Fruits** are eaten.	Cl
42	*Dendrocalamus strictus (Roxb.) Nees*	Bans	Poaceae	Young Shoots is used as **Vegetable**.	H
43	*DilleniaaureaJ. E.Smith.*	Kumbhi	Dilleniaceae	Fruits are cooked and eaten as **Vegetable**.	T
44	*Dioscorea alata*L.	Bankanda	Dioscoreaceae	Tuber is cooked as **Vegetable**.	Cl
45	*Diospyros melanoxylon Roxb.*	Tela	Ebenaceae	Ripened **Fruits** are eaten	T
46	*Eretia laevis* Roxb.	Suruh matha	Ehretiaceae	Young leaves are cooked and eaten as **Vegetable**.	T
47	*Emblica officinalis* Gaertn.	Amla	Euphorbiaceae	**Fruits** are eaten	T
48	*Emilia sonchifolia* (L.) DC.	Kha-praban	Asteraceae	Leaves are cooked and eaten.	H
49	*Erycibe paniculata* Roxb.	Kari	Convolvulaceae	Ripened **Fruits** are eaten.	Cl
50	*Eryngium foetidum* L.	Kishun jeera	Apiaceae	Whole plant used as spices and also mixed in preparation of curry and sauce.	H
51	*Euphorbia microphlla Heyne ex Roth.*	Lal chimti	Euphorbiaceae	Leaves used as **Vegetable**.	H

52	*Ficus cunia* Ham. ex.Roxb	Podai	Moraceae	**Fruits** are edible	T
53	*Gardenia latifolia* Ait.	Papra	Rubiaceae	Ripened **Fruits** are edible	T
54	*Grewia hirsuta* Vahl	Gursakri	Tiliaceae	Ripen **Fruits** are edible	T
55	*Hibiscus subdariffa* L.	Ttepa	Malvaceae	**Fruit** pulp are eaten and also leaves are eaten as **Vegetable**.	H
56	*Holarrhena antidysenterica Wall.*	Korya	Apocynaceae	Boiled flowers are cooked and eaten as **Vegetable**.	T
57	*Holostemma rheedianum Spreng.*	Konga	Asclepiadaceae	Flowers are eaten.	Cl

Note : Cl-Climber, H-Herbs, S-Shrubs and T-Tree

Conclusion

The majority of plants are wild. Since the majority of these plants have therapeutic benefits as well, it is important to preserve and promote their germplasm.

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Environmental Pollution and Sustainable Development

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Abstract: Today, all over the world there is a great concern and worry as to what will become of the earth, considering the inherent effect of the ever-increasing environmental pollution that has adversely distorted the ecosystem, thereby spurring but the international communities, the government, generation public, cooperate bodies, policy makers, professionals and even politicians to take adequate measures aimed at addressing environmental problems. This paper discussed on environmental pollution and sustainability. It presented what our environment is made up, its ever-increasing problems and challenges facing our environment from different perspective. The purpose of this paper is timely; with a consideration that due action is ripe for the proper implementation of environmental planned strategies (Techniques) and tools for addressing environmental menace in different part of the world, by different government, public and private sectors. The obtained results in this paper are rich enough to provide adequate solutions to many environmental problems in different parts of the world, especially in Indian countries.

Keywords: Environmental Pollution, Sustainability.

1. INTRODUCTION

The arrival and reproduction of man on earth has caused a lot of impact and havoc on the Biosphere (environment) which supports life and sustains various human activities. Due to man unchecked actions, for example large scale deforestation of forest for residential and agricultural land uses has changed the habitat organism living in the forest. The hunting of animal by man as led to the extraction of certain animal species. Man has also developed new types of domesticated animals as well as plants to serve his own needs. The rapid increase in activates today in many cities without proper planning and control is the outcome of slums that has penetrated in our physical environment. This is evident particularly in housing sector, transport, water supply, sanitation, power supply and even in employment sector. Those that are presently not employed are equally polluting our environment by engaging themselves in different harmful activities (stealing, pollution, idleness, Etc.) since there is nothing to keep them busy always in the society. The problem of environmental degradation and pollution of water, air, and noise is always on high increase in many cities without proper check, which evidently has resulted in low standard of living in many of our cities and town in India.

2. ENVIRONMENT

The word "environment" may mean different thing to different people. Scientifically, the Physical, environment is different from social or economic. Environment means" that which surround or that which envelop the earth and it consist of the entire ecosystem. Scientifically, the four spheres or division of the earth viz. Lithosphere, Hydrosphere Biosphere, and Atmosphere. This could be broken to include the water body and life therein, landmass, forests, grassland, deserts, animals, man himself and all the interactions taken place among those group. Environment is also defined as the circumstances surrounding or regions in which everything exist. Everything external to the organism is included in it. It also includes open field, mountains, forest, Deserts, snow, Seas, River, Lakes, Wells, Springs, Atmosphere etc.

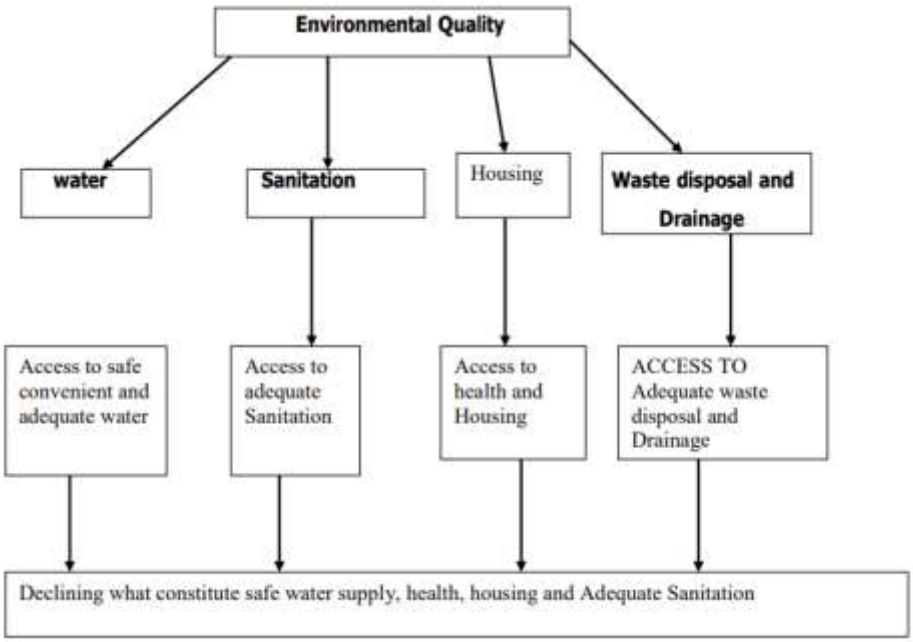

Figure 1. Showing different components of Environmental quality

Environmental quality and its effects Environment quality is a product of many factors that reduce the quality of an environment from what it should be in the physical outfit. General factor such as land degradation, pollutions of water and Air, noise, Sanitation, over pollution, slums, etc, usually reduced the quality of an environment. Since environmental quality involves standard, Samuel et al (2008) provided a simple approach for ensuring the quality of an environment with illustrative sketch as shown above (figure 1) Samuel et al (2008) also added that the main concerned for the environment are the following:

- **i.** How the Atmosphere, the rivers and the oceans are being polluted.
- **ii.** How people might be causing global warming.
- **iii.** How people are destroying the world's forests and other wilderness areas.
- **iv.** How people are endangering the survival of other species v. How people are being careless with toxic (life-threatening) washes.

Research also added that the above measuring technique is applicable in many countries of the world. In addition, the account for environmental differences in many countries is based on the following:-

i. Climatic condition.
ii. Topographic and fertility of the soil.
iii. Availability of industries
iv. Commercial centers and parks

3. POLLUTION

The urban environment is usually polluted by three major sources, viz. Water, Air, and Noise. The world development report of 1992 highlighted the general effect of pollution on health. It also noted that the Tropical forest- the primary source of livelihood for about 140 million people are being lost at the rate of 0.9% annually. The above facts clearly speak for themselves about the alarming rate and situation that many developing countries are facing, including Nigeria due to environmental Degradation.

Types of pollution within urban environment

1. Water pollution: water become contaminated from disease bearing human wastes and also become polluted through industrial influent.

The classification can also be in the order:-

a) **Water communicable disease:** infection related to water supply and sanitation are many and their relationship is complex. However, in many Africa countries, a conception system for understanding disease related to water and sanitation has been developed.
b) **Water related infections:-** water related disease is one which is in same gross way related to water in the environment (Bodies of water) and the impurities within water. Transmission Route Of Water Related Infections (water borne route) Water borne transmission occurs when the pathogen is in the water, which is infected by a person or animal which may then become infected.
c) **Water-wash route:-** Water wash disease is the one whose transmission will reduce by an increase in the volume of water used for hygienic purpose irrespective of the quality of that water. Diseases Cause by Water- Washed route are numerous. An example of such are: Typhoid, Eholeva, Darrheas, Ascarrasis, cholera, Dysentries, polio, infection Hepatitis, bacillary, eye infection, craw-craw, house bone, fewer, etc.
d) **Water based route:-** A water based disease is one in which the pathogen spend a part of its life cycle in a water snail or other aquatic animal. The diseases are due to infection by parasite worm which depends on aquatic intermediate hosts to complete their cycles. Diseases cause by water based Route: Diseases cause by water based is as followed: Guinea worm, Schishomiasis, paragommense, clonorchvasis, etc.

e) **Insect vector route:-** This is spread by insect which lives either in water or lives near water. Diseases cause by insect vector Route:- sleeping sickness, malaria, River blindness, filaviasis, mosquito bone, viruses-yellow fever etc.

f) **Excreta –Related infection**: An excreta –related infection is one which is related to human –excreta (i.e. urine and feaces). The two transmission mechanisms for this are:

   i. Transmission via infected excreta: in this case pathogen is release into the environment through feaces or urine of infection individuals.
   ii. Transmission by an excreta – related insect vector: an insect which visit excreta to breed or to feed may mechanically carries excreta pathogen to food or an insect vector of a non-excreted pathogen and may preferably breed in feacally polluted sites.

2. Air pollution

Air pollution means the presence of any abnormal material or property in the air that reduce the usefulness of the air resources. The term pollution may be referred in context with outdoor open atmospheric conditions, localized air condition, and enclosed space conditions.

Sources of Air Pollution

i. Fuel burning operation for heat and power generation in large steam electric generating plant, in-residence, in hotels, clubs, hospitals and in different processing of laundries, Drycleaners, garage and service station.
ii. The refuse burning operation in different ,municipalities industries and residential apartment.
iii. Burning of fuels for modes of transportation which includes trucks, buses motor vehicles, rail using petrol, diesel and gasoline's.
iv. Industrial and commercial process emission in different manufacture process namely metallurgical plants, chemical plants, refineries mineral production, etc.

Cause of air pollution

i. increase in population and traffic
ii. Development of industries
iii. Development of automobile engineering
iv. Thermal and nuclear generation
v. Development of agriculture etc.

Forms of air pollutions

i. Smoke 2. Dust 3. Gases
ii. Particulate matter from industrials, power generation plants, road-way dust. Etc.
iii. Hydrocarbon- from automobile exhaust 6. Sulphur compound 7. Nitrogen compound 8. Carbon compound 9. Fluorine compound 10. Chlorine compound

Effects of air pollution

(i) Effects on human health

Air pollution	Effect on human health
1.Sulphur dioxide	Causes suffocation, respiratory disease, Irritation of eyes and throat
2.Hydrogen Sulphide	Danger of respiratory paralysis
3.Hydrogen Fluoride	Cause skin disease
4.Carbon Monoxide	Causes lungs diseases and slow poisoning leading to death
5. Oxidants	Causes lungs diseases.

(ii) Effects on Plant

i. Plants may be dried up .
ii. The yield of crop may decrease .
iii. The quality of crops may decline or may be affected by disease.
iv. The growth of vegetation may stop and the quality may be inferior or may be affected by disease.
v. The quality of fruit may become inferior or the quality may also decrease.
vi. The forests area may get destroy gradually vii. The growth of trees may become stunted or they may dry up completely.

3. Noise pollution

Violent noises may cause temporary or permanent impairment of hearing. Noise is also of the major causes of stress and many of the other human afflictions associated with tension, anxiety, accident proneness, high blood pressure and other diseases. The noise produce in urban area due to industrial activities, increases in traffic etc, cause tension and stressed related disorders.

Sources of noise.

a) Domestic noise
b) Public noise
c) Traffic noise
d) Construction noise v. Industrial noise

Adverse effect of noise

a) It can cause loss of sleep.
b) It can increase blood pressure.
c) It can cause irritation of mind.
d) It can cause digestive disorder.
e) It can develop hypertension.

f) sudden loud noise can cause heart failure.
g) The prolong exposure to noise may result into temporal deafness or nervous back down.
h) It affects attitude and psychological reaction.
i) It can spoil the essence of music and speech.
j) It can creates uncomfortable living conditions.
k) It usually interferes with speech communication.

4. Land Degradation

Land degradation is threatening in many countries of the world. Land degradation includes degradation, deforestation and decertification, which are closely related to deteriorating the environment. Land degradation gives rise to loss of productive soil and it reduces the capacity of soil to support its important uses. It occurs mainly from:

a) Removal of vegetative cover, especially in forest cereals where serious development has not reached.
b) Removes top soil during land site clearing by constriction industries.

Soil Erosion:

The common types of soil erosion in different parts of the world today are sheet and gully erosion which are on the high occurrence, and the types of damages causes by them are as follows:

a) Destruction of forest.
b) Destruction of grassland which holds the soil together
c) Destruction of farmland
d) Damage of socio –economic infrastructure and settlement areas. This has affected the foundation of many buildings
e) Poor highway drainage outlet
f) Collapse of roads, culvert and situation of drainage systems and reservoirs.

Relation between environment, human settlement, culture and education

There is a great relation between environment, human settlement, culture and education. A country like Nigeria is a typical example of environmental developments, technological advancement, Religions diversities, large or small scale industries, increase in infrastructural development, tribal differences, marriages etc. All the above are factor that goes along with environment, human-settlement, culture and education .

1. SUSTAINABILITY

The word “sustainability” originates from an ancient principle in forestry that is simply not to gain more timber from the forestry for centuries. In 1987 the “brundland commission” set up by the United Nations (UN) published their report as “our common future” and defined “sustainable development” for the first time as “development that meets the need of the present without compromising the ability of the future generation to meet their needs” sustainable also comes from

the Latin world "sustainer" meaning "to bear ". Sustainability can be translated simple as long – term compatibility. In engineering profession sustainability is seen in there dimensional view as illustrated in figure (II) .

Sustainable development is a means of meeting present needs in ways that do not impair future generations –and other species –from meeting their needs. Because the environment is essential to satisfying the needs of present and future generations, environmental protection is a key to its success.

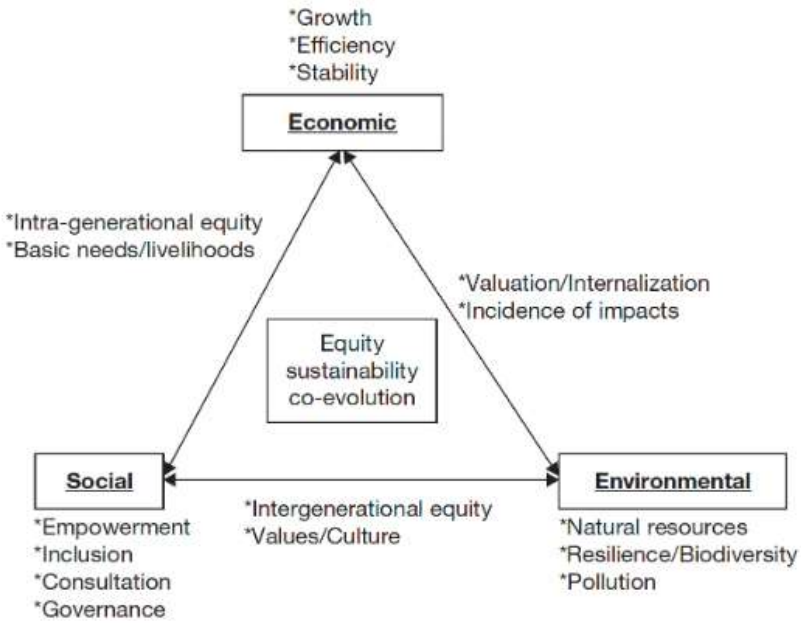

Figure 2. Showing sustainability components of Human environment

Different world scholars equally believe that sustainability is hanging on four major pillars namely:

a) Ecological configuration
b) Economic activities and output (i.e. Monetary system)
c) Good governance and politics (i.e. Equity and efficiency)
d) Institutional capacity and performance of Education Since sustainability embrace all aspect of human's life, a trilling question that is always ask is what should be sustained and develop in our environment?

A few areas that usually possess challenges are:

i. People: child survival, equity, equal opportunities for everybody, etc.
ii. Economy: wealth creation, productive sector, consumption etc.
iii. Society: social capitals, states, wealth, regions, etc.
iv. Good governance: leadership and politics.

v. Education: a lot has been written and said on education in different countries of the world, especially in Indian countries. Knowing fully well the sustaining values of Education, it is still good to bear our understanding on it.

Herbert Spencer, an English philosopher (1820-1903) said the following on education:

i. The great aim of education is not knowledge but action".
ii. "Real education is the one that will bring changes to the people, not information".
iii. "Real Education is a process of enquiring and composed of acts or recognition rather than transfer of information" .
iv. "Education is critical for promoting sustainable development".

Principles of Sustainable Development

1. Humans depend on the environment for countless goods and services that are essential to day-to-day living and the functioning of the economy.
2. The renewable and non renewable resources that support our lives have very real limits. Many signs that we have exceeded limits of the planet's resources are evident.
3. Living sustainably means finding ways of prospering within limits.
4. The future of the biosphere, upon which we humans depend, is in our hands.
5. Intergenerational equity calls on us to live in ways that honor the needs of future generations.
6. Intragenerational equity calls on us to act in ways that honor the rights and needs of all people alive today.
7. The notion of ecological justice says that all species have a right to a clean environment and adequate resources.
8. Building a sustainable society will require participation by governments, businesses, and individuals.
9. Environmental protection and sustainable development will require cooperation of all participants.
10. To create a sustainable society, we must focus on strategies that address the root causes of environmental problems.

Importance of Sustainable Development

"Sustainability is a concept that recognizes that natural systems are essential to provide both economic needs and quality of life"

(University of Florida, Understanding Sustainability series, 2012)

i. SD is not limited to only one community rather it connects space and time.
ii. SD needs cooperation amongst people from various societies, communities and countries.
iii. SD is a continuous process.
iv. SD is not contradictory to growth, profit and development. It helps in planning out limits.
v. All four pillars constitute the core of SDs which make the "way to life" for a person, society and even to a country.

vi. It helps in developing eco-friendly Global culture.
vii. SD ties together concern for the carrying capacity of natural systems with the social challenges facing humanity.

2. PREVENTIVE STRATEGIES FOR ENVIRONMENTAL POLLUTION

There are numerous strategies world- wide for preventing environmental pollution. A few of these are briefly highlighted below:

Water pollution

i. improve quality of drinking water.
ii. Prevent casual use of other un- approved sources.
iii. Increase quality of water used.
iv. accessibility and of domestic supply.
v. Improve hygiene.
vi. Strict laws should be passed to control water pollution by individuals and different bodies.
vii. Safety measures to be implemented to prevent oil spillage.
viii. Chemical waste should be converted to harmless biodegradable substances before being dumped into the rivers and streams.
ix. Refuse should be burnt in an incinerator with built- in devices to prevent water pollution.

Air Pollution

i. Air pollution can be controlled by passing strict laws that will make motor vehicles to comply with anti- pollution regulations
ii. By making people to be aware of the causes and dangers of air pollution
iii. By improving machineries so that more efficient fuel combustion occurs.
iv. Control by ventilation- suitable ventilation system should be provided in kitchen of every house, so that the gases produced by burning of wood, coal, oil, etc. can be exhausted very quickly
v. Control by vehicle rules- the design of vehicle should be such that complete combustion of fuel takes place in the engine
vi. Control by forestation- planting of trees should be planted at parks and public place
vii. Control by zoning – the areas of the town or cities should be divided into different zones, such as residential zone, industrial zone, trade zone, etc. the industrial zone should be far from the residential zone. The planning of the zone should follows the rules and provisions made for those zones.

Noise pollution

i. Domestic noise can be control by operating radio, television, etc. at low volume.
ii. During festival or other functions, loudspeaker should be operated within permissible limit and the time of operation should also be maintained.

iii. To control the noise caused by traffic, the speed limit should be strictly imposed. The vehicles which usually cause loud noise due to automobile fault should not be allowed on high way roads.
iv. The industrial noise may be avoided by keeping the industrials far from residential areas.
v. Design of noise proof doors and windows:- All the open spaces of doors and windows should be properly plugged and packed. The glazed window with double or triple panes of glass usually provides excellent sound insulation. The air spaces of the edges of such panes should be filled with sound absorbing material.
vi. Ear protection aid: The air production aid like soft plastic and rubber ear plugs, head phones should be provided for workers working in industries.
vii. planting of trees: The present of trees between the source of noise and the residential areas reduces of the noise.
viii. Treatment of walls, floors, and ceilings, floating floors suspended ceiling considerably reduce the noise. Acoustical tiles, and other porous materials if fixed, on walls, floors and ceiling also help to reduce noise level.
ix. Use of silencers of filters: This method is applicable to the control of noise from ducts and exhausts.

3. RESEARCH AND DEVELOPMENT OF SUSTAINABLE ENVIRONMENT

Adequate research and development of sustainable environment development. Such effort should not be limited to pure science and technology, but should also include political will and implementation, social values, economic and commercial consideration and public perceptions. Consistence and adequate research and development will result in the “6Rs”

i. Replace unsustainable activities with sustainable, polluting activities with clean process and efficient process with more efficient ones
ii. Re-use and recycle products to conserve resources
iii. Renewable resources used whenever practicable
iv. Re-structure institutions (both Government and non- Governmental organizations) to incorporate commitment to philosophy of sustainable development
v. Reduce consumption of resources and production of wastes
vi. Restore land, water, Air, and ecosystems. Educating and creating public environ.

4. EDUCATING AND CREATING PUBLIC ENVIRONMENTAL AWARENESS

Environmental Engineers and other related Engineering professional bodies have a vital role to pay in mobilizing the public for action aimed at improving the quality of man’s physical environment. This can be achieved by organizing relevant programmers, seminars, workshops, public debates, etc. on environmental issues. The role of the medial profession cannot by over emphasized here.

There is the need for a better understanding of issues of the environment by media Practioners, news editors, features editors, news producers etc. in print and electronic media, to enable them improve on their unique roles in the global efforts on sustainable development.

5. CONCLUSION

The importance of improved life living standard, especially in African countries in the area of water pollution, air pollution, noise pollution, and solid waste disposal in urban cities has long been identified, and loudly spoken in many ways, nearly all developing countries are currently engaged in substantial programs to improve the quality of life of the people, both in rural and urban cities. This paper therefore throws a clarion calls and challenge to the government of different countries, especially in India, at Federal, state, Local levels, all NGOS and Stakeholders, professionals, and individuals to rise up and save our precious environment from further destruction Now.

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Food Security for Sustainable Development

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Introduction:

Food security refers to the ensuring food for all it is the most important step to eradicate absolute mass poverty and lay a foundation for growth and development of a society. Poor diet and non-communicable disease are increasingly associated with poverty both developed and developing countries.

Objectives:-

1. To study role of food security in sustainable development
2. Awareness of Government schemes to ensure food security.

The food security and sustainable development of agriculture sector is subject to a wide range of economy wide policies as well as measures specific to the sector itself the relationship between economic country and stability and agriculture always are made by the most important food security factors. The Classification of food security has difficulties in two areas quality and quantity and has serious effects on the five dimension of food security.

Reviews of literature:-

Between 2015 and 2050 the population is expected to double in Africa to increase by 20% in Asia and by 12% in the rest of the world. Urbanization and income growth create new opportunities for food products it also stimulates improvement in infrastructure including cold chains food safety and quality standards which facilitate trade and transportation of perishable foods. Smallholders and family farmers can benefit from these opportunities as long as there is an enabling environment to facilitate access to markets.

Food security is also essential so that during times of natural calamities such as drought earthquakes, famine, pandemic covid-19, when the production of food grain decreases and the left over stock prices increase people can be supplied with food. If there is enough nutritious food accessible for all of its residents if everyone can access it at a fair price and if there are no barriers to obtaining it then a country is considered to have adequate food security one of the pillars of International human rights law is the right to eat.

Role of Government in food security-

In order to provide the right to food of every citizen of the country. The parliament of India, enacted legislation in 2013 known as the national food security act 2013 also called the right to food act this act seeks to provide subsidized food grains to approximately two thirds of India's 1.33 billion populations.

Methodology:-

Ways to maintain food security in India-

- Enhancing food storage technologies and increasing productivity in agricultural sector
- Focus more on schemes to increase employment and purchasing power in rural and urban areas.
- Community participation and intersectoral coordination
- Monitoring of nutritional programmes

FOOD SECURITY AND SUSTAINABLE DEVELOPMENT IN CHHATTISGARH STATE

The co-existence of the national food security acts 2003 NFSA and the Chhattisgarh food security act 2012 has made the coverage of PDS universal in the state. Chhattisgarh government has enclosed food security act 2012 it was passed on December 21, 2012 by the state assembly unopposed to ensure access to adequate quantity of food and other requirements of good nutrition to the people of the state at affordable prices at all times to lie a life of dignity. As per the decision made by cabinet the new scheme would provide free food grains to 81.35 crore beneficiaries under NFSA for the year 2023 the scheme would also ensure effective and uniform implementation of national food security act (NFSA).

Distribution of fortified rice (PDS) ration card holders in all the districts from April 2023 this will go a long way in the direction of providing nutritional security to the families in the state.

Conclusion:-

Food security is not only concerned with producing enough staple food but it also ensures the functioning of the whole food value chain including processing, storage, distribution, marketing, consumption and waste management. Food security ensures food for all. it is the most important step to eradicate absolute mass poverty and lay a foundation for growth and development of a society

Water Pollution: With Special Reference to Pesticides

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Abstract

In a country with a large population like India, huge reserves of water resources are essential to fulfil the basic needs of human beings. Water is important for many tasks in human life like daily work, agriculture and industry. At present, pollution caused by pesticides in water has had a negative impact on human life. Various pesticides, herbicides, insecticides, fungicides, rodenticides, larvicides, bactericides, algaecides are seeping into the groundwater containing pesticides. But the underground water gets polluted and this water enters the human body through drinking water. Due to excessive amount of nitrate in drinking water of these children, it combines with haemoglobin to form methaemoglobin which hinders the oxygen transport, which leads to the death of the newborn baby. Excess fluoride in drinking water causes a disease called fluorosis, which weakens teeth and bones. Arsenic laden water causes diarrhoea, hyperkeratosis, peripheral neurosis, lung and skin cancer. Most of the farmers use pesticides in inappropriate quantities, which causes harm to humans, Trees, plants and all aquatic organisms are affected and have a negative impact on the environment. Through this research, the side effects of pesticides in the human body after their entry into water have been studied.

Keywords: Environment, Pesticides and Water.

Water and Environment

Water is an indispensable natural resource essential for the existence of man and the ecological system. Through wate is abundantly available in the universe, only 3% of it is fresh water. Approximately 5% of the fresh water equivalent to 0.15% of the entire global waters is readily accessible for beneficial purpose.[1] That contains less dissolved and suspended and unpleasant gases and less biological life. Such high quality of water may be required only for drinking purposes, whereas for other uses such as agriculture and industry, water quality may be quite flexible and in a general sense, even somewhat polluted water may be considered pure.

Polluted water – Water can be considered polluted when its quality or composition changes naturally or as a result of human activities, making it less suitable for drinking, domestic, agricultural, industrial, recreational, wildlife, and other uses. goes Otherwise it is suitable only in its natural or unmodified state.

Drinking water standard – Given the direct consumption of water by humans, domestic water supply is considered the most important use of water. In India, agencies like Indian Council of Medical Research (ICMR), Bureau of Indian Standards and Ministry of Works and Housing have

formulated some drinking water standards which are being followed by various authorities. The World Health Organization (WHO) has also set drinking water standards that are considered international standards. Some important drinking water standards are given in the table.[2]

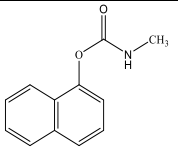
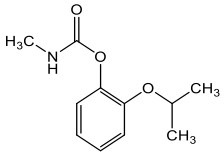
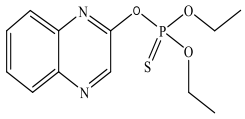
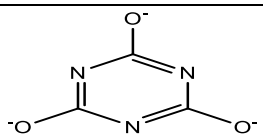
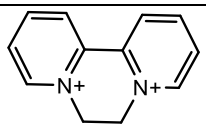
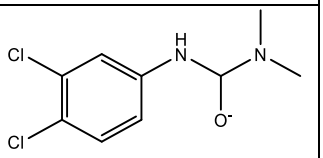
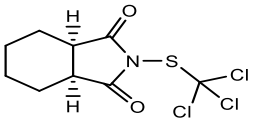
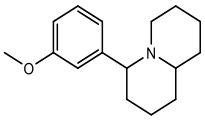
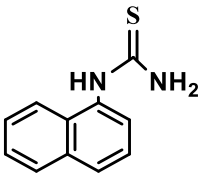
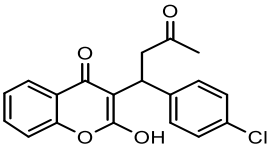
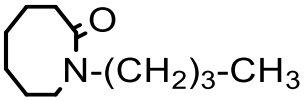
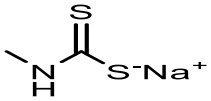
Table Drinking water standards

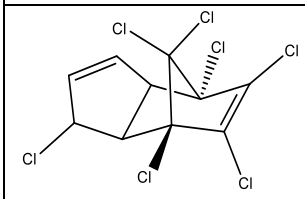
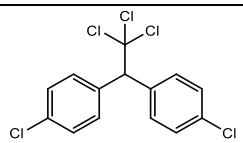
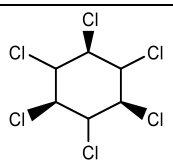
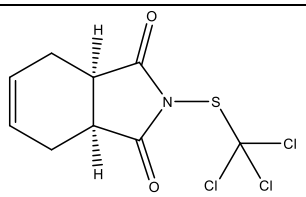
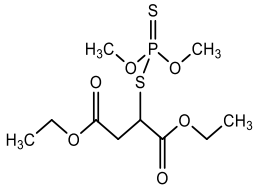
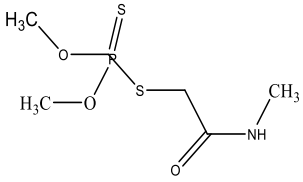
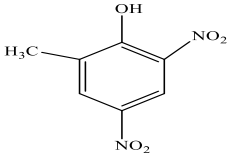
Characteristics	World Health Organization (WHO)
pH value (pH)	6.5- 8.5
Alkalinity (mg/L)	100
Turbidity (NTU)	5.0
Dissolved solid (mg/L)	500
Hardness (mg/L)	100
Calcium (mg/L)	100
Magnesium(mg/L)	30
Chloride (mg/L)	250
Sulphate (mg/L)	250
Ammonia(mg/L)	0.2
Fluoride (mg/L)	1.0
Iron (mg/L)	0.3

Pesticides in India- The economy of developing countries like India is based on agriculture, but insects perform its function. The biggest challenge is to maintain the economy. Therefore, different categories of pesticides are being made. Used by Indian farmers to improve agricultural production. pesticides are poisonous chemical substance or chemical mixture of substances or biological agents

Intentionally released into the environment to avoid, prevent, control, and destroy Populations of insects, fungi, rodents, weeds, or other harmful pests. works by insecticide to attract, attract and then destroy and reduce pests. The scientific opinion is that pesticides are chemical substances designed to kill or retard Growth of pests that hinder the growth of crops, shrubs, trees, wood and other Vegetation desired by humans. The term pesticide includes substances intended for use as plant growth stimulants, defoliants, desiccants or fruit thinning or arresting agents Untimely fall of fruits and vegetables. Generally, pesticides are agriculture-based chemicals. To protect crops, pesticides are used before or after harvesting. Spoilage of goods during storage and transportation also falls into different categories. Spraying of DDT or other chemical elements in domestic plants or fields is also fatal. During the rainy season, water flows out of the ground and ponds and wells become polluted. Spraying of pesticides also falls in this category.4 Under the Green Revolution, to increase agricultural production, a large amount of pesticides, biocides and chemical fertilizers are used, which flows into the river during rains, due to which water pollution becomes excessive.5

Mode of classification of pesticides .

[A] With respect to their target			
Insecticides (for killing insects)	 Carbery	 Propoxur	 Quinolphos
Herbicides (for killing weeds)	 Atrazine	 Diquat	 Diuron
Fungicides (Against fungus)	 Captan	 PCP	
Rodenticides (for killing harmful rodents)	 Antu	 Coumachlor	
Molluscide (for killing weeds)	 Zectrun		
Nematocides	 Vapam		

<table>
<tr><td colspan="5">[B] With respect to their chemical composition</td></tr>
<tr><td>Inorganic</td><td colspan="4">Organic</td></tr>
<tr><td rowspan="2">Mercury</td><td colspan="3">Organochlorine</td><td>Phthalamide</td></tr>
<tr><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Cupper</td><td>Heptachlor</td><td>DDT</td><td>BHC</td><td>Captan</td></tr>
<tr><td>Sulphur</td><td colspan="2">Organophosphate</td><td colspan="2">Nitro-derivative of phenol</td></tr>
<tr><td>Thallium</td><td>  </td><td>  </td><td colspan="2">  </td></tr>
<tr><td>Arsenic</td><td>Malathion</td><td>Dimethoate</td><td colspan="2">DNOC</td></tr>
</table>

Toxic hazards of pesticides in Environment

A large number of agrochemicals are used in agricultural fields to increase crop yields. Their excessive use has very serious consequences on the natural ecosystem. Pesticides On several occasions, residues from crops and plantations have been found in surface waters, affecting water quality and causing fish kills. Amongst all categories of pesticides, insecticides are considered to be highly toxic whereas herbicides and fungicides are 2nd and 3rd on the toxicity list. Depending upon the solubility of pesticides, they enter the natural ecosystems by different means. Water-soluble pesticides get dissolved in water and enter groundwater, rivers, lakes, and streams, hence causing damage to untargeted species whereas fat-soluble pesticides enter the bodies of animals by a process known as bio amplification They get absorbed in the fatty tissues of animals hence resulting in persistence of pesticide in food chains for extended periods of time.

Toxic hazards of pesticides on human

Pesticides have improved human health by controlling vector-borne diseases. Disease; On the other hand, their random and long-term use has resulted in great Seriou's health problems. Humans, mostly children and infants, are extremely vulnerable Harmful effects of pesticides due to inadequate application and non-specificity Nature of pesticides. According to WHO, more than 3,000,000 every year Cases of pesticide poisoning are increasing and more than 220,000 deaths have been recorded

Developing countries. About 2.2 million people, most of whom are in developing countries, are at high risk of exposure to pesticides, as well as some young people, such as infants, are more sensitive than others to the toxic effects of pesticides.6 Water polluted with toxic chemicals causes death of aquatic plant and animals. The amount of dissolved oxygen in polluted water is less.7

Persistent of Pesticide- Pesticides do not retain their original form for long after being deposited on the target surface. Chemical changes are caused by biological modifications and heat, light and water. The part of the pesticide that remains after the passage of time consists of the original chemical and some of its physically and biochemically modified derivatives, and is called pesticide residue.8

Many pesticides do not decompose in the environment but remain toxic to humans, animals and fish for many years. They can multiply their toxic effects as they travel through the food chain from plants to animals and ultimately to us. And increasing the toxic effect, they move up the food chain to animals and humans.[9]

Mode of action and toxicity of pesticides

All pesticides are highly toxic to animals and plants. Killing is done by different mechanisms depending on the chemical nature of the pesticide. Chlorinated hydrocarbons primarily affect the central nervous system, while others may affect the circulatory system or the reproductive system. The route of entry is also important in toxicity. Pesticides can enter the target by oral, dermal or respiratory routes. For example, DDT has very high oral toxicity, but very low dermal toxicity. Parathion, on the other hand, has higher dermal and respiratory toxicity. Pesticides reach humans by eating contaminated food and breathing contaminated air. Pesticides accumulate in various parts of our body and in high concentrations can cause cancer, leukemia, high blood pressure, infertility and kidney damage or even death. Pesticides also affect aquatic organisms and birds, especially those at the end of the food chain.[10]

Some human toxic response to the major groups of pesticides

S.N.	Groups	Effects
1	Naturally occurring organics (Rotenoids, Pyrethroides, nicotine, Alkaloides)	Rotenoids and pyrethroids generally have low toxicity, but in severe cases have renal and respiratory effects. Nicotine compounds are highly toxic, with convulsions, cardiac irregularities, and coma in severe cases
2	Chlorinated hydrocarbons	Moderate to mild acute toxicity, mostly affecting the central nervous system, tremors and incoordination, lipid build-up in severe cases. Heptachlor, aldrin, and dieldrin show CNS disturbances and parasympathetic failures.

3	Organophosphates	Extremely toxic, absorbed by all routes of entry, symptoms include parasympathetic failures, diarrhea and vomiting, tremors and muscle seizures, mental disorientation in chromic exposure due to chronic suppression of cholinesterase
4	Carbamates	Common dimethyl carbamates are potent inhibitors of cholinesterase. Actions and properties like other organophosphates.

Conclusion

Water is a very useful element for human life. Without water, human life cannot be imagined. Water in its purest form is a boon for human life, but when impurities are added to it, it becomes a curse. Exposure to pesticides in water is harmful for the environment and human health. There are various pesticides like herbicides, fungicides, insecticides etc. in water. All pesticides are highly toxic. Pollution due to viruses, bacteria, parasites and worms present in water causes infectious diseases like jaundice, cholera, there are problems like typhoid, diarrhoea, hepatitis, kidney failure etc. Use of water containing heavy metals like excess of nitrates hinders oxygen transport in the body. Excess of chloride causes fluorosis which weakens teeth and bones as well. Use of water containing arsenic causes diarrhea, hyperkeratosis, peripheral neuritis, lung and skin cancer. It is very important for human health that the dissolution of these pesticides in water can be stopped so that water can be obtained in its purest form.

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Chemistry on The Growth of Larvae of *Danaus Chrysippus* Feeding on *Calotropis Procera*

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Abstract

The quality of foliage, particularly its available nitrogen, determines the growth and survival of phytophagous insects. In this paper, we discussed the impacts of leaf chemistry on the growth of larvae. We found that the nitrogen and moisture content were higher on young leaves and larvae prefer to feed on young leaves. Among the instars, the nitrogen content was the highest in the second instar. So, there is no linear relationship between leaf N_2 and growth of larvae. We studied the effect of leaf chemistry on three instars of larvae, I, II, III instars of Tiger butterfly.

Keywords: Plant Chemistry, Growth, Fresh Weight and Dry Weight.

Introduction

The chemistry and quality of resources determine the rates of growth and development of the dependent population. There is growing evidence that plants are nutritionally sub-optimal with respect to the nitrogen, water and some other minerals (South wood, 1973; Dad, 1973; Scriber, 1978; Scriber & Feeny, 1979). Loader and Damman (1991) have been reported the caterpillars of Pieris rapae develop more slowly and devoted more of their time to feeding on low nitrogen plants. The nutritional ecology of insects with respect to nitrogen, water and minerals has been studied by Mattson (1980); Moran & Hamilton (1980); South wood (1985) and Mattson & Scriber (1987). Life history of Plain Tiger butterfly studied by Wadnerkar *et al*., (1979); Ramana, *et al*., (1998); Sharma and Verma (2005); Kheloufi, Mansouri and Belatreche (2019) and Dalui, *et al*., (2022).

We also observed the life cycle of butterfly *Danaus chrysippus* in fields and laboratories. To identify the instar of larvae, we measure the length of larvae by simple measuring method after moulting.

Material and Methods

For the present study, the leaves of three different parts of the plant and three different stages of larvae have been selected. The collected leaves and larvae were analysed for physical and chemical parameters.

Weighed fresh leaf samples (x gm) of different parts of the plants were taken and kept in the oven at 100°c for 24 hr. The dried samples were reweighted (y gm) and this was subtracted from the fresh weight (x gm). The percentage of moisture was evaluated as follows:

$$\% \text{ of moisture} = \frac{100xz}{x}$$

where, z = x-y

Crude fibre content determined gravimetrically after digestion of 1.0 g of dried sample by a 1-percent H_2SO_4 solution for 30 minutes, followed by the same treatment using a 1-percent NaOH solution (Lacerda, 1983).

Crude and true proteins were determined by using the method given by Hambleton (1977).

Total nitrogen was analysed by using the modified Kjeldahl technique (Hambleton, 1977). Phosphorus was determined by using the colorimetric method (Bonting, 1970).

The elements potassium, sodium, calcium and magnesium were determined by mediflame 127 (systronics) model flame emission spectrophotometer (Bonting, 1970).

90 newly hatched larvae which were collected from university campus, were divided into three groups for their instar wise study. Each of them was found to have an initial body length of 0.3 cm. The different groups of larvae were further divided into units of 10 and placed at three different ages (young, middle and mature) leaves (at room) the larvae were weighted after 24 hr.

For determining the growth rate of the first instar, 10 larvae were taken out from their petri plate, when they had attained the first moulting length of 0.7 cm. This moulting length had been determined with the help of separate experiment. The oven dried weight of these larvae was determined separately in each case. The same process was repeated for determining the oven dried weight of the second and third instars for which the moulting length of the larvae was found to be 2 cm and 3.7 cm.

Result

We found that larval stage of butterfly has five instars. In which we studied only the three instars, first, second and third and their successive length.

The data presented in Tab.1 show that the moisture and crude fibre are inversely related between upper and lower leaves. N_2 is more in the terminal leaves and gradually declines towards the basal leaves. The percentage of crude protein is also higher in terminal leaves. Among other nutrients P, Mg follow the trends of nitrogen while Ca and K those of the crude fibre.

The development stages of larvae also show the differences of nutrient content and moisture. The first instar larvae show a higher moisture content. The nitrogen content is highest in the second instar and Ca, Na and K in the third instar (Tab. 2).

Table 3 shows the chemical state of leaves affect the growth of larvae. It shows the moisture, N and other chemicals have moderate correction to the chemical state of larvae, however, Ca has little correlation. Except Ca, all the chemical states of leaves are significantly correlated with the chemical state of larvae.

For the three instars, the larvae gain more biomass, when they feed on upper leaves followed by middle and lower leaves. The final standing crop biomass is also higher, when the larvae feed on upper leaves than middle and then lower leaves (Tab. 4).

There is no linear relationship between leaf N_2 and growth performance of larvae (Thomas and Hodkinson, 1991). Our results indicated poor growth of larvae on old leaves. Incidentally, these leaves also had lowest N_2 content even small variation of N_2 and water in the leaves located on the same plant seem to affect their performance by the larvae. For instance, although there is not much difference in the N_2 content of the middle pair and terminal pair of the leaves. The larvae of three instars in variably chose a terminal pair of leaves to feed. The choice of terminal pairs may be on account of their high moisture and low crude fibre contents. They also contain higher quantities of some other nutrients, such as P and Na. The K and Ca content was, however, higher in the mature leaves of basal pairs. The nutrient contents of leaves affected the growth of larvae and their correlations are significant.

Discussion

The life cycle of *Danaus chrysippus* on different host plants was studied by Wadnerkar *et al*., (1979); Ramana *et al*., (1998); Sharma and Verma, (2005) found that the life cycle of larvae directly affected by the host plant and they show the different patterns of life cycle. The results of this study were shown that the life cycle of butterflies on the host plant of *Calotropis procera* is also different from studies. Belatreche, (2019) and Dalui *et al*., (2022) are found that the length of first, second and third instar larvae were 1.6 ± 0.54, 1.8 ± 0.44 and 2.0 ± 0.70. We also found the length of different instars of larvae, the length of first instar was 0.7 cm, second instar was 2 cm, and third instar was 3.7 cm, which were slightly different from above study.

South wood, (1973); Dad, (1973); Scriber, (1978); Scriber and Feeny, (1979) showed the growth of larvae depend on the nutritional content of post plant leaf such as nitrogen, water and some other minerals. We also found that the growth of three instars of larvae is also affected by the chemistry of the host plant.

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Tab.: 1 Showing chemical state of leaves at different heights [x = 5 samples] in *Calotropis procera*.

Leaves	Moisture [%]	Crude fibre [g/g]	N [%]	Crude protein [%]	True protein [g/g]	P [g/g]	Mg [g/g]	K [g/g]	Ca [g/g]
Upper leaves	0.859±0.009	0.549±0.007	2.568±0.04	9.8±0.21	0.100±0.03	0.0016± 0.000018	0.0064± 0.00048	0.040±0.007	0.042±0.002
Middle leaves	0.857±0.007	0.624±0.008	2.302±0.03	8.2±0.72	0.094±0.01	0.00012± 0.000011	0.0054± 0.00032	0.070±0.009	0.051±0.007
Lower leaves	0.833±0.009	0.780±0.01	2.225±0.05	7.7±0.19	0.084±0.03	0.00012± 0.00001	0.0024± 0.00022	0.050±0.007	0.075±0.009

All values are expressed as mean ± & e.

Tab.: 2 Showing the chemical state of larvae of different instars

[x = 5 samples]

Instars	**Length of larvae [cm]**	**Moisture [%]**	**N [%]**	**Crude Protein [%]**	**True Protein [%]**	**P [g/g]**	**Mg [g/g]**	**K [g/g]**	**Ca [g/g]**
IInstar	0.7	0.960±0.02	3.956±0.1	24.725±0.4	0.304±0.01	0.00010± 0.00001	0.0010±0 .0003	0.08±0.009	0.042±0.002
IIInstar	2	0.900±0.05	2.979±0.07	18.761±0.1	0.144±0.02	0.00011± 0.00001	0.0015±0 .0002	0.09±0.005	0.065±0.006
III Instar	3.7	0.880±0.03	0.707±0.09	23.301±0.3	0.184±0.01	0.00013± 0.00002	0.0019±0 .0007	0.13±0.007	0.011±0.009

All values are expressed as mean ± & e.

Tab.: 3 Shows the correlation between the chemical state of mean value of all instars of larvae and their significant values.

	Moisture [%]	N [%]	Crude protein [%]	True protein [%]	P [g/g]	Mg [g/g]	K [g/g]	Ca [g/g]
Leaves [X]	2.55	7.1	25.7	0.28	0.00043	0.0142	0.17	0.168
Larvae [Y]	2.74	10.64	66.78	0.64	0.00032	0.0044	0.13	0.137
Coefficient correlation [μ]	1.005	0.99	0.99	0.97	0.99	0.73	0.90	0.27
Value of t	3.623	23.7	23.8	6.7	2.31	3.86	7.4	1.009

$$u = \frac{N\varepsilon xy - (\varepsilon x)(\varepsilon y)}{\sqrt{N\varepsilon x^2 - (\varepsilon x)^2}\sqrt{N\varepsilon y^2 - (\varepsilon y)^2}} \qquad t = \frac{u\sqrt{n-2}}{\sqrt{1-u^2}}$$

∗ correlation is not significant correlation of all the chemicals [except Ca] between leaves and larvae are significant.

Tab.: 4 Standing crop biomasses (mg-oD) for different stages of development of larvae; the larvae fed on leaves of different ages, larval samples 10.

Instars	Developmental days	Instar's I	Weight (mg-oD) II	Larva^{-1} III	Wt. Of full growing larva (Mg-oD)
(1) Upper (young)	11	0.54±0.003	20.30±0.32	152.10±0.48	172.80±0.48
(2) Middle (mature)	15	0.37±0.005	12.50±0.42	104.40±0.37	117.20±0.37
(3) Lower (old)	21	0.25±0.009	7.60±0.34	95.00±0.41	102.90±0.56

All values are expressed as mean ± & s.e.

Results are significant for P = 0.05 (ANOVA)

Challenge and Opportunity in Corporate Social Responsibility and Sustainable Development Under Green Marketing

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ABSTRACT

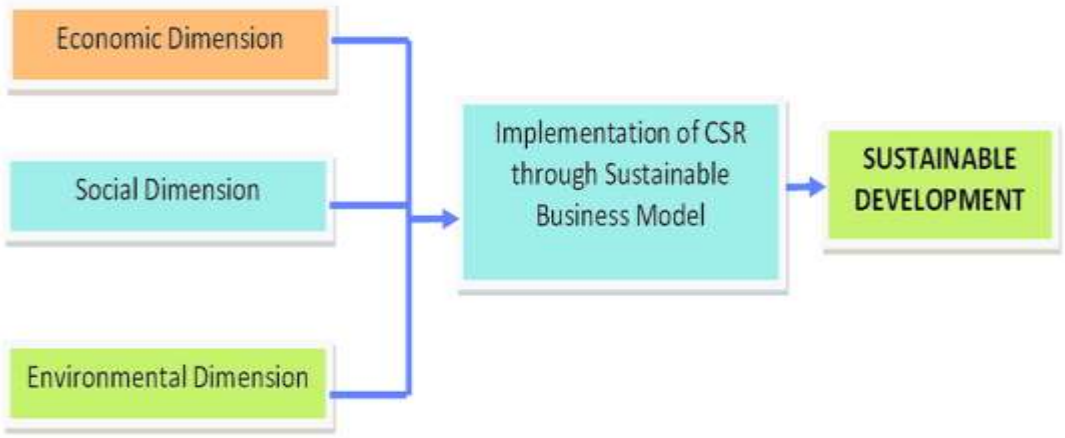
The more and more businesses are pledging their allegiance to the principles of sustainable development, this study explores comparative analysis as a means of tracking ways to interpretation of the substance and principles of sustainable development. Because safeguard both the environment and human lives, the idea of selling ecologically friendly products has gained traction in recent decades. This includes considerations ranging from production to packaging. In particular, there is a growing daily emphasis on and knowledge of organic products. Maintaining the safety of our natural environment—which is currently the most urgent need—while also keeping customers and consumers engaged has grown more difficult in the globalized world. Customers also understand the effects of pollution and environmental problems like global warming. An important tactic for promoting sustainable development, green marketing is a phenomena that has gained popularity in India and other developing and industrialized nations. This research paper focuses on the idea, necessity, and significance of green marketing. Ultimately, there needs to be pressure from suppliers, industrial buyers, and consumers to lessen the adverse environmental effects. In underdeveloped nations, green marketing is becoming more and more significant. This paper examines the potential and problems firms have when implementing green marketing strategies, while also providing an overview of the current state of the Indian market. The future of green marketing and the reasons behind its adoption by businesses, with the conclusion that demand for and use of green marketing will only increase.

Keywords*:* Green Marketing, Consumer Behaviour, Organic food Products, Environmental pollution, Green Marketing, Globalization, Global Warming, Sustainable Development

INTRODUCTION

The phrases “corporate sustainability” and “corporate social responsibility” (CS) are now commonplace in the business world. It’s true that “many consider corporate sustainability and CSR as synonyms,” as van Marrewijk notes. However, it is becoming more and more obvious that there is a need for clarity and associated precision because the two terms have different meanings. The terms “sustainability” and “sustainable development” are also employed in the public sector in addition to these concepts from the business sector, which causes even more misunderstanding. Two key questions arise from these four distinct but connected terms: Do the terms basically mean

the same thing, first of all? Second, if they mean different things, is there a big difference in what they mean (e.g., goal-setting, decision-making, supporting various stakeholders, etc.)?



In order to address these two problems, this essay employs a methodology derived from historians of ideas, or scholars who seek to comprehend the social relations of concepts in order to pinpoint the ways in which each term serves different goals, goals that are now unclear. The main topic of our article is the ways in which clarity helps decision-makers in three key domains of activity: (1) policy advocacy groups, both governmental and non-governmental, that may be pursuing environmental policies; (2) decision-makers in business management, who may be searching for ways to improve social interactions and produce cleaner products; and (3) scholars whose goal is to advance knowledge through academic research, such as by looking into policies that have the greatest chance of Improving business organizations' environmental performance.

As to the American Marketing Association, green marketing refers to the advertising of products that are believed to be environmentally safe. Consequently, green marketing includes a broad variety of activities, including altering the product, the production process, the packaging, and the promotion. The occurrence of many meanings associated with social, environmental, and retail This term serves as an illustration of how challenging it is to describe green marketing because it has multiple meanings that overlap and contradict one another. There are two other names with comparable meanings: ecological marketing and environmental marketing. A holistic marketing approach known as "green marketing" involves producing, promoting, using, and discarding goods and services in a way that is less damaging to the environment. Customers and marketers alike are become more conscious of the need for a change to green goods and services as a result of growing knowledge about the effects of pollution, non-biodegradable solid waste, global warming, and other factors. Even if the "green" shift can seem expensive at first, it will definitely turn out to be both necessary and economical in the end. A company's efforts to develop, market, charge for, and distribute ecologically friendly products are referred to as green marketing, sometimes known as environmental marketing or sustainable marketing.

Any action intended to create and facilitate transactions intended to satisfy human needs or desires with the least amount of adverse effects on the environment is referred to as “green marketing”.

The term "green consumer" refers to a person who avoids products that could provide a health risk to themselves or others, materially affect the environment during manufacture, use, or disposal, consume excessive amounts of energy, generate needless waste, or use materials acquired from outside sources. Threats to endangered species or ecosystems, animal abuse, or adverse effects on neighboring countries are all considered.

Green marketing is the practice of promoting goods that are thought to be more ecologically friendly than alternative options. Therefore, a wide range of actions, such as improving the product, altering the production process, using sustainable packaging, and changing promotion, are included in green marketing.

Green marketing evolved for a number of reasons, including the environment. Green marketing is the promotion of items that are said to be safe for the environment, according to the American Marketing Association. Thus, a wide range of actions are included in green marketing, such as altering advertising, packaging, manufacturing processes, and products. A holistic approach to marketing, green marketing involves consuming products and services, marketing them, and disposing of them in a way that minimizes their negative impact on the environment. More and more people are becoming aware of the need to transition to green goods and services due to increased knowledge about the effects of pollution, non-biodegradable solid waste, global warming, and other related issues.

LITRATURE REVIEW

- **Sheehy, B.; Farneti, F. (2021)** This essay aims to provide clarification on the differences between corporate social responsibility, sustainability, corporate sustainability, and sustainable development. We think their contrasts are now more valuable since we have been able to distinguish their different policy goals and policy scope by looking at their intellectual histories. Insufficient differentiation between the phrases is impeding efforts to regulate and enhance business conduct globally, even if there are certain areas where they overlap. Additionally, people’s and parties’ capacity to support and uphold the policy goals they are dedicated to is strengthened by the study. We hope that our examination and differentiation of the concepts will help corporate management, academic research advancement, and advocates of both governmental and non-governmental policies.
- **B.Konstantin (2020)** Terms like “sustainable development of business organizations,” “social responsibility,” and “sustainable development” should be understood by business organizations in their own right. A clear corporate philosophy and the application of sustainable development concepts are necessary for representatives of the business community to achieve business sustainability and advance sustainable development at the level of business globalization.

- **Huk, K.; Kurowski, M (2021)** Businesses have a significant impact on the environment. It affects enterprises that produce and mine as well as other businesses where trash can have a big effect on the environment deteriorating. In this article, we examine how the idea of corporate social responsibility is applied to the environmental domain. Large disparities and dependencies between the regions and sectors under study were discovered by statistical analysis that we conducted. A change in ISO/EMAS certification was also indicated by our data. This aspect is no longer a determinant of CSR because many nations and industries are currently moving away from certification.
- **Yadav Anjali, Sharma Urvashi (2020),** Green marketing has emerged as a crucial instrument for all businesses looking to reduce their environmental footprint in light of the negative impacts that businesses have on the environment and the global warming crisis. Green marketing is urgently needed and is not a decision that can be made.In the current competitive global context, green marketing might be seen as a new opportunity. In developing nations like India, where there is a lack of resources and an endless supply of human desires, green marketing is becoming more and more popular.
- **Kaur, B.; Gangwar, V.P.; Dash, G.(2022**) To save the health of families, there is a growing demand for eco-friendly items. More empirically based information is anticipated to evaluate the theoretical components that identify the gap between consumers' apparent greenness and their purchase intentions. In India, the idea of environmental attitude and the influences on consumers' purchasing intentions is rapidly expanding. However, the 7Ps (product, price, location, promotion, packaging, positioning, and people) of the green marketing mix in India could be included in the future scope of the study pertaining to the 4Ps. In order to preserve a cleaner and greener environment, consumers will pay extra for green promotions. In agricultural nations such as India, the significance of green advertising increases significantly. Organizations who approach the task by assimilating the conclusions and innovate with eco-driven goods, resources, and novelties will be the ones that reap the most rewards in the future.
- **Gupta Meesha and Syed Asif Ali (2020)** The study reflects a number of variables that will aid academics and marketers in comprehending Indian consumers' inclination to purchase environmentally friendly products when utilizing the well-known social media platforms that are currently in vogue. The study is unique and innovative in that it contributes to the analysis of consumer willingness, an area that has received little attention in the Indian setting. Finding the most appropriate social media activities for eco-friendly products in an Indian setting and developing a scale to measure them is another contribution of the study that will be useful to academics, practitioners, and researchers in the field of eco-marketing in gauging Indian consumers' eco-friendly behavior.
- **Ms. Brinda M, Mr. MURALI .V,Mr. S. Chandra Sekhar, Dr. Rajesh Vemula, Dr. Sarita Rana (2022)** Though many consumers are worried about the products' quality and availability in stores, they have demonstrated a positive attitude toward green marketing products. Measurement of the relationship between consumer perceptions and awareness of Indian Tobacco Company's green marketing products in Bangalore city is the primary goal of the study. A study that looked at the annual income of ITC customers in Bangalore

city and their gender revealed a correlation. It also identified a relationship between consumer perception, awareness, and purchasing decisions about ITC's green marketing items and environmental concerns.

- **Shekher Anjli , Sharma Lovenish , Behera Debashish (2022)** Choosing green marketing globally is best done now. In the unlikely event that all nations produce significant employment, it will coincide with an unprecedented shift in the economic landscape because green marketing is essential to preventing global pollution. From a business standpoint, a clever advertising is one that not only convinces the customer, but also involves them in promoting his product. Because it has a distinct quality and social viewpoint, green advertising shouldn't be seen as just another method of marketing; rather, it should be pursued with far more necessary force. Given the possibility of a dangerous climate device, it's critical that green advancements become the standard rather than the exception.
- **Usharani, Dr. M. and Gopinath, Dr. R. (2020),** The occupation of non-organic food goods gradually diminishes modern life. Natural disasters will affect the planet greatly if they continue to play their part in the future. For that reason, it is the ideal moment to choose "green marketing" on a worldwide scale. If every country implements such regulations, the corporate landscape will undergo a significant upheaval since green marketing is crucial to preventing global pollution. One strategy for preserving the environment for next generations is green marketing. This concept is not going to be simple. In order to determine whether it is realistic for the company to prosper in the market, planning and study are required. For the sake of our future undertakings, marketers and the government should thus take the appropriate action to safeguard both our people and the environment.
- **Shrivastava, Dr. Namrata ,Mishra Ms. Khushi, Shaw, Ms. Kajal, Awinashi Mr. Vijayendra, Pradhan Mr. Vaibhav, Thakre Mr. Roopam (2022)** In order to stop pollution worldwide, green marketing is essential. From a business perspective, a competent marketer is one who actively incorporates consumers in the promotion of their products in addition to persuading them. Green marketing is not just another marketing tactic; it also has social and environmental implications. It must be pursued with far greater vigor instead. Because global warming poses such a serious threat, green marketing needs to become the standard rather than the exception or merely a trend. More institutionalization and widespread adoption are required for the safe and environmentally responsible recycling of commodities such as paper, metals, and plastics. It must become commonplace to utilize energy-efficient lights and other electrical appliances.

OBJECTIVES

The fact that little academic study has been done on environmental or green marketing and sustainable development is one of the biggest problems with green marketing & sustainable development.

- To research the relationship between sustainable development and green marketing.
- To comprehend the prospects connected to eco-friendly marketing.

- must be aware of CSR's obligations in protecting the environment.

METHODOLOGY

Providing a clear path for future empirical research is the aim of this exploratory study. It is also descriptive when fact-finding research is prioritized together with appropriate interpretation. To accomplish this, secondary data was collected. The secondary data was gathered from government documents, books, journals, newspapers, magazines, periodicals, and websites.

GREEN MARKETING

Marketing that highlights a company's products to show off their sustainability is called green marketing, sometimes referred to as eco-marketing or environmental marketing. Green packaging, consumer items with reduced carbon footprints, and eco-friendly distribution networks are all possible product offerings from companies. When companies donate to nonprofits that support sustainability initiatives, they are also utilizing green marketing. As a response to the swift advancements in climate change, green marketing is a part of a larger societal trend toward more ethical and sustainable business practices.

GREEN MARKETING EXAMPLES THAT ARE SUSTAINABLE

- Body Shop Strong ecological positioning is a well-known attribute of this brand. The Body Shop has been certified by Leaping Bunny, the industry leader in non-animal testing products. It also supports educators, upholds human rights, starts medical procedures and staff training programs, acknowledges its commitment to environmental preservation, and—above all—lives up to those ideals. In addition to using 10% less and 100% renewable energy in stores, the business wants to construct green and develop a new sustainable package for its products.
- Ikea: To encourage customers to be environmentally conscious, Ikea created the People & Planet Positive campaign. There is no longer a need for us to pick between sustainability and fashionable design because it uses eco-friendly manufacturing techniques. For its efforts to protect the environment, the company has won various awards. For now, it is

using only renewable energy and making significant investments in environmentally friendly projects.

- Argentina - Goals for the corporation clearly highlight Patagonia's involvement in the Go Green movement and green marketing strategy. It also routinely donates millions to initiatives that support reforestation, endangered wildlife protection, and sustainable farming practices.
- Coffee House Although Starbucks has been certified LEED since 2005, the company has gone above and beyond by declaring that it would cease using plastic straws completely by 2020 and that same year will open 10,000 environmentally friendly locations. By creating throwaway coffee cups, taking part in recycling and green building, helping farmers, and supporting other environmental sustainability activities, the company has been putting a lot of effort into getting this message out to its target audience. Timberland. To market its products, renowned clothing manufacturer and retailer Timberland uses sustainable storytelling. If the brand didn't have a green component, loyal LOHAS followers wouldn't pick it. In addition to growing partnerships and testing materials for its products, Timberland is creating and executing a green marketing plan. In addition to using only organic and renewable resources going forward, it has established environmental standards (TEPS) for all product categories.

FOUR GREEN MARKETING TECHNIQUES

Sustainable packaging: The primary source of pollution worldwide is the excessive use of plastic. It is estimated by Greenpeace that just 9 percent of the 8.3 billion tons of plastic produced since the 1950s have been recycled. The goal of today's conscientious customers is to do away with plastic packaging. Hence, it is advisable to create packaging for your brand using recyclable materials or devoid of plastic.

Green pricing: Since sustainable design is more expensive, eco-friendly products usually have a premium price tag. Customers are willing to pay for them even though the costs are outrageous. Therefore, make sure to include information to back up your claim of being an eco-friendly product if you charge a premium for it. Keep in mind that your brand's items will likely be viewed by more people the more ambitious your goal is.

Accountability: Your brand must be ready for a big shift if you're thinking about going green. An essential part of green marketing is being conscious of pollution. If you want to show your clients that your goals are sincere, reconsider how you do business in terms of ecological and social responsibility and show them that you are concerned about the environment.

Sustainable fashion Remembering the complete life cycle of your product is crucial, not just the package's recycling label. It's important to focus on the details, such the source of your resources and the individuals working on the project. Furthermore, your organization ought to be in charge of the amount of waste generated as well as the distribution and packaging of your goods. Numerous environmental variables need to be considered while making plans for sustainability.

PROCESS OF GREEN MARKETING

External and internal Ps are involved in green marketing. Integrating the external and internal Ps will inevitably lead to green success. In contrast to the internal 7Ps of products, promotion, pricing, place, information sharing, procedures, and policies, the external 7Ps are paying customers, providers, politicians, pressure groups, problems, forecasts, and partners. Using the four Ss—satisfaction of stakeholder needs, safety of products and processes, social acceptability of the organization, and sustainability of its operations—we may identify green accomplishments after merging the external and internal 7Ps

SUSTAINABLE DEVELOPMENT

Growth in the economy that doesn't harm the environment is known as sustainable development. "Development that meets the requirements of the present without risking future generations' ability to meet their own needs" is how the Sustainable Development Commission defines it. In addition, the main goal of sustainable development is to guarantee a society where resources and living conditions satisfy human needs without endangering the environment. The four pillars of sustainable development are the environment, economy, culture, and society. Additionally, rather of being stand-alone concepts, these are related ones. A wide range of academic fields are also covered by sustainable development, including politics, technology, architecture, agriculture, and the economics. Furthermore, 17 sustainable development goals were set forward by the UN in

2015. All nations should take these calls to action seriously in order to protect the environment and promote prosperity. In addition, by 2030, these goals are expected to be achieved.

THE TWO MAIN GOALS OF SUSTAINABLE DEVELOPMENT ARE:

Sustainable resource use, cutting back on waste and pollution, boosting biodiversity, preserving and improving our built and natural ecosystems, and mitigating the effects of climate change—including the global transition to a low-carbon economy—are all part of environmental protection. By satisfying the housing needs of both the present and the future generations, as well as by creating high-quality developments with conveniently accessible local services that take into account neighborhood needs and promote social, cultural, and physical health, social inclusion entails building strong, thriving, and healthy communities.

A strong, competitive economy is created through identifying and then coordinating development needs, as well as by making sure that there is enough land of the right kind, in the right places, at the right times, to support innovation and growth.

OPPORTUNITIES WITH GREEN MARKETING

Reductions in demand: Many companies see these as chances to grab market share from companies that don't provide eco-friendly products. The firms listed below have made an effort to better address the needs of their customers by increasing their environmental responsibility:

Tuna producers changed their fishing techniques in response to growing concerns about dolphin deaths caused by driftnet fishing; Xerox introduced "high-quality" recycled photocopier paper in an attempt to meet business demands for less environmentally harmful products; and McDonald's adopted waxed paper packaging instead of clam shell packaging due to growing public concern over the creation of polystyrene and ozone depletion.

Government pressure: The public and the economy are the targets of government protection, which has important ramifications for green marketing, much like it does for other marketing-related initiatives. Reducing the production of harmful materials or byproducts is one of the many ways that environmental marketing regulations aim to protect customers. Modify the way that companies and customers utilize and/or consume hazardous goods. Make certain that all kinds of consumers are able to evaluate how products affect the environment. To reduce the amount of hazardous waste that enterprises produce, the government has established regulations.

Social duty: A lot of companies are beginning to realize that they have a responsibility to the environment since they are a part of the greater community. This translates into companies believing that they have to meet environmental aims in addition to profit-related objectives. Environmental concerns are thereby integrated into the company's corporate culture. One company that does not publicly promote its environmental initiative is Coca-Cola. They have altered their packaging to have a less environmental impact and have invested a significant amount of money in various recycling projects. Although Coke cares about the environment, it hasn't used that concern for financial advantage.

CONCLUSION

In order to stop pollution worldwide, green marketing is essential. From a business perspective, a competent marketer is one who actively incorporates consumers in the promotion of their products in addition to persuading them. Green marketing is not just another marketing tactic; it also has social and environmental implications. It must be pursued with far greater vigor instead. Because global warming poses such a serious threat, green marketing needs to become the standard rather than the exception or merely a trend. More institutionalization and widespread adoption are required for the safe and environmentally responsible recycling of commodities such as paper, metals, and plastics. It must become commonplace to utilize energy-efficient lights and other electrical appliances. Based on green marketing, consumers are willing to pay extra for a cleaner, greener environment. The last step in minimizing the negative effects on the environment is to apply pressure to suppliers, business buyers, and consumers. Green marketing is far more relevant and significant in developing countries like India. Thus, a company that is committed to environmental preservation would be able to persuade its suppliers to behave in a more "responsible" way in addition to making products that don't harm the land. It is possible for enterprises to be pressured by end users and industrial purchasers to incorporate environmental conservation into their corporate cultures, thereby limiting the adverse environmental impacts of their operations..

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Ethno-medicinal plants used by different traditional healers of Janjgir-Champa Chhattisgarh (India)

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Abstract:

Ethnobotany and ethnomedicine are interdisciplinary fields that study the traditional knowledge and uses of plants by various ethnic groups. The study explores the utilization of ethnomedicinal plants by various traditional healers' in Janjgir Champa Chhattisgarh, shedding light on their indigenous knowledge and practices. Through field surveys and interviews, we document the 54 plant species belong to 29 families in various diseases, their medicinal properties, and the cultural significance attached to them. The findings contribute to the preservation of traditional healing practices and offer insights into potential avenues for integrating traditional knowledge into contemporary healthcare systems.

Keywords: Plant Folklore, Medicinal Flora, Janjgir Champa, Medicinal plant.

INTRODUCTION

The term ethno botany was first given by harshberger in (1895) Ethno botanical plants are relationship between plant and people [1]. Ethno botany deals with the direct relationship of plant with man[1-2]. The term has often been considered synonymous with either economic botany or with traditional medicine. The medicinal plant has potential [3] capacity which people have been using since ancient times. Chhattisgarh is the 26th state of India, where 44.6 % geographical region is found. That is located between 17^{o} to 23^{o}7' north latitude and 8^{o}40' to 8^{o}38' east longitude Janjgir-Champa district of Bilaspur division of Chhattisgarh. The state has known for its traditional knowledge, cultural and places of medicine. The Sal and Sagon forest are very famous. In Chhattisgarh the tribal population is 31% which is 8th rank in India. The main races Gond, Baiga, Muria, covers 70% of Bastar population and 42 tribes are found here. There are 11.6% tribe's people in Janjgir-Champa district [4] which are known for their miraculous [5] medicine herbs and ojha gunia. The life cycle of tribes plants and forest products play a significant role. They have various cultural and scientific progress of the society and so are still being exploited by the modern society. The present surveys have mostly in tribal or rural people how to use herb bark by the tribe people of east Champa comprising of Chandrapur, Dabhara, Malkharoda, Champa, Bamhindih, and Jaijaipur.Champa district is well known for its silk production tendu patta collection and Biri making. It is a big source of economy for rural people. The work chooses based on tribal life because they are healthier and more active. They have lot of traditional knowledge but nowadays

they are advanced, developing and go away for traditional knowledge. Therefore, we want they should not loss their traditional Knowledge and we should be conserve them develop to new therapeutic drugs and gifted to our new generation. In Champa tribes are mostly after 70-year age chances of paralysis and the common disease is malaria, ringworm, jaundice, diarrhea, dysentery and constipation. The people are using lot forms of plant parts like kadha, pest, juice, powder, syrup and oil etc.

The district has generally mixed forest Teak and Sal forest in abundance. There is vast store of forest products. Total forest area of the district is 19850.170 hect. Out of which11849.480 hect is conserved by reserved forest. The protected forest area is 6057.190hect and the unclassified forest is 1943.500 hect. The forest products include timber wood, tendu leaf, mahua, amla, harra, lakh, honey and other medicinal plants.

MATERIALANDMETHODS

STUDYSITE

The present work based on different villages of East Champa (Figure: 1) of Chhattisgarh on ethno-medicinal plants in the healthcare [3] system of tribes. The Janjgir-Champa district lies in the central of Chhattisgarh state in India between (Latitude-21.970553DMS215813.99”N Longitude-82.475276 DMS 822830.99”E).[4] The major ethnic groups in the study area were Gond, Baiga,Uraoun,Agariya,Sawra,Sidar,Khairwar,Sabariya gond etc. Where forming like Rice, tiwda, wheat, gram, maize, kodo kutki, urad, kulthi, and ground nut etc.

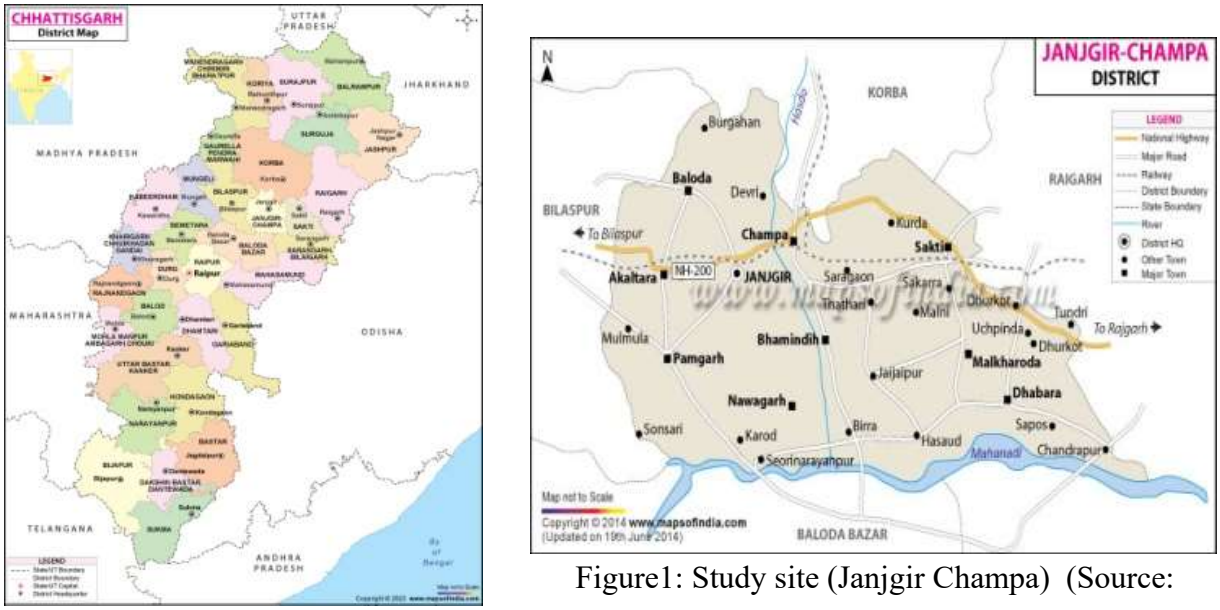


Figure1: Study site (Janjgir Champa) (Source: mapsofindia.com)

NO-BOTANICALEXPLORATION

The ethnobotanical investigations are no study in the East Champa region, so the field surveys in tribal villages east champa region of Chhattisgarh. Villages like Nandeli, Shikarinar, Bhothidih, Khajurani, Malni, Jaijaipur, Kashigarh, Kutrabod, Guchkulia, Malkharoda, Karigaw, Jamgahan, Hardidih, Khondhar, Dabhara, Chandrpur, Amgon, Belkarri, Parsapali, Kotetara, Podishankar, Bamhindih, Afrid, Sodhi, Hathnevara were reported during January to April 2018 for social grouping data on used of various plant species during the documentation period. Information was also gathered using questionnaires on plant part used for medicine vegetable, dye, fibbers, and the data was made with the help of group discussion among different age of the tribe and villager female the society identification of various ethno medicinal plants and their indigenous uses. The photos captured by mobile camera micromax Q4001 the plant species are nomenclature and identify by different books like Bhutiya RK, Ayurvedic medicinal plant volume-1and 2. Tiwari PKS, Medicinal plants of Chhattisgarh volume-2. Manual of ethno botany 2nd edition 1995. Ethno botanical dictionary Science publication, Jodhpur.

RESULTS

Results of the ethnobotanical investigation revealed documentation of a diverse array of wild plants utilized by tribal communities for various needs in ethno botany and ethno-medicinal practices. A total of 54 plant species, spanning 29 families, were identified, with prominent families including Fabaceae, Lamiaceae, Asteraceae, etc. The research focused on East Champa, Chhattisgarh, and compiled ethnobotanical data for analysis. Research information and Ethnobotanical data was gathered and recognized extant East Champa C.G. and assembled it into a data for analysis. The representing plant mostly used to cure skin disease, diarrhea, dysentery, malaria, piles and snack bit etc. Seed and root are most widely used plant part of the reported medicinal plant used followed by root, seed, leaves, bark, decoction etc. The mostly Uraon tribes are uses medicinal plant.

DISCUSSION

The study area sites in each region were found to be abundant in medicinal plants, thriving naturally in their environments. Our research focused on the ethno-botanical usage of plants by different tribes in the area. The findings of the present study revealed 54 medicinal plant genera from 29 families, which were commonly utilized by various tribes to address a range of ailments, as detailed in Table-1. In this region, where access to modern health facilities is limited for most tribal groups, traditional medicine plays a crucial role. Despite the primitive lifestyle observed among the tribal's in East Champa district, their reliance on ethnomedicine is significant. The Uraoun tribes, in particular, stand out for their robust healthcare practices compared to other tribes. These communities leverage a diverse range of medicinal plants to treat various ailments, showcasing a distinctive healthcare approach. In contrast, other tribes tend to depend more on modern healthcare systems. This highlights the resilience of traditional knowledge and practices in contributing to the healthcare needs of these tribal communities.

CONCLUSIONS

The ethno-botanical plant a great role in explaining nature has gifted us with large plant diversity that can be brought in to much sustainable use. The use of plants for the management and treatment of disease has been in practice since ages. The plant-based drugs are prevalently practiced among the Gond, Baiga, Uraoun Sawara, to cure various disorders. Further investigation is necessary to conduct rigorous, well designed clinical practices to observe their effectiveness and safety measure in treatment of pathogenic infection and ethno-veterinary disorders. Such information is likely to help in the conservation of plant diversity and providing important lead for drug discovery. Extensive survey is also likely to help in possibilities of Ex-situ and in-situ conservation of ethno-medicinal plant.

Figure: 1-6 Informants showing various medicinal plants during survey

Baisakhu Uraw

Firat Lal Kudur

Janakram Sawara

AmritLal sawra

Dhansay Sabaria

Laxmi Bai (Gond)

Figure2: Some Medicinal plant used by Healers of Janjgir Champa.

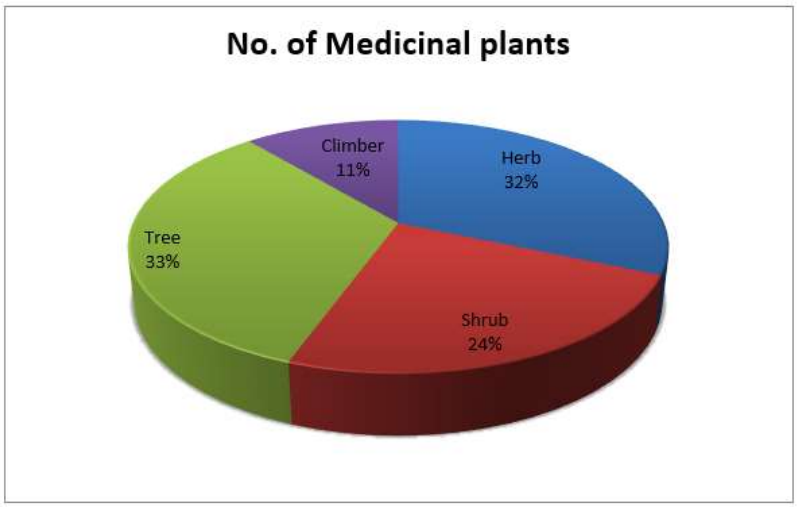
(1)Strychnosnux-vomica (2) Abutilonindicum (3) Wringhtiatinctoria (4) Thespesia populnea (5) Holopteleaintegrifolia (6) Caesalpinia banduch (7) Abrus precatorius (8)Mucana pruriens (9)***Soymida febrifuga***.\

Table 1: Ethno-botanicalplants of East Champa, Chhattisgarh

Common name	Botanicalname	Family	Parts used	Ethnobotanical /medicinal uses
Ramtulsi	*Ocimum gratissimum*	Lamiaceae	Whole part	Vomiting, colic, paralysis.
Kavancha	*Mucana pruriens*	Fabaceae	Trichome seed	Paralysis, diarrhea snack bite
Chirpoti	*Physalis minima*	Solanaceae	Fruit,	Earache, fever, diabetes,
Anar	*Punica grantum*	Lythraceae	Leaf, seed,	Dysentery,swellig diarrhea.
Ghudhmudhi	*phyeranthus indicum*	Asteraceae	Whole part	Digestion, arthritis, piles,
Kasaundi	*Cassiaoccidentalis*	Caesalpiniacee	Whole part	Snack bite, cough, asthma,
Dhawai	*Woodfordi anfruticosa*	Lythraceae	Whole part	Tonic, Dysentery,
Koriya	*Wringhtia tinctoria*	Apocynaceae	Seed, bark	Leprosy, skin disease,dihherea,
Paraspapal	*Thespesia populnea*	Malvaceae	Seed, bark	Ring worm, obesity.
Gurud	*Tinospora cordifoia*	Menispermaceae	stem	Fiver, jaundice Indigestion.
Kosam	*Schleichera oleosa*	Sapindaceae	Fruit, bark, seed	Foot and mouth disorder in Cow
Koichla	*Strychnos nux-vomica*	loganiaceae	seed	T.B. Asthma, piles, dog bite,
Vantulsa	*Hyptis suaeolens*	Iamiaceae	Seed, leaf	Fever, stomachaches, cold.
Sarpinch	*Argemon mexicana*	Papaveraceae	Seed. Stem, latex	Chicken pox, Tap worm,
Bhuineem	*Andrographi paniculata*	Acanthaceae	Whole plant	Malaria, fever, indigestion.
Rusa	*Adhatoda vasica*	Acanthaceae	Root, leaves	Fever, asthma,
Lalgunj	*Abrus precatorius*	Fabaceae	Seed	Paralysis, Steatites, scabies.
Chiti	*Marsdenia tenacissima*	Asclepiadaceae	Root	Malaria fever, skin disease.
Ashok	*Polyanthia longifolia*	Annonaceae	Bark	Stomatitis, hypertension,
Tendu	*Diospyros melanoxylon*	Ebenaceae	Fruit seed bark	Skin disease, dysentery,
Adhanpushpi	*Trichodesma indicum*	Boraginaceae	Whole plant	skin disease,
Rohina	*Soymida febrifuga*	Meliaceae	Bark	FMD, ulcer, chronic fever,
Bel	*Agle marmelos*	Rutaceae	Fruit leaf bark	Diarrhea, dysentery, jaundice, constipation, bleeding piles,
Kumudni	*Nymphaea nouchali*	Nymphaeaceae	Whole part	Digestion
Gataran	*Caesalpinia banduch*	Fabaceae	Root bark, leaf, seed,	Acne, abscess, abortion, skin disease,
Parsa	*Butea monosperma*	Fabaceae	Flower, root	Ring worm, dysentery, epilepsy,
Mehendi	*Lowsonia inermins*	Lythraceae	leaf	Arthritis, headache, jaundice,
Jada	*Ricinus communis*	Euphorbiaceae	Seed, seed oil, root, leaf	Headache, tare. Jaundice,
Karanj	*Pongamia pinnata*	Fabaceae	Seed, oil, flower, root	Blooding piles, Ring worm, eczema.

Karela	*Momordica charantia*	Cuurbitaceae	Immature, fruit	Helminthiasis, skin disease, diabetes, Piles, blooding piles.
Kukurmutta	*Blumia lacera*	Asteraceae	Whole plant, root	Nose blooding, abdominal pain, piles, abdominal worm.
Imali	*Tamarindus indica*	Fabaceae	Fruit pulp,seed,root	Pain, arthritis,indigestion,diarrhea, abdominalpain,
Kahua	*Tarminalia arjuna*	Combretaceae	Stembark	Diarrhea, anaemia, dysentery
Genda	*Tagetes erecta*	Asteraceae	Leaves	Fever, muscular pain, ring worm, wound, blooding.
Hinglaj	*Cenna elata*	Caesalpiniaceae	Leaves	Chicken pox, insect bite, snake bite, skin disease.
Kanghi	*Abutilon indicum*	Malvaceae	Root, seed	Asthma, diabetes, fever, tonic, piles
Negur	*Vitex negundo*	Verbenaceae	Leaves, seed, root	Cough, fever, pneumonia, hair tonic, anti hermitic, Dysentery.
Ghighwar	*Aloe barbadensis*	Liliaceae	Leaves pulp	Jaundice, indigestion, constipation, pimple
Neem	*Azadirachta indica*	Meliaceae	Bark, seed, oil, leaf, flower	Dandruff, malaria, ring worm, eczema, Leprosy, jaundice.
Kaner	*Thevetia peruviana*	Apocynaceae	Root, bark,	Paralysis, toothache, joint pain,
Amarbel	*Cuscuta reflexa*	Convolvulaceae	Whole part	Ulcer, constipation, flatulence, arthritis, fever, piles paralysis.
Meethanem	*Murraya koenigii*	Rutaceae	Whole par	Dysuria, skin disease, purities.
Dudhiya	*Euphorbia hirta*	Euphorbiaceae	Whole par	Alopecia, colic, ringworms.
Nimbu	*Citrus aurantifolia*	Rutaceae	Fruit	Vomiting, purities, epitasis, baldness
Hulhulia	*Cleome gynandra*	Cleomaceae	seed, root, whole part	Fever, dysentery, piles, worms, weakness, scabies And eczema.
Bhelari	*Sida acuta*	Malvaceae	Root, seed	Leucorrhoea,
Tulsi	*Ocimum sanctum*	Lamiaceae	leaves, seed	Ear pain, skin Diseases, influenza, ring worm.
Gulab	*Rosa centifolia*	Rosaceae	Flower	Constipation, pimples.
Gulmohar	*Delonix regia*	Caesalpiniaceae	Whole part	Ulcers, rheumatism,
Lalguma	*Leonotis nepetifollia*	Lamiaceae	Leaves, whole part	Swelling, fever, diarrhoea, thrush, pneumonia.
Chilbil	*Holoptelea integrifolia*	Ulmaceae	Seed, bark	Eczema, ring worm, leprosy,
Chirchita	*Achyranthus aspera*	Amaranthaceae	Whole part	Wounds, dental pain, ear pain, eczema,
Jaldubi	*Tridex procumbens*	Asteraceae	whole part	Wounds, bleeding.
Bhuskatiya	*Solanum xanthocarpum*	Solanaceae	Whole part	Cold, cough, pneumonia, snake Bite, scorpion bite, arthritis, swelling.

Graph 1: Distribution of plants according to their habitat



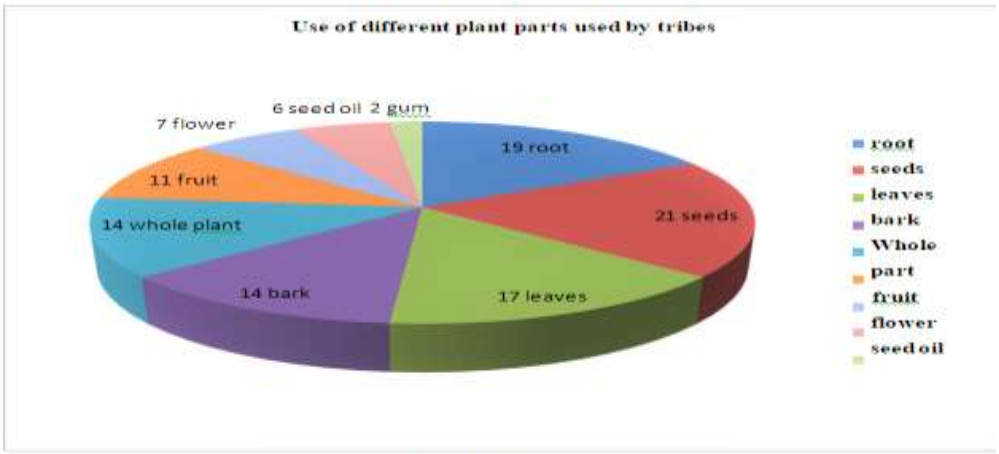


Figure 4: Plants parts used as medicine

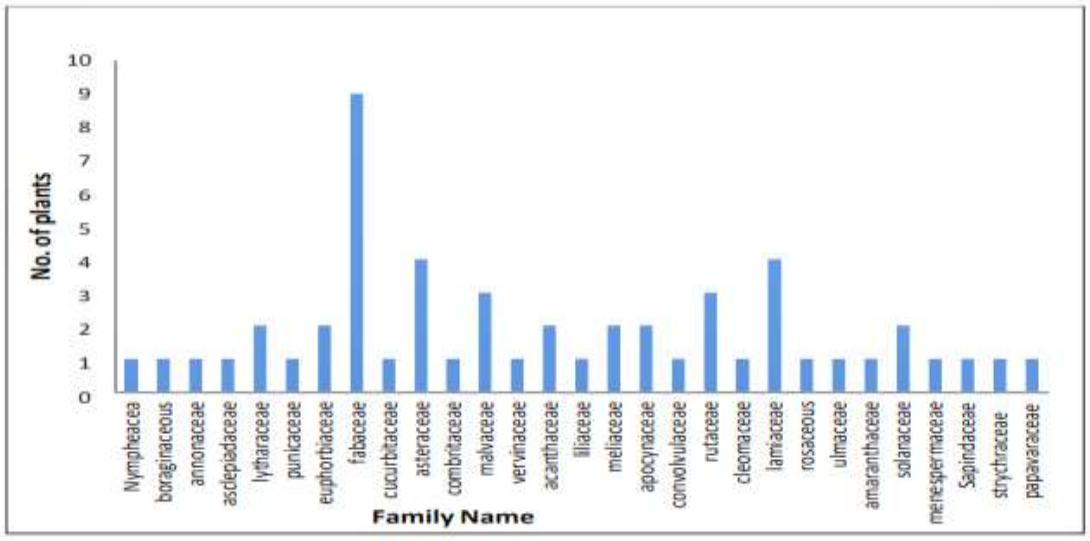


Figure 2: Graphical representation of number of plant in different family used as medicinal plant

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Impact of Global Warming and Climate Change on Financial Markets: A Comprehensive Study

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Abstract:

This abstract provides a succinct overview of the intricate relationship between global warming, climate change, and their profound repercussions on financial markets. As the Earth's climate undergoes unprecedented shifts, the financial sector is facing multifaceted risks and opportunities. The climate related risk is divided into three subcategories, the environmental uncertainty, the economic climate risk and the climate policy risk, which all of them may affect the markets directly or indirectly. Stock prices are affected by beliefs about future path of expected return. Ever-more-ferocious cyclones and extended droughts lead to the destruction of infrastructure and the disruption of livelihoods and contribute to mass migration. Actions to combat rising temperatures, inadequate though they may have been so far, have the potential to drive dislocation in the business world as fossil fuel giants awaken to the need for renewable sources of energy and automakers accelerate investments in cleaner vehicles. Market sentiment is evolving, with increased emphasis on environmental, social, and governance (ESG) factors, reshaping investment strategies. The abstract also highlights the emergence of financial innovations, such as green bonds, green credit, carbon trading and sustainable investment funds, as responses to the challenges posed by climate change. Recognizing the interconnectedness of environmental and economic systems is crucial for stakeholders to navigate this evolving landscape and foster resilient financial markets in the face of climate-induced uncertainties. The empirical evidence is mixed, and few general conclusions can be drawn. It is unclear whether the market reactions are consistent with rational market valuation of the climate risk

Keywords: Climate risk, Global warming, Environmental, Social and Governance, Fossil fuels, Carbon trading, Green credit, Green bonds.

INTRODUCTION

The tragedy of the horizon

There is a growing international consensus that climate change is unequivocal. Many of the changes in our world since the 1950s are without precedent: not merely over decades but over millennia. Research tells us with a high degree of confidence that: In the Northern Hemisphere the last 30 years have been the warmest since Anglo-Saxon times; indeed, eight of the ten warmest years on record in the UK have occurred since 2002; Atmospheric concentrations of greenhouse

gases are at levels not seen in 800,000 years; Achieving a growth path that is resilient, inclusive and sustainable is one of the top policy priorities of our time. Governments around the world are facing the triple imperatives of re-invigorating growth while improving livelihoods and urgently tackling climate change, in line with the goals of the Paris Agreement, while others have been debating the theory, you have been dealing with the reality. Getting the fundamental climate policies right is essential to aligning incentives. There is a need to accelerate the reform of inefficient fossil-fuel subsidies and broaden the carbon pricing base, focusing on tracking the impact and sharing policy experiences. Making greater use of public procurement to invest in low-emission infrastructure can trigger industrial and business model innovation through the creation of lead markets. Governments around the world are facing the triple imperatives of re-invigorating growth while improving livelihoods and urgently tackling climate change. This chapter contains an extended synthesis of the report, showing how acting on climate change can also be good for growth, provided the right policies and structural reforms are put in place. After setting the scene for combined action on climate and growth, the synthesis presents results on the macro-economic implications of a "decisive transition" to a lower mission, high-growth and resilient future. The synthesis then lays out development pathways compatible with the Paris Agreement and how they vary across country types, as well as the need to scale and shift infrastructure investment. Turning to policy, the synthesis also presents the mix of structural and targeted climate policies required, the implications of the transition for exposed businesses and workers and how governments can address them, and changes needed to the financial system.

FINANCIAL SECTOR CONTRIBUTION

1. Carbon pricing and other fiscal policies have a primary role in reducing emissions and mobilizing revenues, but the financial sector has an important complementary role. Financial institutions and markets already provide financial protection through insurance and other risk-sharing mechanisms, such as catastrophe bonds, to partly absorb the cost of disasters.
2. But the financial system can play an even more fundamental role, by mobilizing the resources needed for investments in climate mitigation by reducing greenhouse gas emissions and adaptation by building resilience to climate change in response to price signals, such as carbon prices.
3. In other words, if policymakers implement policies to price in externalities and provide incentives for the transition to a low-carbon economy, the financial system can help achieve these goals efficiently.
4. Global investment requirements for addressing climate change are estimated in the trillions of US dollars, with investments in infrastructure alone requiring about $6 trillion per year up to 2030 (OECD 2017). Most of these investments are likely to be intermediated through the financial system. From this point of view, climate change represents for the financial sector as much a source of opportunity as a source of risk.
5. The growth of sustainable finance (the integration of environmental, social, and governance criteria into investment decisions) across all asset classes shows the increasing

importance that investors attribute to climate change, among other non-financial considerations.

6. Estimates of the global asset size of sustainable finance range from $3 trillion to $31 trillion. While sustainable investing started in equities, strong investor demand and policy support spurred issuance of green bonds, growing the stock to an estimated $590 billion in August 2019 from $78 billion in 2015. Banks are also beginning to adjust their lending policies by, for example, giving discounts on loans for sustainable projects.
7. Sustainable finance can contribute to climate change mitigation by providing incentives for firms to adopt less carbon-intensive technologies and specifically financing the development of new technologies. Channels through which investors can achieve this goal include engaging with company management, advocating for low-carbon strategies as investor activists, and lending to firms that are leading in regard to sustainability. All these actions send price signals, directly and indirectly, in the allocation of capital.
8. However, measuring the impact that sustainable investments have on their environmental targets remains challenging. There are concerns over unsubstantiated claims of assets' green-compliant nature, known as "greenwashing." There is a risk that investors may become reluctant to invest at the scale necessary to counter or mitigate climate change, especially if policy action to address climate change is lagging or insufficient.

CLIMATE CHANGE AND FINANCIAL STABILITY

There are three broad channels through which climate change can affect financial stability:

- **First, physical risks**: The physical climate-related risks represent the economic costs and financial losses due to increasing frequency and severity of climate-related weather events and the effects of long-term changes in climate patterns resulting from continuously growing GHG emission impacts today on insurance liabilities and the value of financial assets that arise from climate- and weather-related events, such as floods and storms that damage property or disrupt trade. Physical risk can affect both the supply and demand sides of the economy. On the supply side, natural disasters can disrupt business activity and trade and destroy infrastructure, diverting capital from technology and innovation to reconstruction and replacement. It affect output levels and output growth by impacting labor productivity, speeding up the depreciation of capital stock, increasing cost of repair and replacement and reducing funds allocated to research and innovation. On the demand side, increasing expenditures for repair and replacement will, ceteris paribus, reduce investment on the consumption demand for other goods. Households confronted with more frequent extreme weather events might increase precautionary saving, which would depress private consumption in general.
- **Acute Risk**: Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.
- **Chronic Risk**: Chronic physical risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves

- **Second, liability risks**: the impacts that could arise tomorrow if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible. Such claims could come decades in the future, but have the potential to hit carbon extractors and emitters – and, if they have liability cover, their insurers – the hardest.
- **finally, transition risks**: The financial risks arise as a result of the shift to a low-carbon economy triggering changes in demand-related factors. This adjustment process is likely to have a significant impact on the economy and in particular, on some financial asset values. Transition risks are characterized by a radical uncertainty on the nature of the low-carbon pathway which could result from the process of adjustment towards a lower-carbon pathway and a more usual uncertainty on the methods for implementing this pathway in economic and social terms. Changes in policy, technology and physical risks could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent. The speed at which such re-pricing occurs is uncertain and could be decisive for financial stability. There have already been a few high profile examples of jump-to-distress pricing because of shifts in environmental policy or performance. Risks to financial stability will be minimized if the transition begins early and follows a predictable path, thereby helping the market anticipate the transition to a 2 degree world.
- **Technology Risk**: Technological improvements or innovations that support the transition to a lower-carbon, energy efficient economic system can have a significant impact on organizations. For example, the development and use of emerging technologies such as renewable energy, battery storage, energy efficiency, and carbon capture and storage will affect the competitiveness of certain organizations, their production and distribution costs, and ultimately the demand for their products and services from end users. To the extent that new technology displaces old systems and disrupts some parts of the existing economic system, winners and losers will emerge from this "creative destruction" process. The timing of technology development and deployment, however, is a key uncertainty in assessing technology risk.
- **Market Risk**: While the ways in which markets could be affected by climate change are varied and complex, one of the major ways is through shifts in supply and demand for certain commodities, products, and services as climate-related risks and opportunities are increasingly taken into account.
- **Reputation Risk**: Climate change has been identified as a potential source of reputational risk tied to changing customer or community perceptions of an organization's contribution to or detraction from the transition to a lower-carbon economy.

ECONOMIC CONSEQUENCES OF CLIMATE CHANGE

1. Even though the climate conflict resulting from green houses gases (GHG) emissions was evident by the Nineties and the well-known agreements made, their enforcement is more difficult than that of other environmental agreements. That is because measures to reduce GHG emissions interfere with the heart of the economy and the market: energy and economical growth.
2. Analyzing the environmental policy responses to climate change the conclusion is that GHG emission reduction can only be achieved through intensive environmental policy. The analysis finds that the effect of climate change impacts on annual global GDP is projected to increase over time, leading to a global GDP loss of 0.7% to 2.5% by 2060 for the most likely equilibrium climate sensitivity range. Underlying these annual global GDP losses are much larger sectoral and regional variations.
3. Agricultural impacts dominate in most regions, while damages from sea level rise gradually become more important. Negative economic consequences are especially large in South and South-East Asia whereas other regions will be less affected and, in some cases, benefit thanks to adjustments from international trade. Emissions to 2060 will have important consequences in later decades and centuries. While extensive environmental protection complements production horizontally, intensive environmental protection integrates into production and the environment vertically.
4. The latter eliminates the source of the pollution, preventing damage. It utilizes the biochemical processes and self-purification of the natural environment as well as technical development which not only aims to produce state-of-the-art goods, but to make production more environmentally friendly, securing a desired environmental state. While in extensive environmental protection the intervention comes from the outside for creating environmental balance, in intensive environmental protection the system recreates this balance itself. Instead of dealing with the consequences and the polluter pays principle, the emphasis is on prevention.
5. It is important to emphasize that climate strategy decisions have complex effects regarding the aspects of sustainability (economical, social, and ecological). Therefore, all decisions are political. At present, and in the near future, market economy decisions have little to do with sustainability values under normal circumstances. Taking social and ecological interests into consideration can only be successful through strategic political aims
6. A huge number of studies have confirmed that global warming reduces well-being (Gelzinis & Steele, 2019; IMF, 2018; Dafermosa et al., 2018). Climate change could have large impacts in terms of reducing the potential of the economy to grow in the future, by reducing labor productivity and diverting resources from investment in current productive capital and innovation to climate change adaptation
7. However, on the other hand, the IMF (2018) points out that there is growing evidence that investors and financial markets do not fully understand, at least not immediately, the impact of weather shocks on output and productivity

8. It jeopardizes macroeconomic and fiscal stability through the destruction of infrastructure, increasing the amounts of necessary subsidies to the economy and social welfare, which all impact economic growth, public debt and its financing costs, employment, inflation, and the like. In addition, all this can lead to an increase in the prices of certain products and services such as agricultural products, insurance, water, etc
9. Also, different industries and sectors have different degrees of sensitivity to climate change. It is usually pointed out that agriculture, tourism, as well as branches based on carbon fuel are the ones most affected due to the expected tightening of standards and the introduction of carbon tax. In this context, the possibility that industries, workers, and other stakeholders associated with fossil fuels and other industries that cause global warming can organize and resist climate change management should not be overlooked.

PATHWAYS AND PRIORITIES FOR A DECISIVE TRANSITION

The long-term temperature goals of the Paris Agreement can be translated into a fixed quantity of long-lived GHGs to be released to the global atmosphere over time. This global "carbon budget" is best presented as a range, reflecting uncertainties on how the temperature target is interpreted, how the climate responds to GHG concentrations, and the role of non-CO2 GHG emissions. The later the peak in global emissions, the greater the rate of emissions reduction required subsequently to stay within the carbon budget. Options for achieving ambitious mitigation goals may be lost if emissions peak too high or too late, and delayed action would lead to higher costs as described above.

The level of gross GHG emissions consistent with a given net carbon budget will also depend on assumptions about technologies for "negative emissions", which would allow for a temporary overshoot before emissions are removed from the atmosphere to maintain net emissions within the overall budget. The global carbon budget compatible with a 66% likelihood of remaining below 2°C is estimated to be 590-1 240 GtCO2 from 2015 to the time of peak warming – roughly 15 to 30 years of fossil fuel-related CO2 emissions at current rates.1

Rapid replacement of fossil fuels by renewable energy

All of the strategies reviewed emphasize the need to promote a rapid shift from fossil fuels to renewable energy, with technological priorities commonly including significant expansion of innovation, investment and deployment in the following energy; bio energy and the use of spare wind water and solar energy to produce electrolytic hydrogen; and liquefied hydrogen combustion for aircraft. The policy settings and infrastructure required to drive a rapid switch in investment from fossil fuels to renewable are likely to include a robust carbon price, feed in tariffs and supportive regulatory initiatives; a rapid phase out of tax breaks and subsidies to fossil fuel intensive industries; and large scale investment in both smart grid infrastructure and local distributed energy networks.

Reducing land use emissions and improving the role of land use in carbon sequestration

Common technological priorities for reducing land use emissions and improving the role of land use in carbon sequestration included the following initiatives: reducing and reversing deforestation; reducing cropland soil emissions through reducing tillage, improving fertilizer and nutrient management, and restoring degraded farmland; cropland carbon sequestration; improving pasture and grassland management through optimizing grazing intensity, expanding planting of deep-rooted perennial grasses, and improving fire management; reducing live stock emissions through active livestock feeding, anti-methanogenic treatments, and improved manure management; and biogasification of organic manure through capture or burning of agricultural methane. The overall findings of the Post Carbon Pathways report on the technical feasibility of large scale de-carbonization are largely consistent with and supported by the conclusions of a number of other recently published reviews of low carbon economy transition strategiesn Clear and effective communication of the most robust scientific evidence of climate change trends, causes and risks remains the essential foundation for overcoming climate change denial and strengthening understanding of the necessity and urgency of action. Evidence of the ways in which climate change is increasing the frequency and severity of extreme weather events will be particularly important in enabling individuals to join the dots between personal experience and broader climate change trends and patterns.

CONCLUSION

The impact of global warming and climate change on financial markets is undeniable and far-reaching, presenting both challenges and opportunities for stakeholders across the globe. As our planet faces unprecedented environmental upheaval, the ramifications are reverberating through the intricate web of economic systems, reshaping the landscape of financial markets in profound ways. Regardless of a growing economic awareness of climate change, it appears that a sufficient level of global awareness about all the dangers and why it is necessary to take measures to limit greenhouse gas emissions as soon as possible has not yet been reached. The reason for this is probably that economic damage as a result of climate change is sporadic, more pronounced in the long run, and there is a misconception that these one-off events are unlikely to recur in the future.

More specifically, deeper analysis of the specific channels by which climate-related risks create hidden vulnerabilities in the financial sector will be an especially important topic for exploration. Continued research investments in this area will require a broad range of research and modeling approaches and tools and new sources of data. We believe these investments over time will increase policymakers' ability to monitor the relationship between climate change and financial stability. In this article, we discussed why climate change is now considered as a source of risk for the financial system and given the large and growing role that the financial sector plays in the economy and society, and the long-lasting effects of financial crises, the assessment of climate-related financial risks should be considered as a public good and should be mainstreamed in economic and financial assessments and in policy evaluation. In this regard, transparent, science-based metrics and methods are crucial for risk management strategies of investors’ portfolios in the low-carbon

transition for financial supervisors to identify the drivers of systemic risk in financial system, and to design measures to mitigate such risks and preserve financial stability.

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A Study on Growth of Population in Raipur City as a New Capital

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Abstract

Raipur is one of the leading premier city of Chhattisgarh state. As a city Raipur has been given a capital status, a new urban centre is coming up near old settlement. Today also Raipur city is undergoing rapid and dynamic changes due to accelerated phase of industrialization and urbanization, which have tremendous impact on the population growth and it effects the overall scenario such as additional housing demands, changes in housing typology and occupancy rate, increased land value, emergence of slums, etc. Hence, there was a tremendous pressure on the urban planners and different development authorities to manage systematic growth of the city. This study is an attempt to find out the probable growth of population, if it had not been declared as the capital of state Chhattisgarh. The paper also looks into the growth of population of the city after it has been declared as a capital city. This study is based on secondary data. This paper analyses how the population change take place when the status of the city is changed. Further, the future population growth as expected is also found out by various methods using mathematical and graphical methods. And the study reveals that 8.0 percent extra impact of population has to face the city than the natural growth.

Keywords : Capital City, Settlement, Population Growth, Population Projection, Urbanization.

Introduction

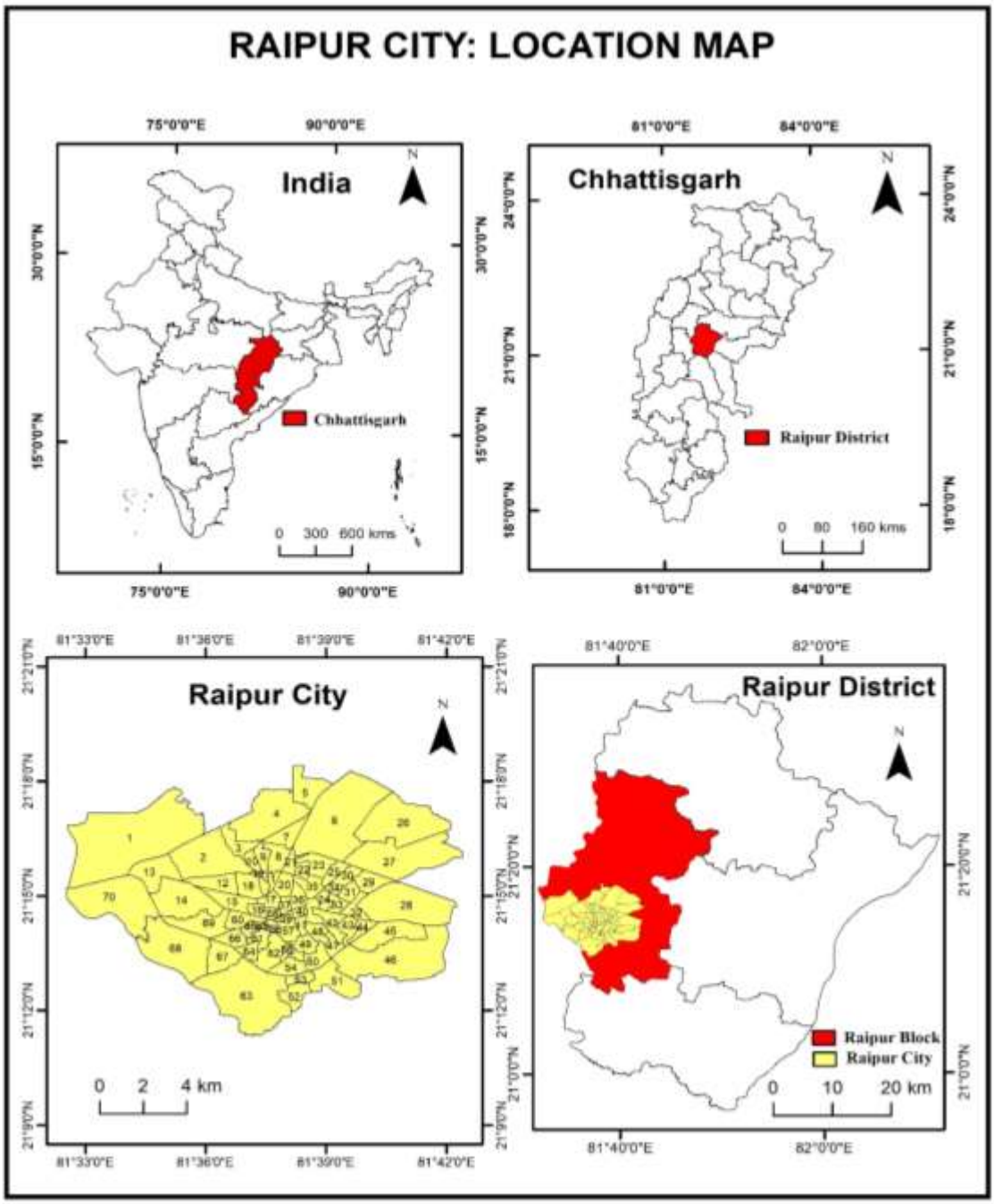
The evolution, growth and development of any city is the sum of a series of processes that have been operative in that area over a period of time. The problem created by the haphazard and unrestricted growth of a city give rise problem like unhygienic slums, polluted environment, uncoordinated development of residential, industrial and commercial areas resulting in traffic bottle necks and many other problems all known and felt by the residents of the city. And the greatest problem of the cities are the problem of managing growth. Constantinos A. Doxiadis , a Greek architect and planner, proposed several solutions for the rapidly growing cities. One of which was for city planners, to leave room for the expansion of the city core, along a predetermined axis so that most urban expansion would be channeled in the single direction. A particular process leads to a particular pattern. In turn the process itself dependent on several factors like, the history of the region, its site and situation, social customs, population planning laws, administration and so on and so forth.

Study Area

Raipur city is located in the middle part of Chhattisgarh state (Rice Bowl) (Fig. 1). This city is extended from 21º 14' North latitude and 81º 38' East longitude. The total geographical area of this city is 326 sq. km. As per Census 2021, total population of this city is 170200. Raipur city is an important junction on the Mumbai – Kolkata trunk line of the South Eastern Central Railway Lines. And enjoys a centre location in Chhattisgarh state. Raipur city lies at the convergence of numerous roads, National Highway No. 6 joining Kolkata and Mumbai runs through the city. The city has an altitude of 298.15 mts.. above mean sea level. The site of Raipur city is a low ridge on the north – east Kharun river.

Raipur city derived its name from its creator, the Kalchuri king Brahmdev Rai, who established it as the capital of his kingdom in early fifteenth century, (Sandarbh Chhattisgarh, 2000). Raipur city is the premier city and it is the largest urban centre of the Chhattisgarh region and it was the second important commercial centre after Indore, when it was a part of erstwhile state of Madhya Pradesh, (Raipur Development Plan, 2011). Now the importance and significance of the city have increased many times due to its new capital status. Raipur was growing city even before it was given capital status because of its commercial, industrial and agricultural activities. The establishment of Bhilai Steel Plant in close proximity has given a great impetus and its nodal location has contributed to its growing importance. It has other factors of importance such as abundant natural resources, availability of critical infrastructure, surplus power and opportunities in infrastructure provisions. Now it is an important administrative, commercial, industrial and educational centre. And coming up of new urban centre near the existing city. So it has to shoulder two responsibilities i.e. administrative and as economic capital of the state. Therefore the pressure of development on Raipur city can easily be predicted in near future.

After declaring Raipur as a state capital on 1st November 2000, its importance has increased instantly and the State Government took various initiative measures to portray Raipur in national and international scenario. The State Government prepared an industrial friendly policy and giving incentives to attract large investments in core sectors and downstream industries, and a rapid work is going on transport and infrastructure developments. At the same time the State Government decided to build a prestigious and beautiful capital city for the state. The prime objective of the city is to be economically viable with least financial burden on State Government.



So it is expected that there will certainly be an impact on the existing Raipur city and there will be a major structural and functional change within the city and ample of employment opportunities will be generated due to the large investment in different sectors. This will result in a huge population growth particularly in existing city. It is predicted that this additional growth in population is due to the people coming from outside of Raipur. It would create tremendous pressure on housing which may cause many undesirable situations. Thus it becomes imperative to develop

necessary policy guidelines, proposals, recommendations, to deal with the future growth of population in the existing city Raipur.

Objectives

The main objectives of the present study are as follows:-

1. To find out the probable growth of population of Raipur city, if it is had not been declared as the capital city of state Chhattisgarh, which is considered as "Scenario - A".
2. This study also looks into the growth of population of Raipur city after it has been declared as a capital city, which is considered as "Scenario – B".

Sources of Data and Methodology

- This study is based on secondary data. Population related data have been collected from Primary Census Abstract and District Statistical Handbook.
- To compute the population growth in Raipur city mathematical and graphical methods have been applied, because mathematical methods can be plotted and graphical data can be described mathematically. In this study Geometric Growth Method and Arithmetic Methods under Mathematical Method, have been used to compute population projection.

Population Projection Method (Justification)

Population projection predicts what type of changes can occur, given assumptions inherent in the projection method and data. Here, projection refers to the size of the population at some point in the future. It is the workout at calculating the future values of given population.

The use of population projection is important for development planning of cities, housing and employment etc. It is also important to estimate the future consumption requirement of various goods and services by the population. The data are needed to the government, non – government organization and private sectors.

Accurate population projection is the back bone of any planning process. It is evident that population projection may not tally with the actual population achieved but they can certainly be close to the reality. The advantages in using mathematical methods is that they are easy to compute.

In order to compute population change the first step to compute the rate of change. This requires having population for two time periods. These can be any two points in time since the rate of change will be based on the number of years between the two time periods.

$$\text{Rate of change } \Delta P = \left(\frac{P_{t2}}{P_{t1}} - 1\right)$$

$$\text{Percentage rate of change } \Delta P = \left(\frac{P_{t2}}{P_{t1}} - 1\right) \text{ x } 100\ \%$$

When computing rates of change and population projection, there are two key assumptions. First, the rate of change over ten years is assumed to be equally divided across each of ten years and second, the population is assumed to continue to grow at the same rate as it has in the past.

Geometric Growth Method

$$P_{t+n} = P_t\ (1 + r)^n$$

Where,

P_{t+n} = is the year we are projecting

P_t = the ending point for computing

r = the rate of change computed above

n = number of decades

Arithmetic Method

$$P_n = P_o + n\bar{x}$$

Where,

P_n = forecasted population after n decades from present known population.

P_o = population at present

n = number of decades

$\bar{x}$ = average (Arithmetic mean of population)

Table – 1 Growth of Population in Raipur City and Decadal Variation, 1901 - 2021

Year	Population (in lakhs)	Decadal variation (%)
1901	0.32	0
1911	0.35	10.00
1921	0.38	8.57
1931	0.45	18.39
1941	0.63	39.82
1951	0.89	41.50
1961	1.39	53.66
1971	2.06	47.35
1981	3.38	64.21
1991	4.63	36.54

2001	6.97	50.54
2011	11.23	61.12
2021	17.02	51.55

Source : District Statical Handbook, 2021

Observation and Discussion

Total Population and Population Growth

Table – 1 presents that while in 1901 in the beginning of the past century, there were only 0.32 lakhs people in Raipur city, at the end of the end of the century in 2001, Raipur population became 6.97 lakhs. Thus during 100 years time period 1901 – 2001, Raipur population increased by almost 20 times. During the past century growth had been affected by some genuine reasons. Although in the decade 1911 – 1921, the growth rate came down to 8.57 percent from 10.00 percent during the previous decade 1901 – 1911 due to dreaded diseases of Cholera, Plague, Influenza, Malaria and other infectious diseases. The growth rate increased as 39.82 percent between 1931- 1941 and 41.5 percent during the decade 1941- 1951 due to better health facilities and health policies. The growth

Fig. – 2 : Growth of Population in Raipur City, 1901 - 2001

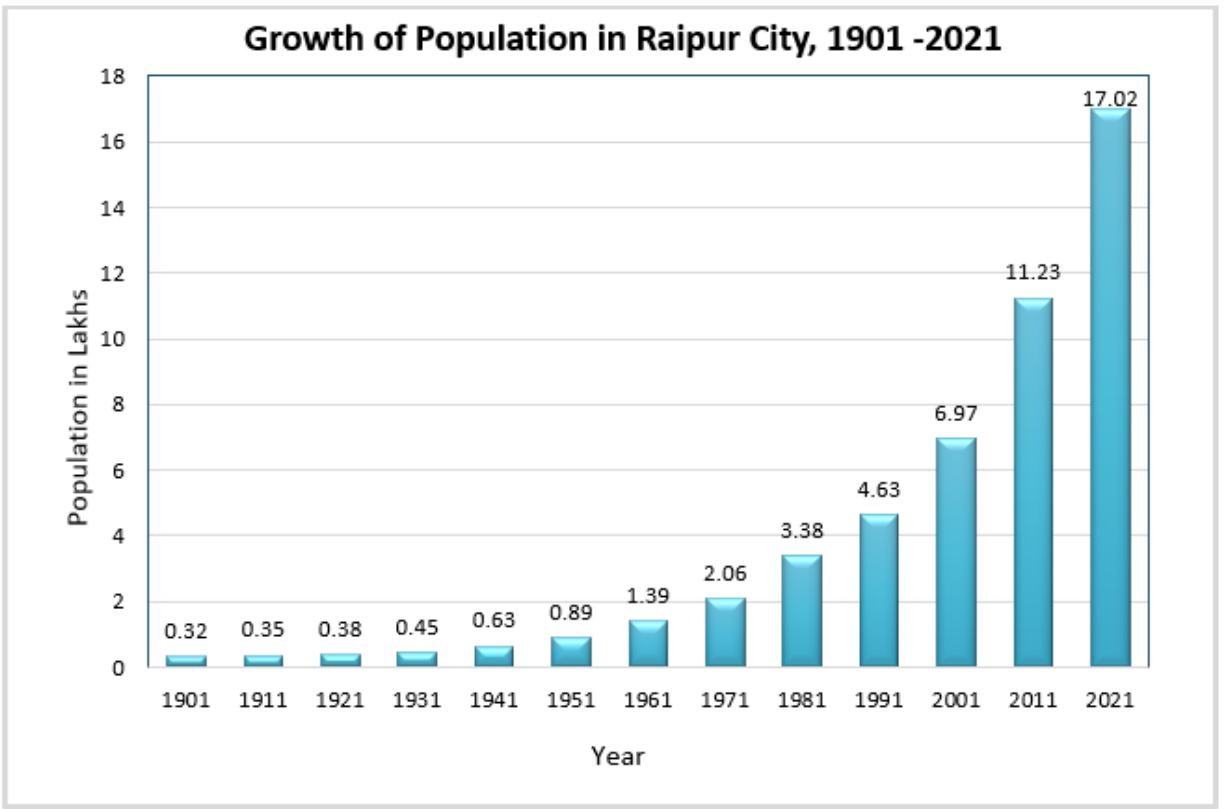


Fig. 2

increased as 53.66 percent between the decades 1951-1961 due to establishment of Bhilai Steel Plant in Bhilai. And during 1971-1981, the settled refugees from Bangladesh had abnormally increased the growth rate up to 64.2 percent. Again the growth rate in the decade 1991-2001 was increased 50.54 percent due to declaration Raipur city as the capital of the new state of Chhattisgarh. And it was increased 61.12 percent in the decade 2001-2011 again due to development of industries, business, transport and infrastructure after declaration of its as a new capital. However, the last decade 2011-2021 shows less growth rate (51.55 percent) than the preceding decade 2001-2011.

The population growth analysis shows positive growth rate every decade in last century and also after declaration of its as capital of Chhatisgarh state (Table–1 and Fig. 2). Construction of Naya Raipur is also responsible for the population growth as well as urbanization of Raipur city. Immigration of people for business, trade, labor and education. That's why the natural population growth of Raipur city is increasing rapidly day by day.

Results and discussion

Scenario – A : Population Projection, If Raipur Was Not Declared As Capital

The future population based on the secondary data has been predicted as under:

In order to derive the growth rate of the city for the next ten years, the growth rate of the last three decades has to be studied. During 1971-1981, the settled refugees from Bangladesh had abnormally increased the population growth rate up to 62.4 percent. Hence, the consideration of this growth rate may erroneous. Again the in the decade 1991-2001 the growth was much (50.54 percent) due to the declaration of Raipur as a new capital of Chhattisgarh state. The growth in the next decade will fall back to the normal, which can be taken as the average of the decadal growth rate of the last two decades, i. e., 0.44 percent. The population has been calculated using three methods described below. The final population data are based on all the three results.

The methods are given below:

Method – 1 : Geometric Growth Method

$$P_{t+n} = P_t\ (1 + r)^n$$

In this case,

P_{t+n} = 2011.

P_t = 6.97 lakhs (in 2001)

r = 0.44

n = 1

Then,

P_{2011} = 10.03 lakhs

Similarly,

P_{2021} = 14.44 lakhs

P_{2031} = 20.80 lakhs

And

P_{2041} = 30.00 lakhs

Method -2 : Arithmetic Method

$$P_n = P_o + n\bar{x}$$

In this case,

P_n = 2011.

P_o = 6.97 lakhs (in 2001)

$\bar{x}$ = 2.34

Then,

P_{2011} = 9.31 lakhs

Similarly,

P_{2021} = 13.99 lakhs

P_{2031} = 23.35 lakhs

And

P_{2041} = 42.07 lakhs

Method – 3 : Graphical Method

Graphical method showing the population projection (Fig. 3) and following table (Table - 2) shows the average population projection from mathematical and graphical methods. (Scenario - A)

Table – 2

Average Population Projection from Mathematical and Graphical Method (Scenario - A)

Year	Population (in lakhs)	Decadal Variation (%)
2001	6.97	50.54
2011	9.67	38.73
2021	14.21	46.94
2031	22.07	55.31
2041	36.03	63.23

Fig. 3 - Graphical Method Shows the Population Projection in Scenario - A

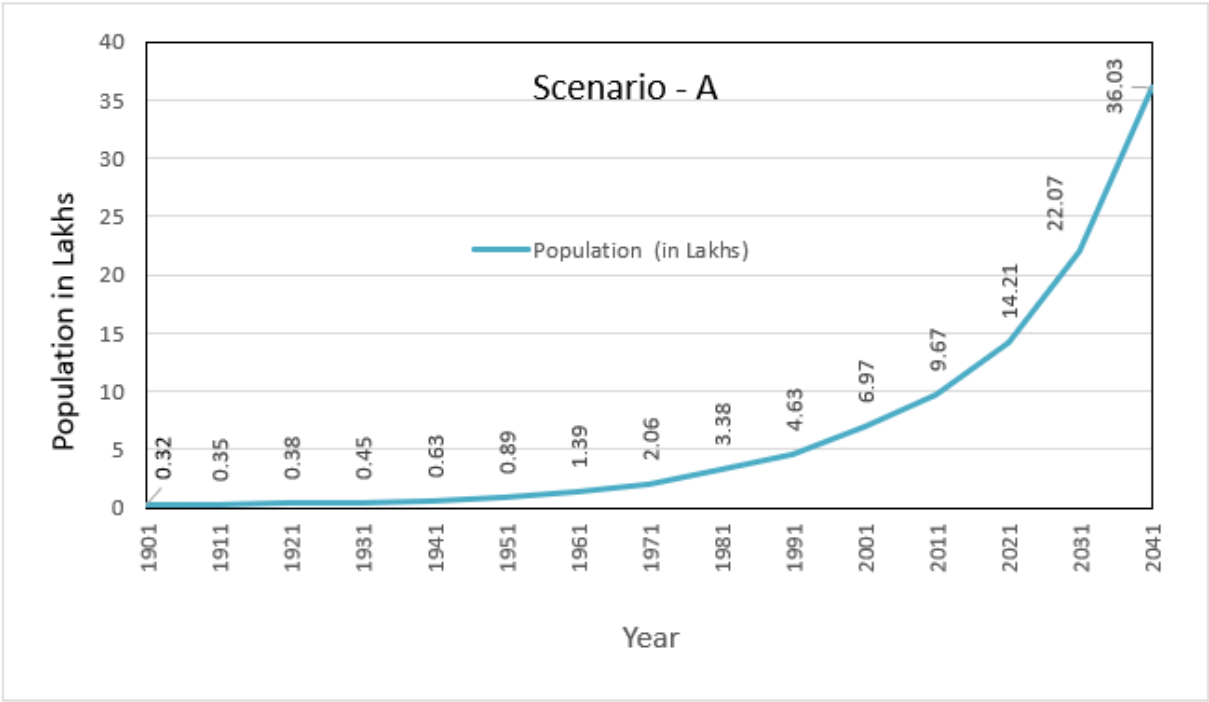


Fig. 3

Scenario – B : Population Projection, After Raipur Has Been Declared As Capital

As per Census 2011, the population of Raipur is 11.23 lakhs in 2011. This population includes the impact on population, as state capital. The projected population for the years 2021, 2031 and 2041 is to be computed by both mathematical and graphical methods.

Method – 1 : Geometric Growth Method

$$\boldsymbol{P_{t+n} = P_t\ (1 + r)^n}$$

In this case

P_{t+n} = 2021.

P_t = 11.23 lakhs (in 2011)

r = 0.56

n = 1

Then,

P_{2021} = 17.52 lakhs

Similarly,

P_{2031} = 27.33 lakhs

And

P_{2041} = 42.63 lakhs

Method -2 : Arithmetic Method

$$P_n = P_o + n\bar{x}$$

In this case

P_n = 2021.

P_o = 11.23 lakhs (in 2011)

$\bar{x}$ = 4.26

Then,

P_{2021} = 15.49 lakhs

Similarly,

P_{2031} = 24.01 lakhs

P_{2041} = 41.05 lakhs

Method – 3 : Graphical Method

Graphical method showing the population projection (Fig. 4) and following table (Table - 3) shows the average population projection from mathematical and graphical methods. (Scenario – B)

Table – 3

Average Population Projection from Mathematical and Graphical Methods (Scenario – B)

Year	Population (in lakhs)	Decadal Variation (%)
2021	16.50	47.00
2031	25.65	55.57
2041	41.84	63.00

Fig. – 4 : Graphical Method Shows the Population Projection in Scenario - B

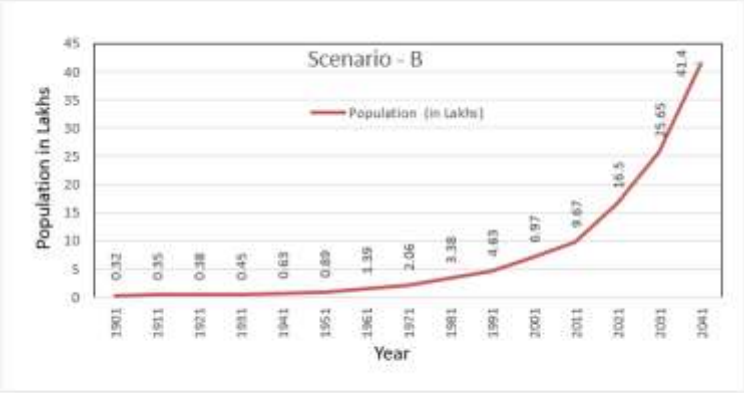


Fig. 4

Fig. – 5 : Comparative Chart Showing the Average Results of Graphical and Mathematical Methods

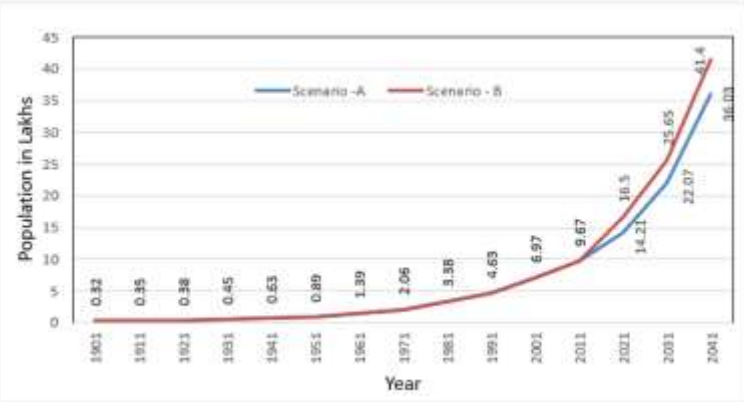


Fig. 5

Conclusion

Comparative figure (Fig. 5) shows the average results of both the methods, i.e., graphical and mathematical methods. The difference of growth rate showed in scenario – A and scenario – B. After computing the population projection, it has been concluded that in scenario – A, population for year 2011 is 9.67 lakhs, for year 2021 is 14.21 lakhs and for year 2031 will be 22.07 lakhs,for the year 2041 will be 36.03 lakhs and population growth rate for five decades are 50.95 percent. But in scenario – B, population projection for the year 2021 is 16.50 lakhs, and will be 25.67 lakhs in the year 2031 and 41.84 lakhs in the year 2041. And the population growth rate for two decades are 59.29 percent. The difference in the both the growth rate is approximate 8.0 percent.

So this is concluded that 8.0 percent extra impact of population has to face the city than the natural growth. This data also help to the urban planners and different development authorities to manage the systematic growth of the city and the provision for future expansion.

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Assesment of the effect of different spacing and application of carbonic fertilizers on growth, flowering and yield of Gladiolus (*Gladiolus grandiflorus* L.)

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ABSTRACT

An experiment was conducted in factorial Randomized Block Design (FRBD) with three replications and twelve treatments. The allocation of treatments to the individual plots was done using random numbers in each replication. The corms were planted on 17 Oct. 2015. The treatments consisted of three various spacing i.e., 30cm x 30cm, 30cm x 15cm and 40 x 15 cm and four combination of fertilizers RDF 200:200:200, NPK 75% + FYM 25%, NPK 75% + GM25%, NPK 75% + VC25% The treatment T_{12} **:** 30 x 15cm^2 + NPK 75% + VC25% performed higher in number of leaves per plant, height of the plant (cm), crop growth rate (CGR), days to spike emergence, length of the spike, number of florets per spikes, vase life of cut spikes (days),days to opening of first florets, longevity of first florets(days). whereas the earliest 50% sprouting, number of sprouts per mother corm, the yield of corms per hectare, number of corms per plant, number of spike per plant and spike yield per hectare recorded highest in Treatment T_8**:**30cm x 15cm + NPK 75% + VC25% and the treatment T_{11} **:**40 x 15cm^2 + NPK 75% + GM 25% performed best in Diameter of corms (cm) and Weight of corms (g). Treatment T_{10} **:**40x15 cm^2 +75% NPK + 25% FYM i.e. observed highest in width of leaf (cm) The cost and return associated with the cultivation of gladiolus in the present investigation clearly indicated that the net return Rs.14,28,591/ha and benefit cost ratio (2.89: 1) were highest in treatment T_8.

Keywords: *Gladiolus, Spacing, Organic manures, Inorganic Fertilizer, yield*

Gladiolus name is derived from the Latin word *'gladius'* means sword because of leaves being sword-like in appearance. Gladiolus (*Gladiolus grandiflorus*) is said to be the "Queen of bulbous plant", because the gladiolus is top in the list of its beauty, glamour, keeping quality, long range of colour like white, crimson, pink, orange, salmon, red, purple cream and rose etc. shades and shapes. Gladiolus is one of the most popular flowering plants, because of its colourful and attractive succession from the bottom. They are available in an extensive array of colours. They produce flowers in almost every shade and may be bi-or tri-coloured. The flowers open first at the base of the spike with the older ones dying as the new ones unfurl. They may be frilly, ruffled, or plain. Plants are generally of two types (1) Having large florets (2) Having miniature or butterfly type flowers. Plant is straight and leaves are also straight, spike stand straight from the base.

Beyond the limit or higher rate of nitrogen delayed the time of flowering and increased the spike length, weight and size of corms. The higher rate of phosphorus and potassium tended to improve the flower quality.

MATARIALS AND METHODS

Field preparation was done by ploughing the field with mould board ploughonce, followed by levelling and weeding manually. Then the field was divided intothree blocks spaced at one meter distance. Each block was further sub-divided into twelve sub-plots at a distance of 0.5 m. The given amount of FYM, Vermicompost and Goat manure was applied in each sub plot treatment wise and then and mixedproperly.The usual method of propagation of gladiolus is through corms and cormels. Healthy corms size ranged between 3cm to 5cm were planted after treating with Bavistin@ 1gm/kg corm.FYM, Vermicompost and Goat manure were given as basal in the given plots treatment wise. Recommended fertilizer of dozes Nitrogen (N=0.130gm/plot) phosphorous (P=0.375gm/plot) and potassium (K=0.99gm/plot) were given during course of experiment. Full doses of potassium and phosphorous were given as basal application at the time of planting and nitrogen was given in three split doses i.e. one forth as basal and remaining three fourth in two equal and split dozes i.e. one at 3 and another at 6 leaf stages. Before planting of corms in the soil, a soil sample was collected from experimental field and analyzed for physical-chemical characteristics. Gladiolus may be grown on wide range of soils. Sandy loam soil is suiTable for good growth and flowering. The most suiTable pH range is 6-7. The soil should be well drained and free from soil borne disease. It is grown in open fields, beds, pots and a border etc. The soil of experimental field was sandy loam in texture and slightly alkaline in reaction. The soil was low in organic carbon (0.45), available nitrogen low (155.40), available phosphorus medium (14.76), and available potassium medium (139.82).

RESULTS AND DISCUSSION

The data presented in Table-1 envisaged that the fifty percent of sprouting the minimum number of days (5.33) was taken by treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost), whereas the maximum number of days (6.46) for 50 percentages sprouting was recorded in the treatment T_1(30 X 30 cm^2 + 200:200:200 kg NPK) .The earliness in sprouting may be due to the application of chemical fertilizer in combination with FYM which promotes or induces early sprouting of corm. This result is confirmed with the findings of **Bisen and Barholia (1990) and Singh (1998)** in potato and gladiolus respectively.

The data presented in Table-1 envisaged that the maximum number of sprouts per mother corm (1.46) was found in the treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) The minimum number of sprouts per mother corm (1.00) was recorded in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK). The superiority of treatment T_8 over the rest of the treatments might be due to availability of optimum amount of nutrient from inorganic fertilizer in combination with Vermicopost. This result is in close conformity with the findings of **Singh and Singh (1971).**

The data presented in Table-1 envisaged that the number of leaves per plant was counted at 30, 60 and 90 days after planting. The maximum number of leaves was observed (10.40) in treatment T_{12}

(40x15 cm^2 + NPK 75% + Vermicompost 25%). Minimum number of leaves per plant was observed (6.86) in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) This might be due to continues availability of essential nutrient to the crop by the application of inorganic fertilizer in combination with organic Vermicompost. These observations followed the results of **Ahmed *et al.* (2004).**

The data presented in Table-1 envisaged that the data on height of the plant was recorded at 30, 60 and 90 days after planting. The maximum height of the plant was observed (124.13 cm) in treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) and it was significantly superior over all of the treatments. Minimum height of the plant was noted (117.66 cm) in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK). The maximum height of plant under the treatment T_{12} might be associated with the availability of optimum nutrient to the plant throughout the growth period by the application of inorganic fertilizer in combination with Vermicompost. This is in accordance with the findings of **Widjajanto and Widodo (1982).**

The data presented in Table-1 envisaged that the maximum leaf width (3.69) was obtained in treatment T_{10} (40X15 cm^2 + NPK 75% + FYM 25%) and the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) recorded the minimum leaf width (3.05) Similar result was recorded by **Shankar (2001)**. He observed that the leaf breadth of gladiolus was maximum in the treatment NPK@ 40:20:20g/m2, **Singh and Bijimol (2000)** (Tuberose).

The data presented in Table-2 envisaged that the days to opening of first florets was recorded minimum in treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) (16.00) and minimum number of florets per spikes was recorded in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (11.02). Findings are in conformity with the findings of **Singh and Bijimol (2000)**

The data presented in Table-2 envisaged that the maximum longevity of first florets in Al_2 $(So_4)_2$ 200 ppm (5.74) was obtained in the treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) whereas the minimum longevity was found in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (4.11 days). It may be due to the exogenous supply of $Al_2(SO_4)_2$ & Sucrose which replaced the depleted endogenous carbohydrate, utilized during the postharvest life of lower and thereby enhanced vase life **Kumar (2005)**

The data presented in Table-2 envisaged that the minimum number of days to spike emergence 64.40 days was taken by the treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%).The maximum number of days to spike emergence 77.46 days. Was taken by the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) The earliness in spike emergence by the application of Vermicompost in combination of inorganic fertilizer may be due to optimum availability of nutrients to the plant due to which plant completed their vegetative growth soon resulting in early spike emergence. These results are in close conformity with the findings of **Ahmed *et al.* (2004**). They observed that the treatment which was comprised of 20 g urea/m2 + 40g (DAP)/m2 + 4kg FYM/m2 taken minimum number of days for emergence flower bud in Dahlia.

The data presented in Table-2 envisaged that the maximum length of spike (101. 35cm) was recorded in the treatment T_{12}. The minimum length of the spike 60.82cm.was obtained in treatment

T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) The maximum length of the spike in treatment T_{12} may be due to the availability of sufficient amount of nitrogen in different phases of growth and development of plants which promotes the length of the spike. Similar result was recorded by **Gupta *et al.* (2008).** They reported that the maximum length of the spike in gladiolus was obtained by applying Vermicompost @ 2.5kg/m2.

The data presented in Table-2 envisaged that the maximum number of florets per spike 16.00 was counted in the treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) and it was significantly superior over all the treatments. The minimum number of florets per spike (11.02) was observed in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) The superiority of treatment T_{12} for number of florets over the other treatments may be due to the availability of organic and inorganic fertilizers and other essential nutrients for longer period at optimum level resulting in more number of florets per spike. This result is in close agreement with the findings of **Ahmed *et al.* (2004).**

The data presented in Table-2 envisaged that the Treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) had the longest vase (13.13days) in $Al_2(SO_4)_2$ - 200ppm where as the minimum vase life 9.96 days in distilled water was obtained in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK). The maximum vase life in treatment T_{12} may be due to the positive effect of inorganic nitrogen in combination with organic manure Vermicompost on the vase life and also due to more accumulation of carbohydrate which increased the vase life of cut spikes. Similar findings are reported by **Narendra *et al.* (2013)**.

The data presented in Table-3 envisaged that the maximum diameter of corm was noticed in the treatment T_{11} 40x15cm^2 + 75% NPK + 25 % Goat manure) (5.66 cm) whereas the minimum diameter of corm was obtained in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (3.35cm). It may be due to Goat manure and other essential nutrient NPK and proper spacing was regularly available to the plant at critical stage of growth and development of corm which, in turn, resulted in faster and better development of corm. This result is in close agreement with the findings of **Varu *et al.* (1994).**

The data presented in Table-3 envisaged that the maximum weight per corm was recorded in the treatment T_{11} (40x15cm^2 + 75% NPK + 25 % Goat manure) (66.69g.) whereas minimum weight per corm was found in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (32.43g). Similar result was obtained by **Varu *et al.* (1994).**

The data presented in Table-3 envisaged that the no. of spike per plant was recorded maximum in Treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) (1.29) and spike was obtained minimum in Treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (1.00). This result is in close agreement with the findings of **Sud *et al.* (2010)**

The data presented in Table-3 envisaged that the highest no. Of corm was obtained in treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) (1.28) and minimum no. of corm was found in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (1.00). It may be due to higher germination percentage of corm with the application of inorganic fertilizer in combination with Vermicompost

and proper spacing (30x15cm^2). This result is in close agreement with the findings of **Sud *et al.* (2010)**

The data presented in Table-3 envisaged that the highest yield of spike per hectare was obtained in the treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) (2,60,000) and minimum spike yield was recorded in treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (1,11,111) The greater spike yield per hectare might be due to an optimum combination of fertilizers and manures with short spacing. The similar increase in flower yield due to increase in number of sprouts and spike length. Similar findings are reported by **Radhika *et al.* (2010)**

The data presented in Table-3 envisaged that the maximum yield of corms 2,67407corms/ha. recorded in the treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) which was significantly superior over all the treatment .The minimum yield of corms (1,11111) corms/ha was found in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK). Increase in yield with treatment T_8 may be due to assimilation of carbohydrate and protein resulting in better vegetative growth of plant. This probably helped in better tuberization of corm and increase their weight and size. may be due to higher germination percentage of corm with the application of inorganic fertilizer in combination with Vermicompost and proper spacing (30x15cm^2). This result is in close agreement with the findings of **Hassandokht and Kashi (2000).**

The highest benefit cost ratio was found in the treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) (3.50:1) whereas the lowest benefit cost ratio was recorded in the treatment T_1 (30 X 30 cm^2 + 200:200:200 kg NPK) (2.77:1)

On the basis of this research, treatment T_{12} (40x15 cm^2 + NPK 75% + Vermicompost 25%) performed higher in number of leaves per plant, height of the plant (cm),days to spike emergence, length of the spike, number of florets per spikes, vase life of cut spikes (days),days to opening of first florets, longevity of first florets(days).Whereas the earliest 50% sprouting, number of sprouts per mother corm, the yield of corms per hectare, spike yield per hectare, was recorded highest in Treatment T_8 (30 X 15 cm^2 + 75% NPK + 25% Vermicompost) and the treatment T_{11} (40x15cm^2 + 75% NPK + 25 % Goat manure) performed best in Diameter of corms (cm) and Weight of corms (g). These characters may affect significantly due to different combination of spacing and source of fertilizer. However, since this is based on one season experiment, further trials may be needed to substantiate the results.

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Table 1 Combined effect of planting density and organic and inorganic fertilizer on growth characteristics of gladiolus

Treatments	Growth Characteristics				
	Days to 50% sprouting	**Number of sprouts per corm**	**Plant height (cm)**	**Number of leaves per plant**	**Width of the leaf (cm)**
S_1 F_1 (T_1)	**6.46**	**1**	117.66	6.86	**3.05**
S_1 F_2 (T_2)	5.6	1.13	120.8	7.46	3.28
S_1 F_3 (T_3)	6.06	1.16	119.46	7.2	3.42
S_1 F_4 (T_4)	5.53	1.26	119	7.33	3.42
S_2 F_1 (T_5)	5.73	1.33	121.93	8.4	3.42
S_2 F_2 (T_6)	5.46	1.26	118.2	7.4	3.40
S_2 F_3 (T_7)	6.26	**1.43**	123.2	**9.7**	**3.63**
S_2 F_4 (T_8)	**5.33**	**1.46**	119.86	7.86	3.38
S_3 F_1 (T_9)	5.73	1.26	118.11	7.6	3.60
S_3 F_2 (T_{10})	5.8	1.26	120.86	7.73	**3.69**
S_3 F_3 (T_{11})	**5.4**	1.4	119.75	7.46	3.39
S_3 F_4 (T_{12})	5.66	1.26	124.13	**10.4**	3.47

S_1 : 30cm x 30cm, S_2 : 30cm x 15cm, S_3 : 40cm x 15cm, F_1 : 200:200:200 kg/h, F_2 : NPK 75% + FYM 25%, F_3 : NPK 75% + GM 25%, F_4: NPK 75% + VC 25%

Table 2 Combined effect of planting density and organic and inorganic fertilizer on floral characteristics of gladiolus

Treatments	Floral Characteristics						
	Days to Spike initiation	**Opening Of first floret (days)**	**Spike length (cm)**	**Number of florets per spike**	**Longevity of first floret In $Al_2(so_4)_3$ (days)**	**Vase Life of Spikes In $Al_2(so_4)_3$**	**No. of spikes per plant**
S_1 F_1 (T_1)	77.46	94.35	60.81	11.02	4.11	10.66	1
S_1 F_2 (T_2)	70.19	83.73	80.78	11.87	4.86	11.66	1.15
S_1 F_3 (T_3)	75.39	84.66	64.83	11.57	4.45	11	1.11
S_1 F_4 (T_4)	72.3	85.24	72.75	14.45	4.90	11.33	1.07
S_2 F_1 (T_5)	65.57	89.24	65.83	13.07	4.53	12	1.00
S_2 F_2 (T_6)	72.53	89.34	99.35	12.27	4.49	12	1.15
S_2 F_3 (T_7)	77.30	90.01	100.39	13.34	5.44	13	1.17
S_2 F_4 (T_8)	67.44	88.12	87.32	14.35	5.21	12	1.29
S_3 F_1 (T_9)	76.35	89.66	87.40	12.44	4.86	12.33	1.01
S_3 F_2 (T_{10})	67.39	80.77	67.09	12.01	5.13	12	1.03
S_3 F_3 (T_{11})	65.43	88.59	86.63	12.07	4.68	11.66	1.15
S_3 F_4 (T_{12})	64.40	80.33	101.34	16	5.74	13.13	1.08

S_1 : 30cm x 30cm, S_2 : 30cm x 15cm, S_3 : 40cm x 15cm, F_1 : 200:200:200 kg/h, F_2 : NPK 75% + FYM 25%, F_3 : NPK 75% + GM 25%, F_4: NPK 75% + VC 25%

Table 3 Combined effect of planting density and organic and inorganic fertilizer on yield characteristics of gladiolus

Treatments	YieldCharacteristics					
	Diameter of corm (cm)	**Weight of Corms (g)**	**No. of Spike per plant**	**Number of Corms per plant**	**Spike yield per hectare ('000 Hectare)**	**Corm yield per hectare**
S_1 F_1 (T_1)	3.35	32.43	1	1.01	111.111	111111
S_1 F_2 (T_2)	4.87	54.17	1.15	1.06	128.148	211481
S_1 F_3 (T_3)	5.40	58.03	1.11	1.15	124.074	139629
S_1 F_4 (T_4)	5.41	60.63	1.07	1.07	120.37	124074
S_2 F_1 (T_5)	4.38	50.19	1.00	1.00	223.703	223703
S_2 F_2 (T_6)	4.55	56.98	1.15	1.15	240	232592
S_2 F_3 (T_7)	5.59	63.55	1.17	1.17	255.555	255555
S_2 F_4 (T_8)	3.54	42.98	1.29	1.28	260.000	267407
S_3 F_1 (T_9)	4.54	53.68	1.01	1	168.333	168333
S_3 F_2 (T_{10})	3.85	38.92	1.03	1.15	172.777	177777
S_3 F_3 (T_{11})	5.65	66.69	1.15	1.11	191.666	191666
S_3 F_4 (T_{12})	4.51	52.70	1.08	1.07	239.999	213333

S_1 : 30cm x 30cm, S_2 : 30cm x 15cm, S_3 : 40cm x 15cm, F_1 : 200:200:200 kg/h, F_2 : NPK 75% + FYM 25%, F_3 : NPK 75% + GM 25%, F_4: NPK 75% + VC 25%

Conservation needs of some rare and endangered plant species of Indravati National Park, Bijapur district, Chhattisgarh

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Abstract: Plants are the nature's greatest gift to mankind and essential for the existence of all life forms. Plant biodiversity is a vital support system for fulfilling the day-to-day needs of humans and animals. However, overexploitation of some plant varieties for food and medicinal purpose or either way destruction of habitat of plants for industrial purpose, due to animal activities results in existential threat for the plant species. Indravati National Park located in the Bijapur district of Chhattisgarh state is home for wide number of plant species some of which fall under the category of rare, endangered and vulnerable plant species. The present study was conducted for the survey and identification of endangered plants species and the conservation strategies needed towards conserving them. Plant species including *Argyreia nervosa; Anacyclus pyrethrum; Bryonia laciniosa; Abrus precatorius*; *Chlorophytum arunadinaceum; Hemidesmus indicus; Plumbago zeylanica; Solanum surattense; Strychnos nux vomica; Tribulus terrestris* were identified in the study.

Keywords: Plant Biodiversity; overexploitation; Indravati; endangered; conservation strategies.

1. Introduction

Medicinal plants have a pivotal role in fulfilling the primary healthcare needs of nearly seventy percent of the population throughout the world (Akshay *et al*., 2014; Gowthami *et al*., 2021). India showcases rich plant biodiversity with around 8000 medicinally important plant species, according to a survey conducted by government of India, around 65% of the population depends on the traditional plant resources to fulfil their healthcare requirements (Akshay *et al*., 2014; Chen *et al*., 2016). Also, to complete the ever-rising demand of ayurvedic and unani medicines the raw materials i.e. the medicinal plants are procured from the forests (Gundu and Adia, 2014). These circumstances result in the overexploitation of the forest land, disturbs natural habitat of the plants and also push the medicinally important plants on the verge of extinction (Heywood, 2019). Thus, conservation strategies including *in situ* and *ex situ* conservation techniques, resource management and biotechnological practises are emphasized for the improvement of the status of the medicinal plant species.

Indravati National Park observed in the Bijapur district, Chhattisgarh, India is covered with moist deciduous forest area and is home for a number of plant varieties. In the present study, the Indravati National Park was selected as the study site for the survey and identification of some rare and endangered medicinally important plant species.

Materials and Methods

3.1 Survey and collection of plant samples from Indravati National Park

Indravati National Park established in the year 1975 is situated at the banks of the river Indravati located in Bijapur district, Chhattisgarh, India. It is one of the most famous tiger reserves of the country. The vegetation of park comprises of tropical moist deciduous forests and covered by hills of Kutru, Kandlapatru and Matti Murka. The study site was selected for the survey and collection of the plant samples with the help of local inhabitants.

3.1.1 Identification of collected medicinal plants

The identification of the collected medicinal plants was performed using questionnaire method through group discussions, personal interviews and structured interviews of the local Vaidya, tribals and the natives of the area. The identification of the medicinal plants was mostly done on the sampling site. Further identification of the plant samples was performed using the online and offline available resources.

3.2 Conservation strategies for conserving the medicinal plants

For the conservation of plant species ex-situ conservation strategy was applied for which potting method was used; for the study the plants were carefully collected from the forest area potted in home garden which consisted of equal proportions of soil and vermi-compost. The observations of the growth of the plant was performed at regular intervals.

Results and Discussion

In the present study, plant survey, collection and identification of rare and endangered medicinal plants was conducted in the Indravati national park during the study period of June 2021 to June 20222. During the plant survey and collection the following plants were identified under rare, endangered and threatened category that included: *Argyreia nervosa; Anacyclus pyrethrum; Bryonia laciniosa; Abrus precatorius*; *Chlorophytum arunadinaceum; Hemidesmus indicus; Plumbago zeylanica; Solanum surattense; Strychnos nux vomica* and *Tribulus terrestris*. The brief description of the plant species along with their medicinal uses is as explained below-

1. **Botanical name:** *Argyreia nervosa;* **Common name:** Jinti; Vajradanti
   Family: Acanthaceae; **Status:** Endangered
   Medicinal uses: Roots mixed with goat milk are given for rheumatic problems; decoction of roots is also used for whooping cough. Juice of the leaves is used for toothache. Ash of the plant mixed with honey is used for bronchitis.
2. **Botanical name:** *Anacyclus* pyrethrum; **Common name:** Kalpanath; Kalpa; Mahatikta
   Family: Acanthaceae; **Status:** Vulnerable
   Medicinal uses: Extract prepared from leaves is used for fever, colic pain and diarrhea; Decoction of the aerial parts of the plant is used for cold, hypertension, malaria and snakebite; Powder of herb mixed with oil is applied for curing eczema; Paste of herb mixed with turmeric is applied on infected wounds.

3. **Botanical name:** *Bryonia laciniosa*; **Common name:** Shivalingi; Shiva mallika
   Family: Cucurbitaceae; **Status:** Endangered
   Medicinal uses: Seeds mixed with jaggery are given for conception; Tincture of roots is given for menstrual problems; Plant decoction is used externally for wounds; Leaves juice mixed with honey is used for stomachache, cough and cold; Leaves fried in coconut oil are given for asthma.
4. **Botanical name:** *Abrus precatorius*; **Common name:** Gunja; Rati
   Family: Fabaceae; **Status:** Threatened
   Medicinal Uses: Decoction prepared using the dried root is used for hepatitis and bronchitis; Powdered seeds are used as oral contraceptive by tribals; Extract prepared using fresh root is used as anti-malarial; Leaves are used for fever, cough and cold.
5. **Botanical Name:** *Chlorophytum arunadinaceum;* **Common Name:** Dhawal Muesli,
   Family: Liliaceae; **Status:** Endangered
   Medicinal Uses: Powder of the roots is given for rheumatic arthritis and joint pain; Roots of the plant are also given for increasing lactation and improving health in females; The roots of the plant are known as "Divya aushadhi" and used as immunity booster, for diabetes, increasing sperm count, prenatal and post-natal care.
6. **Botanical name:** *Hemidesmus indicus*; **Common name:** Anantmul; Magrabu
   Family: Ascelpiadaceae; **Status:** Rare endangered
   Medicinal uses: Decoction of roots is used in skin infections like itching, eczema. Decoction of the roots is used for fever, diabetes and urinary tract infections.
7. **Botanical name:** *Plumbago zeylanica*; **Common name:** Chitra; Agni
   Family: Plumbaginaceae; **Status:** Endangered
   Medicinal uses: Roots boiled in milk are used for throat, chest and mouth inflammation; Powdered roots and bark is used for syphilis and tuberculosis; plant extract is used for curing malaria.
8. **Botanical name:** *Solanum surattense*; **Common name:** Kantakari; Katari
   Family: Solanaceae; **Status:** threatened
   Medicinal uses: extract prepared from the matured fruits is used for diabetes; Paste prepared from plant roots is used for hernia; similarly poultice of roots is used for piles. Powdered seeds mixed with mustard oil is used for tooth ache and denta carries.
9. **Botanical name:** *Strychnos nux vomica*; **Common name:** Kucchla; Vishmushti
   Family: Loganiaceae; **Status:** Rare endangered
   Medicinal uses: Poultice prepared from the leaves is used for chronic wounds; pulp of the fruit is used for parasitic infections; decoction of root bark is used for fever and cholera.
10. **Botanical name:** *Tribulus terrestris*; **Common name:** Gokhru; Gokshur
    Family: Zygophyllaceae; **Status:** Threatened

Medicinal uses: Dried fruit powder is used for genitourinary problems; Decoction of fruit is used for diarrhoea and eye problems. Juice of aerial parts is used as antiflatulent. The medicinal plants collected during the study were further conserved using the potting method. The obtained plant samplings were potted in the botanical garden of department of lifesciences, CV Raman

University, Bilaspur. The observations for the growth of the samplings was done at periodic intervals.

Kumar *et al*. (2011) performed a study on the endangered medicinal plant diversity of Ladakh region and explored the current status of the need of conservation of medicinal plants in the region. Asmat *et al.* (2021) studied the floral diversity of Chitra Gol National park and observed 37 medicinal plants belonging to 24 families and studied the conservation status of the plants. Similarly, Kumar *et al*. (2022) reported the conservation study of Sechu Tuan Mula wildlife sanctuary and explored 37 plant species belonging to endangered and vulnerable category. The results obtained during the present study also enlist the status of medicinal plants in the Indravati National Park area and the need for the conservation of the medicinally important plant species.

Conclusion

With the emergence of industrialization and the rapid growth in population several important medicinal plant species have suffered loss of habitat and overexploitation due to the increasing demand of pharmaceutical drug. The present study, highlights the importance of identification and conservation of medicinally important plants in their natural habitat.

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Interplay of Environment, Sustainable Development, and State Economy: Case Studies from Chhattisgarh

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Abstract

Chhattisgarh, a state located in central India, presents a compelling landscape for examining the intricate relationship between environmental conservation, sustainable development, and economic growth. This paper explores a series of case studies from Chhattisgarh that highlight both challenges and innovative solutions in balancing these often-competing interests. From sustainable forestry practices to community-led conservation initiatives, waste management, tribal handicrafts promotion, eco-tourism, and the Swachh Bharat Abhiyan in Ambikapur, these cases shed light on the complex interplay between environmental protection, socio-economic development, and the pursuit of a greener, more resilient future for the state.

Keywords: Chhattisgarh, environment, sustainable development, economy, case studies, Swachh Bharat Abhiyan, Ambikapur

Introduction

Chhattisgarh, formed in the early 21st century, has emerged as a state with abundant natural resources, a vibrant cultural heritage, and a growing industrial base. However, this development has not come without its challenges, particularly in the realms of environmental conservation and sustainable growth. In recent years, the state has witnessed a surge in initiatives aimed at reconciling the need for economic progress with the imperative of preserving its rich biodiversity and ensuring the well-being of its communities.

This paper delves into selected case studies that encapsulate the diverse efforts undertaken in Chhattisgarh to foster sustainable development while safeguarding its environment. Through these cases, we aim to analyze the strategies, successes, and lessons learned, offering insights into the complex dynamics at play in this region.

1. Case Study: Bastar's Community Forest Management

- **Background:** Bastar, a district in southern Chhattisgarh, is renowned for its lush forests and diverse tribal communities. The region faced challenges of deforestation due to logging, mining, and shifting agricultural practices.
- **Initiative:** In response, a community-led initiative was launched to promote sustainable forest management. Local tribal communities were empowered to participate in decision-making regarding forest resources. The initiative involved training in agroforestry, promoting non-timber forest products (NTFPs), and establishing community forest rights under the Forest Rights Act (2006).

Outcomes:

- Reduced deforestation rates and forest degradation.
- Increased income for tribal households through sustainable harvesting of NTFPs.
- Strengthened social cohesion and empowerment among local communities.
- Improved biodiversity conservation and watershed management.

The case study of Bastar's Community Forest Management highlights the positive impacts of community participation in sustainable resource management (Bhatia & Patil, 2018).

2. Case Study: Raipur's Waste-to-Energy Plant

- **Background:** Raipur, the capital of Chhattisgarh, faced mounting challenges in waste management with rapid urbanization. Landfills were reaching capacity, posing risks to public health and the environment.
- **Initiative:** To address this, the city established a state-of-the-art waste-to-energy plant, capable of processing a significant portion of the city's municipal solid waste. The plant utilized advanced technologies to convert organic waste into biogas and organic compost, reducing landfill dependence.

Outcomes:

- Mitigation of greenhouse gas emissions from landfilling.
- Generation of renewable energy through biogas.
- Production of organic compost for agricultural use, promoting sustainable farming practices.
- Creation of employment opportunities in waste management and renewable energy sectors.

The case study of Raipur's Waste-to-Energy Plant demonstrates the potential of technological solutions in addressing urban waste challenges (Sarkar & Mishra, 2020).

3. Case Study: Kondagaon's Tribal Handicrafts Promotion

- **Background:** Kondagaon, known for its rich tribal art and craft traditions, faced challenges of market access and preserving cultural heritage.
- **Initiative:** A government-supported initiative was launched to promote tribal handicrafts on national and international platforms. This included setting up marketing cooperatives, providing design and skill development training, and facilitating e-commerce platforms.

Outcomes:

- Increased income and livelihood opportunities for tribal artisans.
- Preservation and promotion of indigenous art forms and cultural heritage.
- Enhanced market linkages, leading to higher returns for artisans.
- Boost to tourism through cultural showcases and craft fairs.

The case study of Kondagaon's Tribal Handicrafts Promotion underscores the role of cultural preservation in sustainable economic development (Sharma, 2019).

4. Case Study: Bilaspur's Eco-Tourism and Wildlife Conservation

- **Background:** Bilaspur, situated in eastern Chhattisgarh, boasts diverse wildlife and natural landscapes. However, unchecked tourism activities were threatening fragile ecosystems.
- **Initiative:** An eco-tourism initiative was launched in collaboration with local communities and wildlife conservation organizations. This involved developing sustainable tourism practices, creating nature trails, and establishing community-managed guesthouses.

Outcomes:

- Diversification of local economies through tourism revenue.
- Conservation of endangered species and habitats.
- Increased environmental awareness among tourists and locals.
- Empowerment of indigenous communities as stewards of their natural heritage.

The case study of Bilaspur's Eco-Tourism and Wildlife Conservation highlights the importance of community engagement in conservation efforts (Singh & Sahu, 2021).

5. Case Study: Swachh Bharat Abhiyan in Ambikapur

- **Background:** Ambikapur, a city in northern Chhattisgarh, faced significant challenges in solid waste management, leading to environmental degradation and public health concerns.
- **Initiative:** In response, Ambikapur embraced the Swachh Bharat Abhiyan (Clean India Mission), a nationwide campaign aimed at promoting cleanliness, sanitation, and proper waste management. Ambikapur implemented innovative initiatives such as door-to-door waste collection, segregation at source, and the establishment of material recovery facilities.

Outcomes:

- Drastic reduction in open dumping of waste and littering.
- Improved sanitation and hygiene practices, leading to public health benefits.
- Creation of employment opportunities in waste management and recycling sectors.
- Recognition as one of the cleanest cities in India, enhancing tourism and local pride.

The case study of Swachh Bharat Abhiyan in Ambikapur showcases the transformative impact of community-led cleanliness and waste management initiatives (Government of India, 2020).

Conclusion

The case studies from Chhattisgarh illustrate the multifaceted approaches adopted to foster sustainable development while preserving the environment and promoting economic growth. These initiatives demonstrate the importance of community participation, technological innovation, and policy support in achieving a harmonious balance between conservation and development goals.

As Chhattisgarh continues on its path of progress, these lessons can serve as valuable guiding principles for policymakers, businesses, and communities alike. By embracing sustainability as a core tenet of growth, the state can pave the way for a greener, more prosperous future for generations to come.

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Review of Microwave Propagation in Adverse Atmospheric Condition

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Abstract: The descriptive term microwave is used to describe electromagnetic waves with wavelengths ranging from 1 cm to 1 m and a frequency range is 300 MHz to 300 GHz for 1 cm wavelength. Electromagnetic waves with wavelengths ranging from 1 mm to 10 mm are called millimeter waves. Satellite telecommunication today presents one of the most remarkable opportunities as it enables us to communicate and virtually reach any corner of the world. Great discoveries and developments in this field have enabled us to improve our quality of life. However even as we benefit from this progress, many challenges are encountered as satellite service providers. The propagation of electromagnetic waves in millimeter bands is severely affected by rain, snow, and dust particles in terms of attenuation and depolarization. Nowadays microwave or millimeter waves are being used in various diverse applications such as radars, telecontrol, radio beacons, satellite communication, terrestrial communication links, etc. The uses of radars in many forms such as missile guidance radar, weather-detecting radar, missile-detecting radar, etc. The radars are also used for detecting raindrops hailstone, the formation of rain and snow, thunderstorms, tornadoes, and hurricanes. It may be mentioned that the strong revival of research and development in the millimeter wave region during the past several years is attributed to the urgent need for new technology and the inherent superiority of millimeter wave systems over optical, microwave, and infrared systems, for precipitations of smokes, dust clouds, fog, haze, and other adverse atmospheric condition. It may be noted that the atmospheric propagation effects dominate the design consideration related to microwave and millimeter wave systems. In addition to this rain, cloud, fog, hail, etc. may cause significant signal attenuation and backscatter. Because of the typical interactions of electromagnetic energy with various atmospheric constituents, a thorough understanding of the topic is necessary to access the capabilities and limitations of the microwave and millimeter wave system. In the present endeavor, the motivation is to investigate specifically the propagation characteristics of microwave and millimeter wave energy in adverse atmospheric conditions under sand and dust storms.

KEYWORDS

Attenuation, Dielectric constant, Visibility, and Angle of incidence.

INTRODUCTION

The propagation of electromagnetic waves in millimeter bands is severely affected by rain, snow, and dust particles in terms of attenuation and depolarization. There is a growing interest in the effect of dust particles on the propagation of microwaves. Sand and dust storms occur in many parts of the world, especially in the Middle East arid parts of Asia, as well as in of Southwest USA, in the dry states such as Texas and Arizona, Sudan. Much attention has recently been devoted to the influence of sand and dust storms (SDS) on the performance of microwave communication systems. The particle size distribution of the samples is determined by using measurement techniques such as hydrometer, pipette, sedimentation balance, optical microscope and coulter. An electromagnetic wave in earth's atmosphere depends on the wavelength of signal radiation and the nature of the medium being traversed into the atmosphere is affected by the scattering and absorption of sand and dust particles at frequencies above 10 GHz. The millimeter wave bands are in the short wavelength more attenuation will be induced by absorption and scattering due to raindrops dust and sand particles in the radio path. The attenuation and phase shift constant for microwave medium with dust and sand particles depends on the frequency, visibility, maximum particle size, complex permittivity, shape of the scattering particles, concentration and orientation relative to the wave polarization and moisture content of the particles and elevation angle. Bagnold has determined particle size distributions of sand by sifting. it has been found that radii of sand particles are never less than 0.04 mm and that more usual values, depending on location, lie in the range 0.08-0.15 mm. Bagnold also determined that the size of particle which would be set into motion by the wind velocity of 5 m/s at sand storm height of 1mm was 0.1mm radius. thus the particles that rise higher than for a pure sand storms would have a radius less than 0.1mm dielectric constant measurements were only available to 10 GHz. Ahmed and Auchterlonie made measurements at 10 GHz and this, together with standard reference texts on dielectrics, e.g. Von Hippel's MIT work, was the main source of information. However, in recent years-remote sensing of soil moisture using radio–meters in the microwave and millimeter wave range has yielded as a useful by-product the dielectric constants required. A survey of the journals of geophysical research has revealed data for various soil types and moisture contents up to 37GHz From these works two important conclusions emerge.

- There is little change in both the real and imaginary components of the dielectric for dry soils as frequency and the soil type is varied.
- When moisture is present, the dielectric constant is frequency dependent and the real and imaginary components vary differently.

Njoku and Kong show the variation of complex dielectric constant with frequency and moisture content for sandy soil. The dry sand case shows that the components of the dielectric constant vary negligibly over the 0.3-24GHz range. However, the change is quite marked as the moisture content increases. The real part remains constant at 10 GHz and then decreases, whereas the imaginary part decreases to a minimum at 0.8 GHz and then increases by several orders of magnitude.

REVIEW OF LITERATURE

Foundation for Microwave Engineering by Robert E. Colline, In this book we collect data on microwave frequency ranges. Fundamentals of Microwave and RF Design by Michael Steer, Third edition, With the help of this book we can understand, an introduction to microwave engineering. (1) RF and microwave engineering (a) electromagnetic fields (b) Static field laws (c) Maxwell's equations. The initial study of electromagnetic was predicted by **James Clerk Maxwell** in 1864[1]. He gave a theory on the generation of electromagnetic disturbance comprising time-varying electric and magnetic fields. This radiation is known as electromagnetic radiation. In 1885 **Heaviside** [1] published an analysis of the propagation of microwaves in cable wires. He also gave telegraph equations.

In 1888 **Hertz** discovered **Hertz** oscillator for the production of electromagnetic waves [1]. In 1896 G. Marconi used electromagnetic waves in communication systems as RADAR. In 1931 microwave devices developed called by vacuum tubes. In 1945 the study of the location of satellites concerning earth was given by Arthur C. Clarke [2]. In 1946 Robert Pike and Robert Benninger [1]used microwaves in astronomical context. In 1960 with the development of image processing satellite remote sensing came into existence. The discovery of optical and microwave remote sensing provides various data for civil, research, military, and satellite communication purposes it also helps in studies of the terrestrial environment. In 1955 J. A .Streton [43] gave electromagnetic theory in order to find the attenuation behavior during dust and storm conditions. He suggested that dust particles are considered dielectric spheres the concept of energy over the surface of a sphere. He gives field equations for dust particles in terms of electric and magnetic fields. In 1960 Chandrashekar [3-5] developed radioactive transfer theory. According to this theory, energy is transferred in the form of electromagnetic radiation. The propagation of radiative transfer through medium is affected by absorption, emission, and scattering process. In 1962 R.E. Collin [26] discussed about attenuation caused during dust storm condition in Antenna and Radio wave propagation journal. He shows when signal passes through dust particles causes two phenomena –(1) Absorption (2) Scattering.

In 1968 first time microwave radiometer was used in remote Sensing. The microwave remote sensing is called NEMS used first time for imaging photographs of extra terrestrial object and environment change. In the same year optical remote sensor discovered called NOAA [20-23]. In 1972 active and passive remote sensor s was developed[12]. In 1976 I.Y. Ahmad [52] discussed about microwave propagation through sand and dust storms condition. In1978 Choudhary et al. [63] discussed about surface roughness and types of surface i.e. place medium and rough. They show that rough surface cause more scattering than plane medium. In 1979 T.S. Chu [50] reported about dielectric constant for sandy medium with Von Hipple method. In 1978 Wang et. al. discussed about backscattering of signals due to snow, ice. He also discussed about surface roughness. Wang et al. using optical measurement technique and discussed about microwave brightness [74]. In 1981 H.M.Altshuler [75] measured the dielectric constant for sand, siltclay particles by X- band microwave bench and his method is called by infinite sample method with 4-10 GHz frequency.

In 1981 L.P. Bayvel and A.R. Jones gave concept of pointing vector [25]. He used determine the flow of energy if there is electric and magnetic fields acts perpendicular to each other. In 1982 Ansari discussed about microwave propagation during sand and dust storm condition [35]. In 1982 Ulaby [62] gave a relation between reflectivity of signal due to horizontal and Vertical direction and dielectric constant and angle of incident. In 1985 L.Tsang[58] gave integral equation model for finding scattering coefficient through microwave propagation . In 1987 S.I. Ghobrial et al. [59] suggested the total no. of particle of per unit volume is defined as visibility. The visibility is taken for spheroid and non spheroid particles. In 1994 B.R.vishwakarma and C.S. Rai [27] discussed about transmission line model . In 1996 C.S Rai et al [47] introduces differential cross section, scattering cross section, absorption cross section in terms of angular dispersion of out going signal. In 1997 a joint mission of national Aeronautical space Administration [NASA] and National space development Agency of Japan [NASDA] launched tropical rainfall measurement mission [TRMM]. TRMM microwave imager .The TRMM data provides scattering index, Brightness temperature, precipitation over land and ocean portion.

In 2000 S.K. shrivastava , B.R. Vishwakarma and R.K. saxena discussed about loss evaluation in transmission line model and absorption loss in terms of impedance[39].In 2002 A.K.verma et al [8] discussed about rain rate ocean from IRS- P4 , MSMR compared with other data like TRMM, PR and rain gauge.In 2002 ,2003 S.K. shrivastava et al.[40] discussed about microwave and millimeter wave propagation during dust storm condition find out the variation of attenuation coefficient with respect to frequency, visibility, angle of incident and particle radii. In 2003 S.K. shrivastava et al [40] discussed about transmission line model for loss evaluation in sand and dust storm condition. They also discussed about reflection and transmission coefficient and absorption loss by variation with frequency, visibility, angle of incident and cross polarization. In 2006 C. Kummerow et al [10] discussed rain rate scattering index, over ocean and land portion. In 2006 S.K. srivastava et al.[31] discussed about loss evaluation during dust storm through microwave/ millimeter wave propagation . In 2006 C.Kummerow et al. [8]discussed rain rate scattering index, over ocean, and land portion.

A.J. Ansari et al in 1982 discuss about microwave propagation in sand and dust storms. The theory of microwave propagation in the troposphere has received much attention in the literature owing to the importance of radio relay an satellite communication system. In temperate climates it is bulk refractive index changes producing attenuation and depolarization of the microwaves, that has dominated propagation studies.

S A .A .Abdulla et al in 1988 discuss about the particle size distribution of Iraqi sand and dust storms and their influence on microwave communication systems. Several windblown and dustfall samples were collected in the spring , summer and autumn of 1984 at a height of 20m above the ground surface during severe sand and dust storms over the city of Baghdad ,Iraq. The mode of the number distribution was found to occur at around 2 and 3.5 micrometer for the blowing and falling dust sample, respectively. A computer program was developed to describe the measured distribution by some analytical functions. It was found that the cumulative distributions can be well described by a third degree polynomial and log normal functions for particle diameters ranging from 1 to 100 micrometers.

E.M.Abuhdima et al in 2010 discuss about effect of sand and dust storms on microwave propagation singles in southern Libya .Libya has a large area and it is counted as a country having desertification climate. Wireless communication networks and microwaves system has been installed in the southern part of Libya, where there are dust and sand storms that may affect the microwave single propagation. When microwave and millimeter wave pass through a medium containing precipitations like sand and dust particles , get attenuated through absorption and scattering of energy out of beam by the sand and dust particles. Libya is considered as desertification country, in the last few years many problems in wireless communication networks have been recorded in windy and sandy days in the southern part of Libya, no scientific reason has been given for this problem.

Kamal harb et al in 2013 discuss about systems adaptation for satellite signal under dust and sand and gaseous attenuations .Sand , dust ,gaseous and other atmospheric adverse have a distorting effect on signal fidelity of Ku and Ka bands. Propagation impairments due to atmospheric attenuations can cause uncontrolled variations in signal level , phase, polarization, and angle of arrival. Dust and sand attenuation are considered a dominant impairment for satellite signals in the desert area. Thus quality of service (QoS) in satellite networks are severely affected while facing these kinds of atmospheric conditions. The atmospheric characteristics are important factors for system reliability and QoS provisioning in satellite networks .International Telecommunication Union Radio Communications (ITU-R) maintains a database for atmospheric characteristics around the world that is used to estimate weather attenuations and other parameters. This attenuation is based on the concept of deriving the effective length of path through different weather conditions.

K. H. et al in 2014 discuss about sand and dust storms impact on LEO satellite microwave radio links . Scientific findings have lately revealed that atmospheric dust and sand blowing off vast central African deserts and the middle East to the basin of the Amazon compensates for poor rainforest soils. As the dust and sand plumes nourishes the ecological systems of the world, they concomitantly pose a big threat to wireless communication system, both terrestrial and satellite , by hampering them through degradation of the microwaves .In this paper author present three dimensional relationship of average dust particles size variation with respect to different reference visibilities and heights .It provides a great level of control thus providing dependable and acceptable estimates of dust attenuations any desired location for non-uniform visibilities, particle size distribution ,various frequency ranges, relative humidity values, and for any selected propagation angle. The permittivity of materials at microwave band is represents the real part and imaginary part of the dielectric constant. A summary of the complex dielectric constants ,there is little variation in both real and imaginary parts for the dry soil types as they are dependent on moisture and frequency of operation. In humid weather conditions dust particles in air will absorb water vapor. Measurements done by in Khartoum, showed that with 82% relative humidity in air ,the dust will absorb up to 5.1% by weight moisture.

Elfatih A .A .Elsheikh et al ,in 2015 discuss about preliminary analysis of dust storm effects on microwave links measured in Khartoum .A field on dust storm effect on microwave links in arid area covering a wide range of radio frequency was conducted for seven months in Khartoum,

Sudan. This study is involves computerized monitoring of transmitted and received signal levels of (TRSL) of six microwave links operating at Ku (14GHz) and Ka(21GHz) bands as well as an automatic weather station. The cumulative distribution of measured attenuation due to dusts are analysed based on effect of frequencies and effect of path lengths. The analysis is done higher the frequency, the stronger the impact of the atmosphere on the radio wave propagation. Qun-feng dong et al in 2017 discuss about weathering sand and dust storms. Microwave propagation characteristics in earth satellite links during sand and dust storms are sensitive to the shape of particles, the height of such storms, and the elevation angle. In this article, the formulas of total attenuation and phase shift in earth satellite links for spherical sand and dust particles are developed in terms of visibility, frequency, elevation angle, and height. In an Earth satellite link, dust concentration changes with the height of the dust storms. Based on this, microwave attenuation and cross-polarization in earth satellite links induced by dust storms were studied by a few investigators to determine the effects of different shapes of particles.

MATERIAL AND METHOD

In this review some theoretical models for the exact calculation of microwave signal parameters under adverse atmospheric conditions.

Radiative Transfer Model (RTM) – Radiative transfer model (RTM) for loss evaluation in microwave communication link under different atmospheric condition .In this proposed work to evaluate the scattering ,absorption and extinction coefficients of sand and dust storms ,heavy rain ,snow, fog using radiative transfer model . The measurement can be made in terms of vertical and horizontal polarization. Geometry of particles is taken as spheroid as well as non –spheroid particles in shape. Radiative transfer theory is knows as transport theory. The radiation transport is an important process to transport energy and momentum. The term radiative transfer refers to the physical phenomena of energy transfer in the form of electro- magnetic radiation. The propagation of radiation through a medium is affected by absorption, emission, and scattering process.

Transmission Line Model- Transmission line model for loss evaluation under different atmospheric conditions. In the present work to evaluate the reflection coefficient, transmission coefficient, and absorption loss by utilizing the transmission line concept, during dust and storm conditions. The presence of dust constituents on the atmosphere affect the microwave and millimeter wave propagation both in phase and amplitude. These particle cause adverse effect on microwave propagation. Reflection coefficient, transmission coefficient and absorption loss are calculated using impedance concept as function of frequency and visibility and angle of incidence. For calculating the various propagation parameters two cases have been taken namely (1) normal incidence (2) oblique incidence.

Microwave Emission model :- In this theoretical model called microwave Emission model to find out Emission coefficient of microwave signals ,under dust , storm condition for horizontal and vertical polarization .The dust particles contain sand ,silt and clay particles. When the microwave signal wave passes through the earth surface it is affected doth in phase and amplitude, this may

cause large attenuation due to reflection and transmission of the signal . Emission coefficient is the very important parameter which provides information about soil surface.

Laboratory evaluation of the scattering coefficient of dust particles:-

With the help of an experiment set up for measurement of the complex dielectric constant of sand and dust particle.

RESULT AND DISCUSSION

1. Maxwell developed the theory on the generation of electromagnetic distribution comprising time-varying electric and magnetic fields.
2. Stratton gives the electromagnetic theory to find the attenuation behavior during sand and dust conditions.
3. B.R. Vishwakarma give the basic idea of the transmission line model and he introduces a differential cross-section, scattering cross-section.
4. S.K. Shrivastav developed the modified Transmission line theory, for evaluation of signals under dust storm conditions.
5. During the passage of millimeter wave through the medium containing sand and dust particles the wave will be attenuated as scattering and absorption. With the help of visibility we can determines the microwave of propagation medium is dusty or not. In the microwave propagation through sand, dust storm the power loss depends on frequency and visibility (S.C. Rai e f. al. 1994) At high visibility the particle concentration is low.
6. During this review the theoretical base information for preparing the data link of satellite design in adverse atmospheric condition such as sand and dust storm, rain, snow, fog and dense forest.
7. Theoretical formula which will be derived for calculation of attenuation, phase shift and cross polarization.
8. Experimental setup which will be made to measure the dielectric constant of dust constituent at high frequency.

CONCLUSION

In this review, the sample data of dielectric constant will be useful for preparation of satellite data link which is useful in microwave remote sensing. In the present days, satellite telecommunications is the most remarkable opportunity as they enable us to communicate and virtually reach any corner of the world. With the help of discoveries, research and developments in this field have enabled us to improve our quality of life. The effect of dust storms on propagation is studied by measuring the storm's parameters such as visibility and induced attenuation due to these storms. The preliminary result shows that the higher frequency is more affected by dust storms than the lower. Now a day's microwaves or millimeter waves are being a used in, various diverse applications such as radars, telecontrol, radio beacons satellite communication and terrestrial communication links.

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Sustainable Agricultural Development in Chhattisgarh: Issues & Challenges

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Abstract

Sustainable agricultural development in Chhattisgarh, like many other regions in India, faces significant challenges due to a myriad of issues such as climate change, soil degradation, water scarcity, and socio-economic disparities. This research paper aims to comprehensively analyze these challenges and proposes strategies for promoting sustainable agricultural practices in the state. By employing a multidisciplinary approach, this study investigates the intricate interplay of environmental, economic, and social factors affecting agriculture in Chhattisgarh. The research identifies innovative solutions and policy recommendations to address the pressing issues hindering the sustainable development of agriculture, ensuring food security, and improving the livelihoods of farmers in the region.

Key Words: Sustainable Development, Agriculture, Climate Change, Issues and Challenges.

Introduction

Chhattisgarh is a predominantly agrarian state, with agriculture accounting for a significant portion of its economy and employment. Over 70% of the state's population is engaged in agriculture. There are about 37.46 lakh farmers in the state, of which around 80% are small and marginal. Horticulture and animal husbandry also engage a sizeable share of the total population of the state. Agriculture in Chhattisgarh contributes around 25% of the state's GDP. The state has a total cultivated area of 4.78 million hectares, which is about 35% of its total geographical area. The net irrigated area is 23% of the cultivated area, with red and yellow soil being the predominant soil types. The major crops grown in Chhattisgarh are rice, wheat, millets, pulses, and oilseeds. Rice is the staple crop of the state and is grown on over 70% of the cultivated area. Wheat is grown as a rabi crop on about 20% of the cultivated area. Millets, pulses, and oilseeds are also important crops, and are grown on smaller areas. Agriculture in Chhattisgarh is facing a number of challenges, including climate change, water scarcity, and soil degradation. However, the state government is taking steps to address these challenges and to promote sustainable

Agriculture (*Chhattisgarh – Natural Farming*,).

Agriculture forms the backbone of Chhattisgarh's economy, providing livelihoods to a significant portion of its population. The state's agricultural sector, however, faces various challenges that hinder its sustainable development. Issues such as climate change, soil degradation, water scarcity, and socio-economic disparities have raised concerns about the future of agriculture in the region. This research aims to delve into these challenges, analyze their complexities, and propose viable strategies for promoting sustainable agricultural practices in Chhattisgarh.

Objectives of the Study:

1. To identify and analyze the key challenges faced by the agricultural sector in Chhattisgarh, including climate change impacts, soil degradation, water scarcity, and socio-economic disparities.
2. To explore and evaluate existing sustainable agricultural practices and policies in Chhattisgarh.
3. To propose effective strategies and solutions for promoting sustainable agriculture in Chhattisgarh, considering the socio-economic and environmental aspects.

Sustainable Agriculture Development:

The FAO definition of sustainable agricultural development is "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development... conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable."(*Document CL 94/6 94th Session of the FAO Council ,1988*).

Sustainable agriculture development is an approach to farming that aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. It involves practices that are environmentally friendly, economically viable, and socially responsible. Sustainable agriculture seeks to maximize the efficiency of resource use, minimize environmental impact, and promote resilience in the face of changing conditions. Here are key principles and practices associated with sustainable agriculture development:

1. **Soil Health Management:**

- **Crop Rotation:** Alternating the types of crops planted in a particular field from season to season helps maintain soil fertility and reduces the risk of pest and disease buildup.
- **Cover Crops:** Planting cover crops helps prevent soil erosion, improves soil structure, and enhances nutrient content during periods when the main crops are not growing.

2. **Water Conservation:**

- **Drip Irrigation and Precision Irrigation:** Efficient irrigation methods like drip irrigation reduce water wastage and ensure that plants receive the necessary amount of water.

- **Water Harvesting:** Collecting and storing rainwater helps address water scarcity issues and provides a sustainable water source for agriculture.

3. **Agroforestry:**

   - **Integrating Trees and Crops:** Planting trees alongside crops helps improve soil fertility, provide shade, and enhance biodiversity.
   - **Woodlots and Windbreaks:** Establishing woodlots and windbreaks on farms helps protect against soil erosion, provides habitat for beneficial organisms, and offers additional sources of income.

4. **Organic Farming:**

   - **Avoiding Synthetic Chemicals:** Organic farming avoids the use of synthetic pesticides and fertilizers, relying on natural alternatives to manage pests and enrich soil fertility.
   - **Composting:** Recycling organic matter through composting contributes to soil health and reduces the need for external inputs.

5. **Biodiversity Conservation:**

   - **Polyculture:** Growing a variety of crops in the same area promotes biodiversity and reduces the risk of crop failure due to pests or diseases.
   - **Preserving Natural Habitats:** Maintaining natural habitats on or near agricultural lands supports biodiversity and provides ecosystem services.

6. **Integrated Pest Management (IPM):**

   - **Biological Control:** Encouraging natural predators and beneficial organisms helps control pest populations without the need for chemical interventions.
   - **Crop Rotation:** Changing crops disrupts pest life cycles and reduces the risk of infestations.

7. **Sustainable Livestock Practices:**

   - **Rotational Grazing:** Rotating livestock through different pasture areas prevents overgrazing and allows for natural regeneration of vegetation.
   - **Organic Livestock Farming:** Adhering to organic principles in livestock farming involves providing animals with access to open spaces, natural diets, and avoiding the use of antibiotics and growth hormones.

Sustainable agriculture development requires a holistic and integrated approach that considers the ecological, economic, and social dimensions of farming. It involves the collaboration of farmers, policymakers, researchers, and consumers to create a resilient and environmentally friendly food system.

Sustainable Agriculture in Chhattisgarh:

Sustainable agriculture practices in Chhattisgarh, as in many other regions, aim to balance environmental stewardship, economic viability, and social well-being. Chhattisgarh, being an agrarian state with a significant rural population, has been implementing various strategies to promote sustainable agriculture. Here are some key aspects of sustainable agriculture in Chhattisgarh:

1. **Organic Farming:** The promotion of organic farming methods involves avoiding synthetic pesticides and fertilizers, relying on natural alternatives, and emphasizing soil health through practices like composting. Government initiatives may include training programs, subsidies for organic inputs, and certification support for organic farmers.
2. **Agroforestry:** Integrating trees into agricultural landscapes helps improve soil fertility, prevent erosion, and enhance biodiversity. Agroforestry practices may include planting trees on farm boundaries, alley cropping, or integrating fruit and timber trees with crops.
3. **Water Conservation:** Given the importance of water resources in agriculture, sustainable practices in Chhattisgarh often involve water conservation methods. Techniques like drip irrigation, rainwater harvesting, and watershed management are promoted to ensure efficient water use and reduce dependency on rainfall.
4. **Crop Diversification:** Encouraging farmers to diversify their crops helps improve resilience to pests, diseases, and climate variability. Crop rotation and introducing drought-resistant and pest-resistant varieties contribute to sustainable agriculture practices.
5. **Sustainable Livestock Farming:** Integrating livestock with agriculture is a common practice, and sustainable livestock farming involves proper waste management, rotational grazing, and ensuring animal welfare. Promoting organic practices in animal husbandry, such as organic feed and natural healthcare, aligns with sustainable principles.
6. **Climate-Resilient Agriculture:** Given the potential impact of climate change on agriculture, there is an emphasis on adopting climate-resilient agricultural practices. This may involve the introduction of drought-resistant crops, improved water management, and strategies for coping with changing weather patterns.
7. **Educational Initiatives:** Promoting awareness and education about sustainable agriculture practices is essential. Farmer training programs, workshops, and educational campaigns contribute to the adoption of sustainable practices.

Sustainable agriculture in Chhattisgarh involves a combination of traditional wisdom, modern technology, and community engagement. By integrating these practices and ensuring the active involvement of farmers and stakeholders, Chhattisgarh can work towards building a resilient and sustainable agricultural sector that benefits both the environment and the livelihoods of its people.

Issues and Challenges:

1. **Climate Change Impacts:** Changing weather patterns, irregular rainfall, and increased occurrences of extreme weather events pose significant challenges. Unpredictable weather affects crop cycles, leading to yield uncertainties and financial losses for farmers.
2. **Soil Degradation:** Improper land use practices, deforestation, and excessive use of chemical fertilizers have led to soil erosion, loss of fertility, and degradation. Soil health needs to be restored through sustainable agricultural practices.
3. **Water Scarcity:** Unequal distribution of water resources, coupled with inefficient irrigation practices, results in water scarcity, especially during dry seasons. Sustainable water management solutions are crucial to address this issue.
4. **Land Fragmentation:** Inheritance patterns often lead to land fragmentation, resulting in small and economically unviable landholdings. Fragmented land makes mechanization difficult and lowers overall productivity.
5. **Socio-economic Disparities:** There are disparities in access to resources, education, and market opportunities among different social and economic groups. Bridging these gaps is essential for inclusive agricultural development.
6. **Land Tenure Issues:** Land tenure disputes and lack of clear land titles often hinder investment in land and agricultural activities. Clearing these legal challenges is vital for agricultural development.
7. **Biodiversity Conservation:** Encroachments and monoculture practices threaten biodiversity. Conservation efforts are necessary to maintain natural ecological balances in agricultural landscapes.

Future prospects and solution for Chhattisgarh:

Future Prospects for Chhattisgarh Agriculture:

1. **Diversification of Crops:** Encouraging farmers to diversify crops beyond traditional staples can enhance resilience to climate change and market fluctuations. Promoting cultivation of high-value crops and cash crops can increase farmers' income.
2. **Agroforestry:** Integrating trees and shrubs with crops through agroforestry practices can improve soil fertility, provide additional income through timber and fruit production, and contribute to environmental conservation.
3. **Precision Agriculture:** Embracing precision agriculture technologies, such as sensors, GPS, and data analytics, can optimize resource use, increase productivity, and reduce environmental impact.
4. **Sustainable Water Management:** Implementing efficient irrigation systems, rainwater harvesting, and watershed management projects can address water scarcity issues and ensure consistent water supply for agriculture.
5. **Promotion of Organic Farming:** Encouraging organic farming practices reduces chemical inputs, preserves soil health, and meets the growing demand for organic produce in national and international markets.

Solutions for Chhattisgarh's Agriculture:

1. **Capacity Building:** Invest in training programs, workshops, and educational campaigns to enhance farmers' skills and knowledge about sustainable agricultural practices. Empowering farmers with information is crucial for successful implementation.
2. **Infrastructure Development:** Improve rural infrastructure, including roads, storage facilities, and market yards, to reduce post-harvest losses and improve market access for farmers.
3. **Research and Development:** Increase funding for agricultural research institutions to develop crop varieties that are resilient to climate change, disease-resistant, and high-yielding. Research should also focus on sustainable farming practices suitable for Chhattisgarh's agro-climatic conditions.
4. **Financial Support:** Provide easy access to credit, subsidies on agricultural inputs, and insurance schemes for farmers. Financial support ensures that farmers can invest in sustainable practices without financial constraints.
5. **Market Linkages:** Strengthen market linkages by establishing farmers' markets, supporting Farmer Producer Organizations (FPOs), and connecting farmers directly with consumers. These initiatives reduce dependency on middlemen and ensure better prices for farmers.
6. **Policy Reforms:** Implement and enforce policies that promote sustainable agriculture, protect farmers' rights, and incentivize eco-friendly practices. Regularly review and update policies to address emerging challenges and opportunities.
7. **Climate-Smart Agriculture:** Promote climate-smart agricultural practices, including agroforestry, cover cropping, and soil conservation techniques. These practices enhance resilience to climate change and minimize environmental impact.

Conclusion:

In conclusion, the research on sustainable agricultural development in Chhattisgarh has highlighted the multifaceted challenges faced by the agricultural sector in the region. Issues such as climate change, soil degradation, water scarcity, socio-economic disparities, and limited access to resources have been identified as significant obstacles to sustainable farming practices. Through an in-depth analysis, various strategies have been proposed to address these challenges, focusing on climate-resilient farming practices, soil health management, efficient water management, empowerment of smallholder farmers, and research and extension services. These strategies aim to create a more sustainable and resilient agricultural sector in Chhattisgarh.

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Electricity Generation Through Microbial Fuel Cell from Bacterial Species (*Geobacter* and *Clostridium*) By Using Wheat Straw As Substrate

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ABSTRACT

Continuous reliance on fossil fuels has made environmental problems worse and harmed the stability of the world energy supply. Lignocellulosic biomass is now seen as the implicit source of renewable energy in an effort to lessen dependency on non-renewable energy sources. In this situation, wheat straw can be extremely important due to its composition that contain high cellulose which is an efficient source of bioelectricity as compare to rice, two-chambered microbial energy cells can produce electricity from wheat straw.

Keywords: MFC,Bacteria (*Geobacterr, Clostridium*,),Wheat Straw and composition of wheat

INTRODUCTION

An apparatus known as a microbial fuel cell (MFC) is a type of bioelectric generator that uses microorganisms' inherent abilities to generate electricity. The tiny bacterial biofilm it uses to adhere to the anode catalyst is all that it needs. Through the use of the natural device, the chemical energy produced by the bacteria ingesting sugars and other nutrients is subsequently transformed straight into electrical energy. According to Frank Gronwald (North Carolina A&T University) and Rutgers University, the device generates electrical current by recovering electrons created during microbial metabolism. Utilizing lignocellulosic biomass presents a significant opportunity for the production of bioenergy from "alternative generation of biofuels." (Binod & Associates, 2010; Chandra & Associates, 2012; Chen & Associates, 2011a). Different types of biofuels, including bioethanol, methane, and others, can be used depending on the final usage.

Bacteria produce electrons from substrates, which are transmitted to the anode (negative terminal) and flow to the cathode (positive terminal) via a conductive substance with a resistor or under a load to power a device Conventionally, positive current travels from the positive terminal to the negative terminal, the opposite direction of electron flow. The device must be able to replenish the substrate oxidized at the anode, either continuously or intermittently. Otherwise, it is termed a biobattery. Electrons can be delivered to the anode through several methods, including mediators or shuttles, membrane-associated electron transfer, bacteria-produced nanowires, and unknown mechanisms. Adding chemical mediators like neutral red or anthraquinone-2,6-disulfonate

(AQDS) to the system allows bacteria that cannot use the electrode to produce energy. The MFC is defined as "mediator-less" if no exogenous mediators are supplied, even if the mechanism of electron transport is unknown.

In most MFCs, electrons reach the cathode and combine with protons from the anode and oxygen from the air to produce water. Chemical oxidizers, such as ferric cyanide or Mn (IV), can be utilized, although they must be renewed or regenerated. Bacteria can catalyze the reoxidation of metal ions, such Mn, when reduced from Mn (IV) to Mn (II), utilizing dissolved oxygen.

Substrate. Because it is inexpensive and widely available in nature, wheat straw is regarded as one of the lignocellulosic waste materials appropriate for renewable primary energy resources, such as ethanol. In Asian countries, wheat ranks as the fourth most important staple food. Academic scholars have recently shown a great deal of interest in the production of bioelectrical energy through microbial bioelectrochemical processes, in which microorganisms are employed as catalysts to oxidize or decrease reactions at electrodes. wheat grains may contain following amount of components as early researches said.

Components of wheat

Component	**Wheat straw % W/W**
Cellulose	32.7
Hemicelluloses • Xylose • Arabinose • Acetyl groups	24.5 19.3 2.7 2.5
Klason lignin (acid insoluble)	16.8
Ash	4.7
Extractives	6.2
Other components	15.1

Microbial Fuel Cells

Bacteria:

Anode-respiring electroactive bacteria, such as ***Geobacter sulfurreducens***, have been studied for nearly two decades for their ability to generate electrical current through metabolic respiration of organic substances within multilayered biofilms. The extracellular matrix, which permits electrons to be transported over tens of micrometers, distinguishes these biofilms. Several extracellular matrix components have been proposed as critical to accomplishing extracellular electron transfer (EET). Electron transport begins at the inner membrane and goes through the periplasm and outer membrane before reaching the extracellular environment. Cytochromes in these places are known to play a significant function in transporting electrons outside the cell. Microbial nanowires, also known as cytochrome polymers are assumed to be the primary pathway for electrons in the extracellular environment to a solid electron acceptor. Extracellular polymeric compounds have also been suggested to play a function in EET in G. sulfurreducens.

Clostridium microorganisms are Gr(+), strictly anaerobic, spore-forming microorganisms that can consume both simple and complex carbohydrates (Mitchell, Citation1998). The saccharolytic clostridia can ferment a wide range of sugars (hexoses, pentoses, and disaccharides) to produce organic acids (such as acetate and butyrate), solvents (ethanol, isopropanol, butanol, 1,3-propanediol, 2,3-butanediol, acetone), and hydrogen via the acetone-butanol-ethanol (ABE) process (Jones & Woods, Citation1986). They can also destroy lignin-containing materials, such as lignocellulosic waste, due to the presence of numerous cellulases and hemicellulases in a vast extracellular multi-protein complex known as a cellulosome (Mitchell, Citation1998).Indeed, ***Clostridium species*** bacteria offer a viable option for producing power and biofuel. Through a process known as acaetone-butanol-ethaanol fermentation, some species of Clostridium, such Clostridium acetobutylicum, are able to ferment carbohydrates and create biofuels like ethanol and butanol. Furthermore, by passing electrons to an electrode, Clostridium species can be employed in microbial fuel cells to produce power. Therefore, the ability to use Clostridium bacteria to produce both power and biofuels gives them a double benefit.

AIM OF OBJECTIVE

1. Isolation and culturing of wheat straw degrading microbes.
2. Prtreatment of wheat straw before use.
3. Construction of MFCs chamber.

REVIEW OF LITERATURE

Microbial Fuel Cells

Electrical energy production utilizing microorganisms via microbial fuel cells (MFC) is a renewable and sustainable technology that is regarded as one of the most efficient (HaoYu et al., 2007; Salgado, 2009) and carbon-neutral energy sources (Lovley, 2006. Many types of wastewaters, including domestic, animal, brewery, and food processing wastewaters, have been successfully treated with MFCs by removing organic contaminants and producing valuable energy (electricity or hydrogen gas) (Oh and Logan, 2005; Jacobson et al., 2011).

Early works:

(MFCs) are among the most well-known examples of this type of bioelectrochemical conversion, in which the energy contained in organic composites' chemical bonds is transformed into electrical energy via biocatalytic reactions: S.-E. Oh and A. Gurung (2015). Cells of this sort use biological components such as enzymes or living cells to directly create power from the chemical energy contained in various organic or inorganic compounds.Two electrodes separated by a semipermeable membrane are immersed in solution. A biological species, such as a microbial cell or enzyme, can exist in solution (or in suspension) within the cell's anodic compartment, or it can be immobilised at the electrode. When a sufficient fuel is provided, it either partially or completely oxidizes at the anode, and the electrons generated during this process are used to decrease oxygen at the cathode. The early examples by Potter and Cohen previously stated, employed living cells as the active component. Later work [Davis and Yarborough 1962] involves adding E. Coli or

glucose oxidase to a glucose-containing half-cell, allowing tiny currents to be created. The addition of methylene blue to the system resulted in significantly greater currents. This can be explained by the fact that electron transport from microorganisms to the electrode is a relatively inefficient process, therefore the inclusion of a simple mediator molecule, such as methylene blue, dramatically boosts cell performance. Further research used dichloroindophenol as a mediator in a glucose oxidase-based cell, with efficiencies near 100% [Weibel and Dodge 1975].

Bacteria:

Microbes play an important role in MFCs by catalyzing the release of electrons from energy-rich bonds in organic substrates under anoxic conditions. Pant et al. (2010b) and Pandey et al. (2016) reviewed various pure substrates and types of waste water that have been employed as a carbon source for microorganisms in MFCs. The electrons released during the oxidation process travel through versatile microbial electron transport chains (Fredrickson et al. 2008; Kracke et al. 2015), which include serially arranged conductive protein complexes, cytochromes, nanowires, and redox proteins (Costa et al. 2018), before being donated to the MFC's anode. In a classic review (2007), Schröder discusses the underlying mechanics and energy implications of anodic electron transport. Electron transfer between microorganisms and electrodes (Lovley 2012; Kumar et al. 2017) can be either indirect—mediated by naturally generated or artificially introduced redox shuttles (Martinez and Alvarez 2018)—or direct extracellular electron transfer (Yang et al. 2012).Glasser et al. (2017) provide valuable insights into endogenous extracellular electron shuttles, whereas Lovley (2017) outlines the processes involved in direct interspecies electron transfer, which allows for long-distance electron transport in bioelectrochemical systems. Zheng et al. (2020) provide a detailed overview of the dynamics of electron transfer within microbes (intra), between microbial species (inter), and at the microbe-electrode contact.

Mixed consortia of electrogenic and electrotrophic microorganisms (Logan 2009; Logan et al. 2019) have been shown to contribute more effectively to current production in MFCs than pure bacterial cultures. This difference could be attributed to synergistic interactions between syntrophic microbial species, which result in effective utilization of available substrates (Kiely et al. 2011) via the formation of electrochemically active biofilms (Borole et al. 2011; Babauta et al. 2012; Reguera 2018; Kiran and Patil 2019). Electroactive biofilm development and performance can be improved (Li et al. 2018a) by selectively regulating growth conditions (Doyle and Marsili 2015, 2018), utilizing synthetic biology (Glaven 2019), and employing engineering techniques (Angelaalincy et al. 2018, Chiranjeevi and Patil 2020). Microbial consortia communities have also been profiled and characterized using 'omics' technologies (Rittmann et al. 2008; Lacerda and Reardon 2009; Moran et al. 2013; Franzosa et al. 2015; Kouzuma et al. 2018), flow-cytometric approaches (Koch et al. 2014), computational tools (Haft and Tovchigrechko 2012; Segata et al. 2013), and statistical analysis (Buttigieg and Ramette 2014) to obtain structural and functional insights (Zhi et al. 2014).

Wheat Straw

Wheat straw is a byproduct, or the dry stalk of wheat after the grain and chaff have been removed (Gubitz et al., 1998; Bajpai, 1999; Singh et al., 2009).

Wheat straw consists largely of cellulose, hemicellulose, and lignin. The primary components of WS are nodes, internodes, and leaves (McKean and Jacobs, 1997).

MATERIALS AND METHOD

Isolation of mixed microbes from soil: In this work, a mixed CDB culture can be used as an inoculum in the MFC. The CDB will be isolated by transferring 1 g of soil to a modified Dubos' salt medium supplemented with carboxymethyl cellulose (CMC) as the only carbon source. The CMC-amended Dubos' salt medium had 10 g/L CMC, 0.5 g/L $NaNO_3$, 1.0 g/L K_2HPO_4, 0.5 g/L $MgSO_4 \cdot 7H_2O$, 0.5 g/L KCl, and 0.001 g/L $FeSO_4 \cdot 7H_2O$. The CDB culture will be cultured for one week at 30 degrees Celsius before being used as an inoculum in the MFC.

Inoculum preparation for straw degradation To assess the isolates' ability to digest starch, a standard agar-plate experiment can be used. Bacteria will be inoculated onto starch-agar plates (3 g beef extract; 10 g soluble starch; 15 g agar; 1 L distilled water) and incubated at 23 °C and 30 °C for 48 hours. Following incubation, the surface of the agar was saturated with Gram's or Lugol's iodine solution, and the findings should recorded immediately. The formation of zones around the bacterial colonies following the reaction may be induced by the synthesis of extracellular enzymes capable of degrading starch. A lack of zones suggests that the isolate was unable to hydrolyze starch.

Cutting and pretreatment of wheat straw: For each pretreatment batch, 37.5 g of wheat straw (dry weight (DW) basis) was combined with tap water (for A-HTP) or aqueous sulfuric acid (for SA-HTP) at a 7:1 liquid-to-solid ratio in a 1-L reactor.The sulfuric acid loading (96%) was 0.5 g per 100 g of wheat straw (DW). The reaction time was 15 minutes. For A-HTP, the temperature settings were 160, 175, 190, and 205 °C, corresponding to SF values of 2.9, 3.4, 3.8, and 4.3. SA-HTP temperature settings were 160 and 190 °C, resulting in SF values of 2.9 and 3.8, respectively.

MFC Construction and Operation:

- Microbial fuel cell technology converts chemical energy into electrical energy through the oxidation of organic waste and various carbon sources. Microbial fuel cells consist of anode and cathode chambers, microorganisms, exchange membranes, substrates, electrodes, and an electrical circuit for electricity generation.
- The anode and cathode chambers of MFC are composed of glass, plexiglass, and polycarbonate. Anode electrodes can be made of carbon paper, carbon cloth, or graphite. The electrode's aerobic nature is maintained by using an air cathode formed of pl-black catalyst or platinum material.

- The Shewanella and Geobacter species account for the vast majority of the microbial population in MFC technology. Photosynthetic bacteria are successfully employed to create power. MFC employs mixed bacterial cultures, including those found in natural microbial communities, marine and lake sediments, residential wastewater, and brewery effluent.
- MFCs create power using substrates like acetate, glucose, propionate, and butyrate. Bio-electricity generation employs a variety of organic substrates that bacteria consume in anaerobic operation.
- Microbial Fuel Cell technology's construction is dependent on its design. There are two types of MFCs: single-chambered and dual or two-chambered.

EXPECTED OUTCOMES

Wheat straw is the primary agricultural waste from wheat, and it is used as the fourth major feed for ruminants in underdeveloped nations. Nonetheless, the waste biomass is turned into electricity. According to our findings, lignocellulose, cellulose, and hemicellulose are all glucose-containing composites found in wheat straw and may serve as the primary carbon source for some anaerobic microorganisms. These microorganisms devour this carbon emulsion rapidly and produce H_2, CO_2, and electrons as byproducts. The electron is the primary source of electricity generation. MFC cell system produces steady electricity

IMPORTANCE OF STUDY/APPLICATION

The importance of our topic is to generate bioelectricity from renewable sources rather than nonrenewable fossil fuels to meet the electricity demands of our state, cities, or countries.Wheat straw is an abundant renewable resource that can be easily hydrolyzed.Thus, energy recovery from wheat straw, notably employing MFCs to overcome the obstacles of other current approaches, has been of great interest using bacteria with distinguishing features (Clostridum- both biofuel and bioelectricity, and Geobacter- bioelectricity).

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Exploring the Versatility of Neem (*Azadirachta indica*): A Comprehensive Guide to its Applications

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Abstract:

Neem *(Azadirachta indica*) is a versatile plant with a long history of use in various traditional systems of medicine and agriculture. This research paper provides an in-depth analysis of the botanical characteristics, phytochemical composition, medicinal properties, and agricultural applications of neem. The paper explores the bioactive compounds present in different parts of the neem tree, such as neem oil, neem leaves, neem seeds, and neem bark, and discusses their pharmacological effects, including anti-inflammatory, antimicrobial, antidiabetic, and anticancer properties. Neem is used in dermatitis eczema, acne, bacterial, fungal, and other skin conditions. It has been shown to have a long-term effect as a potent anti-inflammatory agent that also aids in the maintenance of a healthy immune system and is used in the treatment of inflammation in the skin. It has been used for skin and blood purifying purposes. Neem helps in the prevention of diseases, but it also gives us the ability to combat illnesses by improving our immune system. Oil and azadirachtin were extracted from neem seed and neem leaf ingredient and their derivative compound, nimbinin, nimbandiol, was extracted by soxhelt extraction technique, supercritical fluid extraction technique, TLC, UV, and HPLC method by using different single and binary mixtures of organic solvents, as well as in aqueous forms. Azadirachtin is extracted from dried neem kernel powder by using di-chloro methane as a solvent UV absorbent at 220 nm. Azadirachtin was analyzed by HPLC on a C-18 column at a flow rate of 1ml/min, using aceto nitryl: 1% triethyl amine pH 4 (60:40:1) as the mobile phase at 210nm. neem extract consists of a posh mixture of molecules, including normal hydrocarbons, phenolic compounds, terpenoids, alkaloids, and glycosides. In agriculture, neem extract and azadirachtin are both used as organic pesticides.

Key words: Green treasure, Insecticidal properties agents, pharmacological property

Introduction-

Neem *(Azadirachta indica*), commonly known as Indian lilac or margosa tree, is an evergreen plant native to the Indian subcontinent. It has been revered for centuries in traditional systems of medicine such as Ayurveda, Unani, and Siddha for its therapeutic properties. Additionally, neem has a rich history of use in agriculture, serving as a natural alternative to synthetic pesticides and

fertilizersThe increasing interest in natural remedies and sustainable agriculture has sparked renewed attention towards neem and its diverse applications.

Neem belongs to the Meliaceae family and is characterized by its tall stature, compound leaves, and small white flowers. The tree typically grows in tropical and subtropical regions, thriving in areas with well-drained soil and ample sunlight. Neem is cultivated extensively in countries like India, Bangladesh, Sri Lanka, and parts of Africa for its medicinal and agricultural benefits.Neem contains a wide array of bioactive compounds, with the most notable ones being limonoids, triterpenoids, flavonoids, alkaloids, and fatty acids. Neem oil, extracted from the seeds, is rich in azadirachtin, a potent insecticidal compound that disrupts the growth and development of pests. Other constituents like nimbin, nimbidin, and nimbolide contribute to neem's diverse pharmacological effects.The medicinal properties of neem have been extensively studied and documented. Neem exhibits antibacterial, antifungal, antiviral, antidiabetic, anti-inflammatory, and immunomodulatory activities. It has been used traditionally to treat various ailments such as skin disorders, gastrointestinal disorders, respiratory infections, and parasitic infestations. Neem-based formulations are also being investigated for their potential in cancer prevention and treatment.

In agriculture, neem plays a crucial role in pest management, soil fertility enhancement, and crop protection. Neem-based pesticides and fertilizers offer effective alternatives to synthetic chemicals, minimizing environmental pollution and reducing the risk of pesticide residues in food products. Neem cake, a byproduct of neem seed oil extraction, serves as an organic fertilizer and soil conditioner, enriching the soil with nutrients and improving its water retention capacity.Its extracts have antiviral, antibacterial, antifungal, antifungal, antihelmintic, antiallergic, anti-dermatic, and anti-inflammatory properties. The neem leaves extract contains nimbin, nimbinene, 6-desacetylnimbiene, nimbandiol, nimbolide, and quercetin [2]. Neem extract is made up of a posh mixture of compounds, including normal hydrocarbons, phenolic compounds, terpenoids, alkaloids, glycosides, flavonoids, steroids, and glycosides. These chemical substances are analysed by their biological activity, physiological action on the living organism, or medicinal uses [2][3]. Neem (*Azadirachta indica)* is a medicinal plant with a variety of pharmacological properties. Neem leaves extract has anti-inflammatory, antipyretic, and antimicrobial properties[6]. Mechanical pressing, supercritical fluid extraction, high-performance liquid chromatography extraction, and Soxhlet extraction are among the many ways to extract neem oil from the seeds and leaves. For the extraction of neem oil, the most common Soxhlet extraction technique is used because mechanical pressing reduced the turbid oil yield, the product was less turbid. On the basis of high solvent strength, non-reactivity with oil and oil micelle and with equipment, solvents were used in extraction of oils from neem seeds and leaves. The effects of variables such as temperature, time, and particle size were investigated [10]. Neem extract is used pesticide water based formulation of a biological material which mainly contain an active ingredient Azadiractin it acts as a very active insect phagorepellent and systematic growth disruptor[11]. The azadirachtin was then separated from the extracted oil by high-performance liquid chromatography (HPLC)[12][15]. Azadirachtin's molecular weight is 720gm, and its melting point is 160^{o}C [13]. Neem seed is a

species of neem tree that contains a high amount of oil which is commonly used as insecticides, lubricants, and drugs for diseases such as diabetes and tuberculosis.

Extraction from Neem (*Azardirachta indica*), essential oil and its biomedical and food preservation techniques:

Extraction of essential neem oil from neem seed was carried by soxhlet extraction method using ethanol and n-hexane as organic solvent as single & binary solvent system. Physico-chemical property of the extracted oil was also determined by using classical wet chemical method. Azadirachtin is extracted from the dried neem kernel powder using Di-Chloro methane as solvent.The potency of neem extract as avasodilator that lowers blood pressure. the antimicrobial activity of aqueous and ethanol extracts of neem leaves and bark was assessed by the disk diffusion method against standard bacterial strains[28]. Neem leaf is used for leprosy, eye disorders, bloody nose, intestinal worms ,stomach upset[16]. It also used as loss of appetite, skin ulcers, diseases of the heart and blood vessels, fever, diabetes, gingivitis and liver problems[21]. Neem extract is also capable of controlling pathogenic microorganisms. Neem leaf powder is used as biosorbent for the purpose of water purifying property which helps in removing dyes from the water such as congo red [27]. Neem oil is used in food preservation against microbial spoilage due to its active antibacterial and antifungal properties and its nanoemulsion used in biopolymer based composite food packaging films and coatings which affect several factors such as storage temperature, duration and area of the package in contact with the food item, composition of the food, concentration of the active agents, and the biopolymeric material may affect the degree of migration of the bioactive agents from the package into the food item [26].

Literature review on therapeutic and agricultural potential of neem leaves ,fruits and seeds:
Asija R. *et.al* (2019) [17] reported that preparation and evaluation of neem (*Azadirachta indica*) extract microbead using hydrogel system for wound healing .It was applied neem on wounds in the form of aqueous extract of various part of plant and result was a polymeric encapsulation in the form of beads allowed controlled delivery as well as enhanced stability of Azadiractin. M. Mustafa *et.al* (2016) [21] study on antimicrobial efficiency of neem against *Enterococcus faecalis*. An in vitro study used neem extract 2% chlorhexidine, 3% sodium hypoclorite on *E.faecalis*. neem leaf extract as significant antimicrobial activity against *E.faecalis* by using Agar-diffusion test conclude that neem leaf extract used as alternative agent in root canal disinfection.

Faize Asam *et.al*(2009) [2] study on antibacterial activity of various phytoconstituents of neem. It was prepared plant material extract two different concentration 50gm and 75gmof sample for different phytoconstituents of neem extract against bacterial strains by using disc diffusion method .Aremu *et.al*. (2009)[4] study on physio-chemical stability studies of neem seed oil was formulated using vanishing cream base at concentration 0-10%w/w as control formulation. The result shows that neem oil cream formulation maintain its physical chemical integrity . The neem seed kernel is an acrid bitter greenish yellow to brown oil. The calculated yield is between (19 – 25% w/w). In that physical and chemical evaluation of neem seed oil cream formulations over a period of one year using pH, viscosity and specific gravity as parameters. Devi *et.al* (2023)[18] study on medicinal importance of *Azadirachta indica*. It reported that the various part of neem like

leaves ,fruit,seed having a chemical & medicinal values neem plant shows antifungal , insect repellent , antiulcerogenic ,immonalogical properties. P.S. Lama,*et.al* (2022)[19] study on effect of *Azadirachtaindica*. Seed extract on larvae & adult anopheles mosquitoes in nasorawa state Nigeria . It shows susceptibility test on mosquito & mortality in the control tubes was recorded but for a more appreciable result mosquitoes larvae should be targeted when using the neem seed extract.

R.M.Ngurea,*et.al* (2009)[20] study on Anti-trypanosomal effect of *Azadirachta indica* extract on trypanosom brucei rodesiense infected mice. Preparation of sample extraction. It's effect on white mice was observed plant extract was not toxic to treated with mice during experiment.

D.A .Mahmoud *et.al.* (2023)[22] study on antifungal activity of different neem leaf extract with nimonol against some human pathogens extract used for antidermatophytic activity by using HPLC and chromatography for purification of nimonol .

Innocent I. Ujah *et.al* (2021)[23] study on phytochemicals of neem plant extract such as steroids,phenols ,alkaloids by phytochemical screening method which recorded biological and therapeutic properties .

N. Mehta , A. Chandra , A. Thakur *et.al*.(2021) [27] It study that neem oil and leaves are inseparable part of animal feed as it is a good source of minerals, proteins and carotene.Also neem leaves are used as a part of poultry feed to keep the a *flatoxicosis* caused by *Aspergillus flavus* which is a major threat to poultry industry. S.Dubhashi, V. Prana, M. Singaiah *et.al*. (2013) [13] study the retention time of Azadirachtin is determined using HPLC and retention time of Azadirachtin was found to be 3.8min. For this purpose the column used for chromatographic separations was reverse phase phenomenex® Luna 5µ C18 (2) 100A (250 × 4.60 mm i.d). The analysis was tried at wave length of 217nm but it shows many peaks of impurities hence, the analytical wavelength of 210nm was set and the sample was injected. The chromatographic separations were accomplished using mobile phase consisting of Aceto nitryl: methanol: 1% tri ethyl amine adjusted to pH 4(60:40:1) , filtered through a filter using Value stage vacuum pump. Mobile phase was pumped at a flow rate of 1 ml/min at room temperature.D.Jessinta O. Sandanasamy *el.at*(2013)[24] study on fatty acid composition and antibacterial activity of neem seed oil also investigate toxic effect of seed oil against two multi-drugs resist bacteria as E.coli and S.aureus analyse by gas chromatography , mass spectrophotometry. C.N.Thasmi et.al(2020)[5][7] Study on the effect of neem leaf (*Azadirachta indicaA.Juss)*extract on tubules seminiferous of Rat (*Rattus norvegicus*). The study used 15 adult rats. The control group was only given water and each treatment group was given neem leaf extract with the dose of 50(P1),100(P2) ,150(P3) & 200(P4) mg/kg BW orally for 30 days. The result obtain that oil is used for prevent the pregency .Administration of neem leaf extract orally to white rats for 30 days at various doses shows damage to the seminiferous tabules and affected the spermatogenesis process at doses of 150gm/kg BW & 200 mg/kg BW.

S.Sarawaneeyarak et.al. (2015)[6] Study on the effect of neem extract & azadirachtin on soil microorganism . It reported that neem are nontoxic to human animals & environment . Neem used as pesticides to controlling agricultural pest. Azadiractin extracted from neem oil capable for controlling pathogenic microorganism . The effects of neem extract & azadirachtin on soil

microorganism was tested in vitro by inoculate poured NA & PDA plates with soil suspension . This study found that both azadirachtin & neem extract usage reduce the number of root nodules on mung bean plants. K. Girish et.al. (2008)[8 The paper "Neem – A Green Treasure" by K. Girish and S. Bhat likely explores the various ecological, medicinal, and agricultural aspects of the neem tree (Azadirachta indica). Here's a summary of what such a paper might cover:Neem is renowned for its ecological significance. It is a hardy tree that can thrive in arid and semi-arid regions, making it valuable for afforestation and soil conservation efforts. The neem tree also plays a vital role in maintaining biodiversity by providing habitat and food for various organisms.Medicinal Properties**: Neem has been used in traditional medicine for centuries due to its diverse pharmacological properties. Its leaves, bark, seeds, and oil contain bioactive compounds with antibacterial, antifungal, antiviral, anti-inflammatory, and antidiabetic properties. Neem-based remedies are used to treat a wide range of ailments, including skin disorders, digestive issues, and respiratory infections. Neem products, such as neem cake and neem oil, are also beneficial for soil health. Neem cake, a byproduct of neem seed oil extraction, is used as an organic fertilizer and soil conditioner. It improves soil structure, increases water retention, enhances nutrient availability, and suppresses soilborne pathogens and nematodes. The use of neem-based products aligns with principles of environmental sustainability. Unlike synthetic pesticides, neem formulations are biodegradable and have minimal adverse effects on non-target organisms, including humans and wildlife. Incorporating neem into integrated pest management (IPM) strategies helps reduce reliance on chemical inputs and promotes eco-friendly agriculture.Despite its numerous benefits, the widespread adoption of neem-based solutions faces challenges such as variable efficacy, limited availability, and regulatory constraints. Addressing these challenges requires further research, innovation, and policy support to unlock the full potential of neem as a green treasure for sustainable development and highlights the multifaceted value of the neem tree as an eco-friendly resource with diverse ecological, medicinal, and agricultural applications, underscoring its importance for human well-being and environmental conservation. A. Mehta , A. Jain , G. Saxena (2022)[28] It was study to evaluate the antibacterial activity of ethanolic extract of Neem tree leaves (Azadirachtaindica) against standard American Type Culture Collection (ATCC) bacterial strains and clinical isolates. The Mean±SD values of total phenolic content and total flavonoid content in the neem extract turned out to be 68±0.46 and 114±2.7 mg QE/ gm respectively. It also strongly observe that the ethanolic extract of Neem tree leaves exhibits remarkably significant antibacterial activity not only against the standard ATCC strains such as E. coli (ATCC 25922) , P. aeruginosa (ATCC 27853) ,S. aureus (ATCC 25923) but also against various clinical isolates.

Conclusion –

Neem is a remarkable plant with immense potential in healthcare, agriculture, and environmental conservation. Its bioactive compounds exhibit diverse pharmacological properties, making it a valuable resource for medicinal drug discovery and development. In agriculture, neem-based products offer sustainable solutions for pest control and soil management, promoting eco-friendly farming practices. Further research and innovation are needed to fully harness the therapeutic and agricultural benefits of neem, paving the way for its wider adoption and utilization in various sectors. Azadirachtin and neem extract are widely used in agriculture to control insect populations

on control of diseases of human as well as animals using non-toxic herbal products. Neem is also applied on wounds in the form of aqueous extracts of various parts of the plant but is associated with problems of stability on long term storage. *Azadirachta indica* is a good source of phytochemicals, the study has shown the presence and concentration of phytochemicals of neem plant.Neem has vast present study revues application in medicinal field.

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A Review on Extraction, Techniques and Uses of Neem (*Azadirachta indica*)

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Abstract:

Neem (*Azadirachta indica*) is the most effective traditional medicine as a source of many therapeutic agents, and it thrives well in tropical and semitropical countries. It has a number of health-promoting properties and uses. Neem is used in dermatitis eczema, acne, bacterial, fungal, and other skin conditions. It has been shown to have a long-term effect as a potent anti-inflammatory agent that also aids in the maintenance of a healthy immune system and is used in the treatment of inflammation in the skin. It has been used for skin and blood purifying purposes. Neem helps in the prevention of diseases, but it also gives us the ability to combat illnesses by improving our immune system. Oil and azadirachtin were extracted from neem seed and neem leaf ingredient and their derivative compound, nimbinin, nimbandiol, was extracted by soxhelt extraction technique, supercritical fluid extraction technique, TLC, UV, and HPLC method by using different single and binary mixtures of organic solvents, as well as in aqueous forms. Azadirachtin is extracted from dried neem kernel powder by using di-chloro methane as a solvent UV absorbent at 220 nm. Azadirachtin was analyzed by HPLC on a C-18 column at a flow rate of 1ml/min, using aceto nitryl: 1% triethyl amine pH 4 (60:40:1) as the mobile phase at 210nm. neem extract consists of a posh mixture of molecules, including normal hydrocarbons, phenolic compounds, terpenoids, alkaloids, and glycosides. In agriculture, neem extract and azadirachtin are both used as organic pesticides.

Key words: Oil, Neem, Inflammation, therapeutic agents, medicine

Introduction-

Azadirachta indica is a tree in the mahogany family *maliaceae*. Neem (*Azadirachta indica*) is well-known for its medicinal properties. all parts of the neem plant, including leaves, seeds, bark, flowers, fruit, and their extract, can be used in medicine, cosmetics, furniture manufacturing, cattle and poultry feeds, nitrification of soils for various agricultural crops, and pest control. Its extracts have antiviral, antibacterial, antifungal, antifungal, antihelmintic, antiallergic, anti-dermatic, and anti-inflammatory properties. The neem leaves extract contains nimbin, nimbinene, 6-

desacetylnimbiene, nimbandiol, nimbolide, and quercetin [1]. Neem extract is made up of a posh mixture of compounds, including normal hydrocarbons, phenolic compounds, terpenoids, alkaloids, glycosides, flavonoids, steroids, and glycosides. these chemical substances are analysed by their biological activity, physiological action on the living organism, or medicinal uses [2][3]. Neem (*Azadirachta indica)* is a medicinal plant with a variety of pharmacological properties. Neem leaves extract has anti-inflammatory, antipyretic, and antimicrobial properties[6]. Mechanical pressing, supercritical fluid extraction, high-performance liquid chromatography extraction, and Soxhlet extraction are among the many ways to extract neem oil from the seeds and leaves. For the extraction of neem oil, the most common Soxhlet extraction technique is used because mechanical pressing reduced the turbid oil yield, the product was less turbid. On the basis of high solvent strength, non-reactivity with oil and oil micelle and with equipment, solvents were used in extraction of oils from neem seeds and leaves. The effects of variables such as temperature, time, and particle size were investigated [10]. Neem extract is used pesticide water based formulation of a biological material which mainly contain an active ingredient Azadiractin it acts as a very active insect phagorepellent and systematic growth disruptor[11]. The azadirachtin was then separated from the extracted oil by high-performance liquid chromatography (HPLC)[12][15]. Azadirachtin's molecular weight is 720gm, and its melting point is 160ºC [13]. Neem seed is a species of neem tree that contains a high amount of oil which is commonly used as insecticides, lubricants, and drugs for diseases such as diabetes and tuberculosis.

Extraction of neem and it's uses-

Extraction of essential neem oil from neem seed was carried by soxhlet extraction method using ethanol and n-hexane as organic solvent as single & binary solvent system. Physico-chemical property of the extracted oil was also determined by using classical wet chemical method. Azadirachtin is extracted from the dried neem kernel powder using Di-Chloro methane as solvent.The potency of neem extract as avasodilator that lowers blood pressure. the antimicrobial activity of aqueous and ethanol extracts of neem leaves and bark was assessed by the disk diffusion method against standard bacterial strains[28]. Neem leaf is used for leprosy, eye disorders, bloody nose, intestinal worms ,stomach upset[16]. It also used as loss of appetite, skin ulcers, diseases of the heart and blood vessels, fever, diabetes, gingivitis and liver problems[21]. Neem extract is also capable of controlling pathogenic microorganisms. Neem leaf powder is used as biosorbent for the purpose of water purifying property which helps in removing dyes from the water such as congo red [27]. Neem oil is used in food preservation against microbial spoilage due to its active antibacterial and antifungal properties and its nanoemulsion used in biopolymer based composite food packaging films and coatings which affect several factors such as storage temperature, duration and area of the package in contact with the food item, composition of the food, concentration of the active agents, and the biopolymeric material may affect the degree of migration of the bioactive agents from the package into the food item [26].

Literature Review-

Faize Asam *et.al*(2009) [2] study on antibacterial activity of various phytoconstituents of neem. It was prepared plant material extract two different concentration 50gm and 75gmof sample for different phytoconstituents of neem extract against bacterial strains by using disc diffusion method .Aremu *et.al*. (2009)[4] study on physio-chemical stability studies of neem seed oil was formulated using vanishing cream base at concentration 0-10%w/w as control formulation. The result shows that neem oil cream formulation maintain its physical chemical integrity . The neem seed kernel is an acrid bitter greenish yellow to brown oil. The calculated yield is between (19 – 25% w/w). In that physical and chemical evaluation of neem seed oil cream formulations over a period of one year using pH, viscosity and specific gravity as parameters. Asija R. *et.al* (2019) [17] reported that preparation and evaluation of neem (*Azadirachta indica*) extract microbead using hydrogel system for wound healing .It was applied neem on wounds in the form of aqueous extract of various part of plant and result was a polymeric encapsulation in the form of beads allowed controlled delivery as well as enhanced stability of Azadiractin. J. Devi *et.al* (2023)[18] study on medicinal importance of *Azadirachta indica*. It reported that the various part of neem like leaves ,fruit,seed having a chemical & medicinal values neem plant shows antifungal , insect repellent , antiulcerogenic ,immonalogical properties. P.S. Lama,*et.al* (2022)[19] study on effect of *Azadirachtaindica*. Seed extract on larvae & adult anopheles mosquitoes in nasorawa state Nigeria . It shows susceptibility test on mosquito & mortality in the control tubes was recorded but for a more appreciable result mosquitoes larvae should be targeted when using the neem seed extract.

R.M.Ngurea,*et.al* (2009)[20] study on Anti-trypanosomal effect of *Azadirachta indica* extract on trypanosom brucei rodesiense infected mice. Preparation of sample extraction. It's effect on white mice was observed plant extract was not toxic to treated with mice during experiment.

M. Mustafa *et.al* (2016)[21] study on antimicrobial efficiency of neem against *Enterococcus faecalis*. An in vitro study used neem extract 2% chlorhexidine, 3% sodium hypoclorite on *E.faecalis*. neem leaf extract as significant antimicrobial activity against *E.faecalis* by using Agar-diffusion test conclude that neem leaf extract used as alternative agent in root canal disinfection. D.A .Mahmoud *et.al.* (2023)[22] study on antifungal activity of different neem leaf extract with nimonol against some human pathogens extract used for antidermatophytic activity by using HPLC and chromatography for purification of nimonol .

Innocent I. Ujah *et.al* (2021)[23] study on phytochemicals of neem plant extract such as steroids,phenols ,alkaloids by phytochemical screening method which recorded biological and therapeutic properties .

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A. Mehta , A. Jain , G. Saxena (2022)[28] It was study to evaluate the antibacterial activity of ethanolic extract of Neem tree leaves (Azadirachtaindica) against standard American Type Culture Collection (ATCC) bacterial strains and clinical isolates. The Mean±SD values of total phenolic content and total flavonoid content in the neem extract turned out to be 68±0.46 and 114±2.7 mg QE/ gm respectively. It also strongly observe that the ethanolic extract of Neem tree leaves exhibits remarkably significant antibacterial activity not only against the standard ATCC strains such as E. coli (ATCC 25922) , P. aeruginosa (ATCC 27853) ,S. aureus (ATCC 25923) but also against various clinical isolates.

Conclusion –

Nowadays, neem and its extracts are used in numerous herbal and allopathic medicines.

Antibacterial activity of various phytoconstituents of neem was studied to rationalize its traditional use. neem is one of the best nontoxic biological sources for development of modern drugs. Azadirachtin and neem extract are widely used in agriculture to control insect populations on control of diseases of human as well as animals using non-toxic herbal products. Neem is also applied on wounds in the form of aqueous extracts of various parts of the plant but is associated with problems of stability on long term storage. *Azadirachta indica* is a good source of phytochemicals, the study has shown the presence and concentration of phytochemicals of neem plant.Neem has vast present study revues application in medicinal field.

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Promoting Sustainable Development through Environmental Education in Physical Education and Sports Science: A Focus on India and Chhattisgarh State

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Abstract

The imperative to address environmental degradation and promote sustainable development is of paramount importance in India, particularly in regions like Chhattisgarh State, where the impact of industrialization and urbanization is significant. This research paper explores the role of environmental education within the context of physical education (PE) and sports science in India, with a specific focus on initiatives and challenges in Chhattisgarh. By examining existing literature, case studies, and empirical data, this paper highlights the benefits of integrating environmental education into PE programs to foster a sense of responsibility towards sustainable practices among students. The methodology included a comprehensive literature review, analysis of case studies, and data collection through surveys, interviews, and observations. The data analysis section presents findings related to the current status of environmental education in PE, challenges faced, and the impact of initiatives. The discussion highlights key insights, challenges, opportunities, and policy implications arising from the study, emphasizing the importance of community engagement and holistic student development. Drawing on examples from India and Chhattisgarh, this paper advocates for the inclusion of environmental education in PE and sports science curricula as a means to promote holistic development and contribute to sustainable development goals.

INTRODUCTION

India, with its diverse ecosystems and growing population, faces unique challenges in balancing economic development with environmental conservation. Chhattisgarh State, known for its rich natural resources and industrial growth, exemplifies these challenges. The need for environmental education within disciplines such as physical education (PE) and sports science becomes crucial in fostering a generation of environmentally conscious citizens. This research paper aims to explore the role of environmental education in PE and sports science, with a focus on India and the specific context of Chhattisgarh State.

LITERATURE REVIEW

Environmental education, sustainable development, and physical education (PE) intersect in significant ways, especially in the context of India's diverse ecological landscape and the imperative for sustainable practices. This review aims to synthesize the existing literature on these topics, focusing on India's efforts, challenges, and potential opportunities in integrating environmental education into PE curricula to promote sustainable development.

1. Environmental Education in India:

- **Policy Framework:** India's National Policy on Education (1986) emphasized the integration of environmental education at all levels of schooling. The National Curriculum Framework (2005) underscored the need for a holistic approach to environmental education, integrating it across subjects.
- **Curricular Integration:** The Central Board of Secondary Education (CBSE) and other educational boards have guidelines for including environmental education in various subjects, including PE. Studies (Sethi, 2018) have highlighted the importance of integrating environmental concepts into PE to promote a sense of environmental responsibility among students.
- **Teacher Training and Awareness:** Research (Kumar & Meena, 2019) emphasizes the need for targeted teacher training programs to effectively integrate environmental education into PE. Awareness campaigns and workshops (Bhattacharya & Chattopadhyay, 2017) have been conducted to enhance PE teachers' understanding of environmental issues.
- **Impact and Effectiveness:** Studies (Chakraborty, 2020) have shown that schools with dedicated environmental education programs, including in PE, witness positive changes in students' attitudes towards conservation. Research (Sengupta, 2016) indicates that integrating environmental education into PE not only enhances ecological awareness but also improves students' physical health and well-being.

2. Sustainable Development and PE in India:

- **Role of PE in Sustainable Development:** PE plays a crucial role in promoting sustainable lifestyles and behaviors among students (Saxena & Sharma, 2019). Research (Dutta & Saxena, 2018) suggests that PE programs that incorporate sustainability principles have a lasting impact on students' choices and actions.
- **Integration of Sustainable Practices:** Case studies (Singh & Mishra, 2020) have highlighted schools in India where PE classes incorporate activities such as waste management, energy conservation, and organic farming. Initiatives like "Green Schools" (Green Rating for Integrated Habitat Assessment) by the Indian Green Building Council (IGBC) promote sustainability in school environments, including PE areas.
- **Community Engagement and Advocacy:** Studies (Das & Sen, 2017) emphasize the role of PE in fostering community engagement towards sustainable development goals. PE events, such as marathons and sports festivals, have been used as platforms for raising awareness about environmental conservation (Mishra & Chatterjee, 2019).

3. Challenges and Opportunities in India's PE and Environmental Education Landscape:

Challenges:

- Inadequate Resources: Many schools lack the resources, both financial and infrastructural, to implement effective environmental education programs within PE.
- Curriculum Overload: With a focus on academic performance, PE and environmental education often take a back seat in school priorities (Bhattacharya & Chattopadhyay, 2017).
- Teacher Preparedness: A lack of training and awareness among PE teachers regarding environmental concepts hinders effective integration (Sethi, 2018).
- Limited Interdisciplinary Approach: The siloed nature of educational disciplines sometimes hampers collaboration between PE departments and environmental science departments (Sengupta, 2016).

Opportunities:

- Interdisciplinary Collaboration: Encouraging partnerships between PE departments, environmental science departments, and NGOs can create holistic programs (Das & Sen, 2017).
- Policy Support: Developing national and state-level policies that mandate the integration of environmental education into PE can provide a structured framework.
- Community Participation: Involving local communities, parents, and stakeholders in school-based environmental projects can enhance the impact (Kumar & Meena, 2019).
- Innovative Teaching Methods: Using experiential learning, outdoor activities, and project-based approaches can make environmental education in PE more engaging (Chakraborty, 2020).

The literature review underscores the importance of integrating environmental education into PE in India to promote sustainable development. While challenges such as resource constraints and curriculum overload persist, opportunities exist for collaboration, policy support, and innovative teaching methods. Moving forward, targeted teacher training programs, standardized guidelines, and community involvement can enhance the effectiveness of environmental education within PE. By nurturing environmentally conscious citizens through PE, India can make significant strides towards achieving sustainable development goals and fostering a culture of ecological stewardship.

Identification of Key Themes, Challenges, and Best Practices in Integrating Environmental Education into Physical Education (PE) Programs

Environmental education within the realm of physical education (PE) holds immense potential for fostering environmentally responsible behaviors among students while promoting holistic development. The literature review presents key themes, challenges, and best practices related to the integration of environmental education into PE programs, focusing on insights from various studies and initiatives.

1. Key Themes:

- **Holistic Development:** Several studies emphasize the role of environmental education in PE for fostering holistic development. This includes physical, mental, and environmental well-being (Larson et al., 2018). The integration of environmental themes aims to nurture students who are not only physically fit but also environmentally conscious and socially responsible (Bullock & Riecken, 2019).
- **Sustainability Awareness:** Environmental education in PE seeks to enhance students' understanding of sustainability issues. This includes topics such as climate change, biodiversity loss, and resource conservation (Kumar & Meena, 2019). Through exposure to environmental concepts, students develop a sense of stewardship towards the environment and a commitment to sustainable practices (Dhawan & Das, 2020).
- **Practical Learning and Experiential Activities:** Best practices often involve hands-on experiences and practical learning. Outdoor activities such as nature walks, gardening, and eco-friendly sports events are highlighted (Chakraborty, 2020). Experiential learning approaches in PE, such as "plogging" (combining jogging with picking up litter) or community clean-up drives, engage students directly in environmental conservation efforts (Saxena & Sharma, 2019).
- **Interdisciplinary Collaboration:** Integrating environmental education into PE often requires collaboration across disciplines. This includes partnerships between PE departments, science educators, and environmental organizations (Bhattacharya & Chattopadhyay, 2017). Cross-curricular projects and initiatives allow for a comprehensive approach, where students learn about environmental concepts through physical activities and scientific exploration (Das & Sen, 2017).

2. Challenges:

- **Limited Resources:** A common challenge identified in the literature is the lack of resources, both financial and infrastructural, for implementing environmental education in PE (Sengupta, 2016). Schools may struggle to provide outdoor spaces, equipment for eco-friendly activities, and materials for environmental projects within PE classes (Singh & Mishra, 2020).
- **Teacher Training and Awareness:** The need for teacher training programs to equip PE educators with the knowledge and skills to integrate environmental education is emphasized (Mishra & Chatterjee, 2019). Many PE teachers may not be adequately trained in environmental concepts or how to incorporate them effectively into their lessons (Sethi, 2018).
- **Curriculum Integration:** Balancing environmental education with the core objectives of PE within the curriculum poses a challenge for educators (Kumar & Meena, 2019). Integrating new themes and concepts while meeting academic standards and time constraints in PE classes requires careful planning and coordination (Chakraborty, 2020).
- **Time Constraints and Prioritization:** The limited time allocated to PE classes within school schedules can be a barrier to in-depth exploration of environmental topics (Bullock

& Riecken, 2019). Schools often prioritize academic subjects over PE and environmental education, leading to challenges in dedicating sufficient time and resources to both (Dutta & Saxena, 2018).

3. Best Practices:

- **Outdoor and Nature-Based Activities:** Studies highlight the effectiveness of outdoor activities such as nature walks, hiking, camping, and wildlife observation in fostering environmental awareness (Das & Sen, 2017). Nature-based PE lessons, where students interact directly with the environment, have been found to enhance learning outcomes and ecological understanding (Chakraborty, 2020).
- **Project-Based Learning and Eco-Clubs:** Implementing project-based learning approaches within PE, where students work on environmental projects, promotes hands-on learning and real-world application (Saxena & Sharma, 2019). Establishing Eco-Clubs or green teams within schools provides students with a platform to initiate and lead environmental initiatives, fostering a sense of ownership (Bhattacharya & Chattopadhyay, 2017).
- **Integration with Local Contexts:** Best practices often involve integrating environmental education with local contexts, such as community clean-up drives, restoration projects, or studying local flora and fauna (Kumar & Meena, 2019). This approach not only enhances students' understanding of local environmental issues but also encourages community engagement and action (Dhawan & Das, 2020).
- **Incorporation of Technology and Multimedia:** Utilizing technology tools, multimedia resources, and interactive platforms in PE classes can enhance students' engagement with environmental concepts (Mishra & Chatterjee, 2019). Virtual field trips, educational apps, and digital storytelling about environmental issues are effective methods to supplement traditional PE lessons (Sengupta, 2016).

The literature review reveals a rich landscape of key themes, challenges, and best practices in integrating environmental education into PE programs. Holistic development, sustainability awareness, practical learning, and interdisciplinary collaboration emerge as core themes. Challenges such as limited resources, teacher training, curriculum integration, and time constraints present significant hurdles.

However, best practices such as outdoor activities, project-based learning, Eco-Clubs, integration with local contexts, and the use of technology offer promising avenues for effective integration. Moving forward, addressing these challenges while leveraging best practices can create robust environmental education programs within PE, nurturing environmentally conscious and physically active individuals.

Case Studies: Successful Initiatives in Integrating Environmental Education into PE in India and Chhattisgarh State

1. "Green Schools Program" - India

The "Green Schools Program" initiated by the Center for Science and Environment (CSE) in India stands as a prominent example of successful integration of environmental education into physical education. The program aims to make schools more environmentally friendly and instill sustainability values among students. Under this initiative, schools are encouraged to adopt eco-friendly practices, including waste segregation, water conservation, and tree plantation drives. Within the framework of the Green Schools Program, physical education classes are used as platforms to promote environmental awareness and action. Students participate in eco-fitness activities such as "plogging," combining jogging with picking up litter, to keep school premises clean. Additionally, PE teachers incorporate lessons on the importance of outdoor activities for physical health and their impact on the environment. The program has led to a significant reduction in waste generation in participating schools, along with a visible improvement in the cleanliness of school grounds. Students have developed a sense of ownership and responsibility towards their environment, translating into sustainable behaviors both in and out of school. The integration of environmental education into PE has resulted in holistic learning experiences, combining physical fitness with ecological consciousness.

2. "Eco-Clubs" in Schools - Chhattisgarh State

Chhattisgarh State has implemented the establishment of "Eco-Clubs" in schools as a means to promote environmental education and sustainability among students. These Eco-Clubs often collaborate with the physical education department to organize eco-friendly sports events and activities. For example, schools host "Green Sports Days," where students participate in games and races that emphasize environmental themes. PE teachers work in tandem with Eco-Club coordinators to design obstacle courses that include challenges related to waste segregation, energy conservation, and nature appreciation. The Eco-Clubs have become platforms for hands-on learning experiences, where students actively engage in environmental projects and initiatives. Through the integration of environmental themes into PE activities, students not only improve their physical fitness but also develop a deep understanding of ecological principles. The Eco-Clubs have also led tree plantation drives, clean-up campaigns, and awareness programs within school communities, fostering a culture of sustainability.

3. "Raipur Green Marathon" - Chhattisgarh State

The "Raipur Green Marathon" organized annually in Chhattisgarh's capital city, Raipur, combines fitness with environmental conservation, drawing participation from students, educators, and the wider community. As part of the marathon event, schools encourage students to train for the run while also participating in eco-friendly activities. PE teachers incorporate discussions on the importance of preserving natural habitats and reducing carbon footprints into their training sessions. Students are encouraged to collect pledges for tree plantation or waste reduction as part of their marathon preparations. The Raipur Green Marathon has become a flagship event that

promotes both physical fitness and environmental stewardship. Students not only improve their running abilities but also gain a deeper appreciation for the environment. The event has garnered community support, with local businesses sponsoring eco-friendly prizes and tree saplings for participants. Through this integration of environmental themes into PE, the Raipur Green Marathon has become a symbol of sustainable living and active citizenship.

4. "Outdoor Education Initiatives" - Various States in India

Several states in India, including Chhattisgarh, have emphasized outdoor education as a means to integrate environmental learning with physical activity. In Chhattisgarh, schools have adopted outdoor education initiatives that involve field trips to nature reserves, national parks, and eco-friendly adventure camps. PE teachers accompany students on these trips, where they engage in activities such as trekking, birdwatching, and nature trail explorations. Lessons on local flora, fauna, and ecosystems are seamlessly integrated into these outdoor adventures. Students benefit from immersive experiences in nature, developing a strong connection to their environment. These outdoor education initiatives not only improve physical fitness but also nurture a sense of environmental stewardship. Students learn firsthand about biodiversity, conservation, and sustainable living practices. The integration of outdoor education into PE has resulted in students advocating for environmental protection measures within their schools and communities.

These case studies from India and Chhattisgarh State exemplify successful initiatives in integrating environmental education into physical education programs. Through innovative approaches such as eco-friendly sports events, Eco-Clubs, green marathons, and outdoor education, schools have been able to foster a generation of environmentally conscious and physically active individuals. The seamless integration of environmental themes into PE not only promotes sustainable behaviors but also enhances students' overall learning experiences. These examples serve as inspirations for educational institutions worldwide, showcasing the potential of PE as a vehicle for environmental education and sustainable development.

Current Status of Environmental Education in PE

In India, the integration of environmental education within Physical Education (PE) programs exhibits a varied landscape across educational institutions and states. Recognizing the significance of fostering holistic development among students, the National Policy on Education (1986) emphasized the inclusion of environmental education at all schooling levels, including PE. Educational boards like the Central Board of Secondary Education (CBSE) have provided guidelines for incorporating environmental themes into various subjects, including PE. However, the implementation of environmental education within PE remains inconsistent, with some schools successfully integrating it into their curricula while others have limited focus on this aspect. The National Curriculum Framework (2005) further underlined the necessity for a comprehensive approach to environmental education, integrating it seamlessly across subjects.

Challenges persist in the effective integration of environmental education into PE programs. One significant challenge is the inadequate training of PE teachers in environmental education methods and curriculum development. Additionally, schools often lack the necessary resources and

infrastructure to implement environmental education effectively within PE classes. The prevailing emphasis on academic achievement sometimes sidelines PE, reducing opportunities for integrating environmental topics. Another challenge lies in the absence of standardized guidelines for incorporating environmental education into PE across all schools, leading to inconsistencies in approaches and outcomes.

However, amidst these challenges, opportunities for improvement and advancement exist. Developing standardized modules or guidelines for integrating environmental education into PE could provide a structured framework for schools. Conducting regular workshops and training sessions for PE teachers would equip them with the necessary skills and knowledge to effectively integrate environmental themes. Collaborations with environmental organizations, NGOs, and government agencies offer avenues for creating engaging and impactful programs. Furthermore, awareness campaigns among school administrators, teachers, students, and parents can highlight the importance of environmental education within PE.

In Chhattisgarh State, efforts have been made to incorporate environmental education into various aspects of the curriculum, including PE. Some schools have established Eco-Clubs and initiatives to promote environmental awareness among students. The state government has launched programs such as the Harit Chhattisgarh Abhiyan to emphasize environmental conservation. Despite these positive steps, challenges such as uneven implementation across schools, infrastructure constraints for outdoor activities, and limited teacher awareness persist. Enhancing Eco-Club initiatives, updating PE curricula to include explicit references to environmental concepts, expanding outdoor education programs, and fostering community engagement present opportunities for further progress. By addressing these challenges and seizing opportunities, schools in India, including Chhattisgarh State, can create more impactful environmental education programs within the framework of PE, nurturing environmentally conscious and physically active individuals.

RESULTS

In Chhattisgarh, survey data suggests that while some schools have made efforts to include environmental topics within their Physical Education (PE) programs, the integration often appears fragmented and inconsistent. This lack of comprehensive integration poses challenges in delivering a cohesive environmental education experience to students. Limited resources and insufficient training for PE teachers emerge as significant barriers hindering the effective incorporation of environmental themes into PE classes. Without adequate support and guidance, educators may struggle to develop and implement structured environmental education modules within the PE curriculum, leading to a disjointed learning experience for students.

Despite these challenges, case study analyses highlight the positive impact of environmental education initiatives within PE programs. Schools that have dedicated efforts to integrate environmental education demonstrate tangible benefits, including increased student awareness of environmental issues and active participation in eco-friendly activities. Students engaged in these programs exhibit a deeper understanding of sustainability concepts and a heightened sense of environmental responsibility. Moreover, schools with well-structured environmental education

programs observe higher levels of student engagement and community involvement. These findings underscore the potential of robust environmental education integration within PE to not only enhance student learning but also foster a culture of environmental stewardship within school communities in Chhattisgarh. Efforts to address the challenges of fragmented integration, such as providing resources, training, and structured guidelines, can further amplify the positive impacts of environmental education initiatives within PE programs. Through these initiatives, Chhattisgarh's schools can create meaningful learning experiences that empower students to become active contributors to environmental conservation and sustainable development.

DISCUSSION

The findings from Chhattisgarh's schools regarding the integration of environmental education into Physical Education (PE) programs underscore the need for a more systematic and comprehensive approach. The data reveals that while some schools have attempted to incorporate environmental topics within PE, the integration often appears fragmented and inconsistent. This fragmented approach presents challenges in delivering a cohesive environmental education experience to students. Lack of teacher training and inadequate resources emerge as primary obstacles that need to be addressed through policy interventions and strategic planning. Without proper support and guidance, educators may find it challenging to develop structured environmental education modules within the PE curriculum, hindering the effectiveness of these initiatives.

Successful case studies within the region highlight the importance of community engagement in sustaining environmental education initiatives within PE programs. These initiatives demonstrate that partnerships with local organizations, government agencies, and NGOs can significantly enhance the impact of PE programs on sustainable development. Community involvement not only enriches the learning experience for students but also creates a network of support that fosters long-term sustainability of environmental education efforts. Collaborative projects and activities involving the local community can provide students with practical experiences and real-world applications of environmental concepts learned in PE.

From a policy perspective, the findings suggest several recommendations to enhance the integration of environmental education into PE in Chhattisgarh's schools. Developing state-level guidelines for the systematic inclusion of environmental education within PE curricula can provide a structured framework for educators. Advocacy efforts for funding allocations and targeted teacher training programs are crucial to support the effective implementation of environmental education initiatives. By investing in the professional development of PE teachers and providing them with the necessary resources, schools can strengthen the integration of environmental topics into their curricula.

Moreover, the discussion emphasizes the holistic development of students through the integration of environmental education into PE. Beyond raising awareness of environmental issues, these initiatives can cultivate essential skills such as critical thinking, problem-solving, and teamwork among students. By engaging in eco-friendly activities, students develop a deeper understanding of sustainability principles and become actively involved in environmental conservation efforts.

Ultimately, integrating environmental topics into PE not only contributes to the academic growth of students but also nurtures them as responsible and informed citizens committed to sustainable practices and environmental stewardship.

CONCLUSION

The findings of this research underscore the potential of integrating environmental education into physical education and sports science programs in India, particularly in Chhattisgarh State. While challenges such as limited resources and fragmented integration exist, successful case studies demonstrate the positive impact of environmental education on students and communities. Moving forward, policy interventions, teacher training programs, and community partnerships are crucial to fostering a culture of sustainability within PE curricula. By equipping students with knowledge, skills, and a sense of responsibility towards the environment, India and Chhattisgarh can contribute significantly to achieving sustainable development goals while nurturing a generation of environmentally conscious citizens.

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Smart Technologies for a Greener Tomorrow: IoT and AI in Environmental Monitoring

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ABSTRACT

"Go green, breathe clean"

Introduction: Protecting our planet starts with 'I': The Earth is the only planet where we can live and rest. Each one of us need to save the earth to save the hope of life in the future. We need to **"Go Green' to keep the earth clean"**. Modern environmental technology has enabled us to capture naturally occurring energy which reflects a highly positive impact of technology on the environment.

- **Technology: beneficial to the environment:** To combat environmental pressures, green energy production is one of the most significant positive impacts of technology on the environment.
- **Technology: Helps protect the environment:** Localised sensor networks keep track of energy and water usage to reduce waste, while air pollution trackers warn the public about levels of harmful elements in the atmosphere.
- **The Role of I.T in the environment:** Information technology plays a significant role in environmental health and sanitation by providing tools and systems that can help monitor, track, and improve various aspects.
- **SMART Technology & environment:** SMART Technology typically involves low-energy devices with lower energy usage, reducing their carbon which is a good choice for an environmentally conscious consumer.
- **IOT in environmental monitoring:** IOT-based systems can be used to detect any changes in gas levels that could indicate a potential safety hazard or environmental issue which can help detect any hazardous gases and take immediate decisions around emissions reduction.

The aim: This research paper aims in creating awareness among people about environmental protection, honouring and protecting the planet Earth, by using smart technologies and simple tips like: Reducing, reusing, and recycling, educating, conserving water, shopping wisely and planting trees, hoping for a greener tomorrow with easy access at finger tips, from anywhere without risking health.

Results: We, Dr. Caroline Satur and Dr. Sunil Gouraha, being Nature lovers, who celebrate our green Planet's birthday any time, followed the motto: “Go Green”, among students, together, by being green, staying clean, thinking green, living green, being clean, going green, buying green, saving green and keeping our planet evergreen which brought a huge difference!

Conclusion: IOT has the power to pave the way for a greener tomorrow by enhancing energy efficiency, resource management, environmental protection, and promoting a circular economy. So, **"Green is the fresh emblem of well-founded hopes”.**

Key-words: Environmentally conscious, smart technologies, greener tomorrow, environmental monitoring, environmental technology, Nature, environmental health, educating.

INTRODUCTION

"Green is the fresh emblem of well-founded hopes”

With the growth of global problems like pollution and environmental intoxication, poverty and starvation, climate changes, extensive deforestation, depletion of mineral and organic resources, overconsumption of non-renewable resources, and others, the demand for development using sustainable technology has been increasing. Energy demand evolves and the world’s energy systems undergo an expeditious transition due to technological shifts, regulations, and consumer preferences.

The 2021 year of the COVID-19 pandemic has been a breakthrough in the global energy landscape. Energy efficiency is triggered by technological advancements and fuel switching will cause the decline of energy intensity.

World Earth Day is observed on **22nd April** to create awareness among people about environmental protection. The concept of Earth Day was first introduced by peace activist John McConnell at a UNESCO Conference in **1969**. The primary purpose of suggesting the celebration of this day was to honour and protect the planet Earth and take non-violence measures to maintain peace and prosperity on it to make it a better place to live.

World Environment Day was first celebrated in Switzerland on **June 5, 1973** with the slogan **“Only One Earth”.** The date was chosen by the United Nations to honour the 1972 UN Conference on the Human Environment, a landmark summit in conservation and environmental awareness.

Protecting our planet starts with ‘I’: The Earth is the only planet where we can live and rest. Each one of us need to save the earth to save the hope of life in the future. We need to “Go Green’ to keep the earth clean”. Modern environmental technology has enabled us to capture naturally occurring energy which reflects a highly positive impact of technology on the environment.

IoT environmental monitoring

IoT environmental monitoring is a process that uses Internet of Things (IoT) technology to collect data about the environment, such as air quality, temperature, and humidity levels.

This data can then be analysed to better understand the indoor and outdoor environment and make informed decisions about how to reduce the impact of negative aspects of the local environment on business, etc. Alternatively, it can be used to change business activities to help protect the planet or the local community.

The benefits of using IoT-based environmental monitoring:

- **Improved understanding of the environment via data:** With real-time data feeds being supplied by remotely deployed IoT sensors, organisations can better understand, quantify and qualify the environment. Targeted actions can be taken to reduce environmental impact or to spot problems, such as excessive CO2, noise or airborne chemicals as they occur.
- **Improved efficiency:** With real-time data, organisations can identify and address any problems long before they become more serious. By employing warning alarms, businesses can be more reactive and proactive. This can result in a better working environment, cost savings and less downtime.
- **Increased sustainability**: IoT environmental monitoring systems help organisations identify areas where they can reduce their areas of environmental stress for employees and stakeholders, thus helping them be more sustainable in the long term.
- **Business Growth:** Companies often need to comply with environmental standards in order to assure their customers that they are a progressive organisation whose values chime and adhere to their own policies and direction of travel.

The four basic steps of environmental monitoring:

1) Observation (To monitor Environment and Collect Data): The first step in the environmental monitoring process is to observe and collect data which involves using sensors or other IoT devices to measure factors such as air quality, temperature, and humidity levels. These connected IoT devices gather data about the environment and transmit it to a central hub. From here, the data can be reviewed in real-time or used for further analysis off line.

2) Analysis (To measure Data): The next step is to analyse the data collected by IoT devices. This includes looking at trends over time, identifying areas of concern, and any correlations between environmental variables, time of day, behaviours and the relationships between indoor and outdoor metrics. IoT sensing devices pick out key points of the data that indicate everything from chemical and water leaks to air pollution levels. This data analysis can help businesses measure their environmental footprint and make informed decisions about how to reduce their environmental impact.

3) Storage (To catalogue Data): Once the data has been analysed, it needs to be stored so that it can be accessed in the future. IoT environmental monitoring systems make this easy by storing the data in a secure cloud-based database, allowing businesses to access the data whenever they need it and analyse how their environmental impact is changing over time. Global databases, such as the Microsoft Planetary Computer, catalogue enormous quantities of environmental data from around the world – although not every cloud database is that large.

4) Action (To provide Actionable Insights from Data and Analysis): Finally, businesses need to be able to take action based on the data that has been gathered and analysed. IoT-enabled environmental monitoring systems can provide insights into how businesses can best reduce their environmental impact, such as by using renewable energy sources or introducing water conservation measures. These actionable insights may involve changing operational processes, implementing new technologies, or even making changes to their overall business strategy.

The various devices used for environmental monitoring:

Environmental monitoring devices are of different shapes and sizes, from small handheld devices to larger IoT-enabled systems. The most common types are:

- **Sensors:** These measure air quality, temperature, humidity, light levels and other factors. They can also be used to detect chemical or water leaks.
- **Data Loggers:** These record and store data over a set period of time, which can be used to measure changes in the environment over time or detect any sudden changes.
- **GIS (Geographic Information System):** This combines mapping technology with real-time data to provide detailed visualisations of environmental conditions.
- **Remote Monitoring Systems:** These systems allow users to monitor environmental conditions remotely and in real-time, providing timely insights into the state of their environment.
- **Drone-based Systems:** Drones can be used to collect aerial data and conduct surveillance of an environment. This helps businesses monitor for potential problems or hazards, such as oil spills or illegal logging.
- **IoT-Enabled Systems:** IoT-Enabled Systems collect data from multiple sources and provide a comprehensive view of the environment. These systems are used to measure long-term trends, identify areas of concern, and monitor environmental changes over time.

IoT-enabled environmental monitoring systems are increasingly popular as they provide businesses with the ability to collect and analyse large amounts of data quickly and accurately. This can help inform decisions around reducing their environmental footprint and achieving sustainability goals.

By understanding how their environment is changing, businesses can better prepare for future challenges and ensure that they are acting responsibly and sustainably. With the help of IoT-based environmental monitoring, businesses can make informed decisions about how best to reduce their environmental impact, helping them to operate more efficiently and sustainably in the future.

Uses Cases of IoT Environment Monitoring:

The three main types of environmental monitoring are soil, atmosphere and water: IoT environment monitoring is used in a wide range of industries, from agriculture and forestry to urban planning, energy generation and distribution.

In the agricultural sector, IoT-based systems are used to monitor crops, soil health, water quality and weather conditions. This information can be used to inform decisions about pest control, fertilisation, irrigation and land management.

IoT-based systems in the energy sector are used to monitor emissions, air quality and weather conditions. Thus, helping public bodies, environmental agencies and companies to monitor and take action to reduce negative environmental impact. Meanwhile, in urban planning, IoT-based systems can be used to monitor traffic congestion or air pollution levels in smart cities. This data can be used to inform decisions about how to reduce the environmental impacts of future urban development.

The six examples of Use Cases of IoT Environmental Monitoring:

1) Air-Quality Monitoring: Industrial processes, like burning fuel, emit air pollutants and organic compounds that can negatively impact human health and the environment.

- Whether it's from industrial processes, car exhausts or herds of cattle, the carbon monoxide, hydrocarbons and greenhouse gases emitted must be monitored to ensure good air quality and to protect the wider environment.
- Indoor spaces are also subject to pollutants. For example, man-made fibres and materials emit volatile organic compounds (VOCs) over time which are detrimental to human health. Excessive dust and airborne particles are not good for respiratory health and can affect those with COPD and contain allergens for those sensitive to them.
- The variance between indoor and outdoor air quality is also important. For example, opening a window to alleviate CO2 levels can cause more problems if outdoor air quality pollution is considered more harmful.
- IoT-based systems can be used to monitor air quality in order to detect any changes or anomalies that could indicate an issue. This data can be used to identify areas with poor air quality, inform decisions around emissions reduction and inform the development of more sustainable processes.

2) Water-Quality Monitoring: Water quality is an important factor in determining the overall health of aquatic ecosystems and human health for those who inevitably come into contact. IoT-based water quality monitoring systems can be used to control the contamination levels of water sources and identify any potential pollutants that could be harmful to people or the environment. This data can then be used to help manage water resources more effectively, inform decisions around pollution mitigation and inform the development of sustainable strategies for water management. This data can also be passed on to monitoring authorities for wider consideration and policy formation.

From municipal water treatment monitoring and drinking water quality monitoring to agricultural irrigation monitoring and control, IoT-based systems can provide valuable information to ensure the quality of water sources. Advanced smart water monitoring systems can even use IoT technology to monitor water flow rates and even the presence and distribution of water leaks.

3) Energy Monitoring: Considering there is a limited amount of global energy resources, measures must be taken to ensure effective conservation. IoT-based energy monitoring systems can be used to track energy usage, detect any anomalies or changes that could indicate an issue and inform decisions around energy conservation. This is particularly prevalent within the energy distribution systems and through measurements at points of consumption, most notably through the use of smart meters.

- Utilising this data can help prevent spikes in energy usage, stabilise the power grid, and reduce the volume of fossil fuels used in homes and businesses. This data can also be used to measure air quality and identify potential areas for improvement in terms of sustainability.
- By recording energy consumption on a real-time basis, businesses can gain valuable insights into their energy usage and make informed decisions around emissions reduction.

4) Commercial Farming: The agricultural sector is one of the most energy-intensive industries, with commercial farming operations requiring huge amounts of energy to power irrigation systems, lighting and cooling. IoT-based systems can be used to monitor soil health, crop conditions and water quality in order to inform decisions around pest control, fertilisation, irrigation and land management. This data can also be used to inform decisions around energy efficiency and help reduce the environmental impacts of agricultural operations. Using IoT-based environmental monitoring as an essential aspect of modern sustainable farming, it enables businesses to monitor and manage environmental conditions on a continuous basis. Not only can this data be used to inform decisions around emissions reduction and sustainability, but it can help farms reduce their environmental impacts while maintaining profitability. Other uses for environmental monitoring within commercial farming include tracking the health of livestock, predicting weather patterns and tracking soil temperature.

5) Toxic Gas Detection: The presence of harmful gases can be extremely dangerous to people's health and the environment. As such, the detection and monitoring of these gases is highly important. IoT-based systems can be used to detect any changes in gas levels that could indicate a potential safety hazard or environmental issue. Predominantly used to monitor H2S or CO in a refinery or petrochemical workplace, IoT-based systems can help detect any hazardous gases and inform decisions around emissions reduction. These systems are also used in parking garages, enclosed workspaces, industrial sites and mining operations to monitor for the presence of carbon monoxide and ensure safety. IoT connectivity can help systems quickly identify any dangerous changes in gas levels and provide critical alerts to launch tasks, such as shutting down valves or entire systems.

6) Animal Conservation: The conservation of endangered species is a highly important issue and one that can be addressed by utilising IoT-based technologies. Most national parks around the globe use IoT-based environmental monitoring to intelligently track the animals and their movements, allowing park rangers to effectively monitor the park. IoT sensors and cameras can be used to monitor animal movement, detect changes in behaviour or any potential threats, and inform decisions around wildlife protection. Data collected from this type of monitoring can provide valuable insights into animal behaviour and inform decisions around conservation management, habitat restoration and protection. Not only can these systems help ensure the safety of endangered species, but they can also be used to monitor the impact of human activities on wildlife.

The Internet of Things can provide insights into how humans are impacting the environment and help inform decisions around emissions reduction and wildlife protection. But one must ensure that he/she chooses the right SIM card for IoT purposes.

Artificial Intelligence and Iot Improves Environmental Sustainability:

When we talk about environmental sustainability, we often refer to the negative impact of technologies on the world around us. Yet if we dwell more on the use than the potential of specific innovations, we see that it all depends on how we choose to act. In fact, among the innovations of the Internet of Things and Artificial Intelligence, several can help companies increase the levels of environmental sustainability of their processes if used correctly.

Here's how Artificial Intelligence and IoT can improve environmental sustainability:

Virginijus Sinkevičius, Commissioner for Environment, Oceans, and Fisheries, said: "There is only one planet Earth, yet between now and 2050, we will consume resources as if we had three planets. The new plan will make circularity the norm in our lives and accelerate the green transition of our economy. Future-oriented actions will create business and job opportunities, enshrine new rights for European consumers, harness innovation and digitization, and ensure that nothing goes to waste, as it does in nature."

Artificial Intelligence and IoT for pollution reduction:

Pollution is one of the main factors of environmental degradation. Responsibility is linked to factory emissions, pesticide use, and intensive livestock farming.

The Internet of Things can offer support for pollution reduction through connected sensors. Their function is to measure values and monitor trends. IoT sensors will need to be placed at emission points or at high risk of pollution to capture data adequately. Suppose the data collected by the sensors are passed to an AI software from their analysis. In that case, it will be possible to create predictive or prescriptive models that will serve to identify in advance the deviations in the monitored values. Detecting such variations will allow corrective actions to be put in place before the process gets out of control.

There are various forms of pollution and, consequently, various possible applications, but we can explain the subsoil contamination. Pesticides and intensive crops poison the soil, and part of these harmful substances reach the groundwater modifying its natural balance.

With the use of connected drones equipped with Edge Computing and Artificial Intelligence devices, it is possible to do, for example, intelligent monitoring of crops. That is, you can monitor the land through computer vision. If the drone's artificial intelligence has been trained to recognise anomalies when the drone arrives at a spot that presents a problem, it will stop and send a signal to the central office. This way, we can monitor large areas and save crops before we risk losing them.

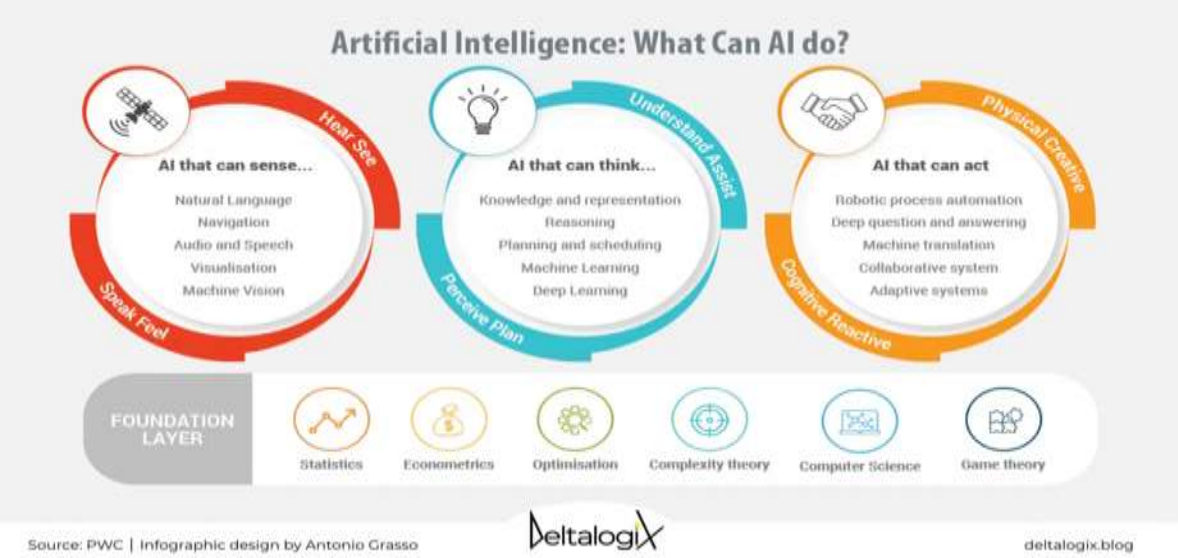
Artificial Intelligence and Iot for Environmental Protection:

The combined use of Internet of Things technologies and Artificial Intelligence does not only act in the final stage of production processes. The real potential lies in the predictive phase. In fact, thanks to innovations such as computer vision, it is possible to protect endangered forests and animals through constant monitoring. In forests, it will be sufficient to install cameras that warn of a possible fire. While for animals, you can connect, in a non-invasive way, a device that monitors the species by tracking their movements. The constant recording will trigger an alarm when the animals are in places that could threaten their health.

Artificial Intelligence and IoT for waste reduction:

- When it comes to waste reduction, connected sensor technology has already shown its potential. Just think of faucets with proximity sensors that stop water flow after hand washing or lights that turn on as you pass by. The next challenge will be to recycle devices, waste, and energy produced. A continuous recycling stream will require collecting usage data from users' connected devices. Companies will then be able to take action before the item or service becomes waste.
- Every year millions of electronic devices become waste that damages the environment. Large multinational companies have already started a path to reduce waste by working with recyclable materials and monitoring devices even when they are in the hands of consumers. In this way, it will be possible to replace the device before it breaks and recondition it giving it a new life.
- The same goes for energy. The attempt to spread the Smart Grid also serves to minimise energy waste. Thanks to the union between the connected sensors of IoT and the flexibility of Artificial Intelligence, a sort of energy sharing is possible.
- Technologies and progress alone are not enough. Climate change shows how we are in an emergency phase in which we all need to work together: institutions need to understand that stricter regulations are needed; entrepreneurs need to get serious about activities that go beyond economic return, and individuals need to understand that:

Gandhi- "A better planet is a dream that begins to come true when each of us decides to improve ourselves."



The Ability of Artificial Intelligence: Artificial Intelligence Senses

Words, thoughts, and actions are concepts that, in Artificial Intelligence, belong to the reasoning sphere more than to the emotional one. When we talk about a probabilistic system, we have to imagine software that, so programmed, could interpret our emotions. But feelings cannot be translated into bits and bytes.

- **The ability to Hear:** Artificial Intelligence listens and responds using our language. Yes, thanks to software that can understand natural language and thanks to technologies that allow the recording of sounds. However, this does not mean that it will be able to provide us with answers other than those built into the software's programming.
- **The ability to See:** And more, can Artificial Intelligence see? It depends. The ability to record images and turn a physical space into a digital one is the closest virtual aspect to human sight. These abilities fall under computer vision and are applied through technologies such as video surveillance.
- **The ability to Think:** How does Artificial Intelligence emulate human thinking? Through neural networks and the use of algorithms typical of deep learning. However, we are still far from obtaining a result as complex as that resulting from human reasoning.

Artificial Intelligence simulated reasoning works like deductive thinking introduced by Aristotle:

"All men are mortal, Socrates is a man, and therefore Socrates is mortal."

In this sentence, you will start from true premises and true rules and get the correct result. In the case of AI, if we enter verified data and train the software correctly, we will get exact results.

AI is based on a probabilistic system and a computational model. The probability of correct answers increases as more data is entered and as the training path improves.

Then AI can be used to simulate the following cognitive activities:

- Schedule or plan actions such as those of operating and maintaining machinery.
- Graphically represent data resulting from simple reasoning. The data analysis implemented by the marketing department with specific software is a perfect example of how time and resources are optimised with AI.
- Artificial Intelligence can see, hear and act by simulating human capabilities but only up to a point.

The ability to Act: In companies, the combination of Artificial Intelligence and Robotic Process Automation (RPA) generates a radical change. It improves process efficiency, optimises time and resources, and reduces the risk of human error.

The result of the actions required of a software equipped with Artificial Intelligence can be of the following types:

- descriptive: it scans and lists a series of actions, documents, and/or data in general,
- predictive: it predicts what might happen in a medium to long time based on the data it analyses,
- prescriptive: starting from standard models related to the activity we want to analyse, the software can tell us what could still be done to improve performance.

Digitizing the entire business system with the use of programs that leverage automation and AI allows, for example, to:

- achieve constant interaction between departments working on the same process but at different stages;
- automate activities that required dedicated resources and high time scales, as well as the risk of making mistakes in repetition;
- get answers from processing huge amounts of complex data to manage.

THE AIM: This research paper aims in creating awareness among people about environmental protection, honouring and protecting the planet Earth, by using smart technologies and simple tips like: Reducing, reusing, and recycling, educating, conserving water, shopping wisely and planting

trees, hoping for a greener tomorrow, from anywhere without risking health. So, **"Green is the fresh emblem of well-founded hopes"**

RESULTS

We, Dr. Caroline Satur and Dr. Sunil Gouraha, being Nature lovers, who celebrate our green Planet's birthday any time, followed the motto: "Go Green", among students, together, by being green, staying clean, thinking green, living green, being clean, going green, buying green, saving green and keeping our planet evergreen which brought a huge difference! In this paper, we surveyed and identified the most critical technologies used for green IoT which resulted in keeping our environment and society smarter and greener, in which ICT revolution (i.e., FRID, WSN, M2M, communication network, Internet, DC, and CC) had qualitatively augmented the capability for greening IoT. Artificial Intelligence and IoT technologies, when used together improved environmental sustainability by reducing waste, pollution and protecting the environment.

SUGGESTIONS:

We suggest:

- To look at digital as a set of indispensable tools to grow business and further enhance our cognitive capabilities.
- Save the earth to save the hope of life in the future.
- Earth day is our Green Planet's Birthday. To celebrate it every day.
- Earth is the only planet where we can live and rest. To use its resources but never waste them.

CONCLUSION

The IoT provides insights into how humans are impacting the environment and helps inform decisions around emissions reduction and wildlife protection. IOT has the power to pave the way for a greener tomorrow by enhancing energy efficiency, resource management, environmental protection, and promoting a circular economy. The tremendous technology development in the 21st century has many advantages. The growth of technology demands for high energy accompanied with intention e-waste and hazardous emissions. Based on the critical factors of ICT technologies, the things around us will become smarter to perform specific tasks autonomously, rendering of the new type of green communication between human and things and also among things themselves, where bandwidth utilisation is maximised and hazardous emission mitigated, and power consumption is reduced optimally.

Gandhi- "A better planet is a dream that begins to come true when each of us decides to improve ourselves."

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A Review *on* Fuzzy and Intuitionistic Fuzzy Settings of Projective and Injective Module

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Abstract- this review paper presents a survey report on the fuzzification of dual pairs of the module in fuzzy and intuitionistic fuzzy sense and also opens the research gap in the field of fuzzification of dual pairs of the module

1. Introduction

Here, we mention only a few pairs studied so far by different mathematicians. These dual pairs are-

- Projective module and injective module.
- Projective cover and injective envelope.
- M-Projective module and M-Injective module.
- Quasi Projective module and Quasi Injective module.
- Quasi M-Projective module and Quasi M-Injective module.
- Pseudo Projective module and Pseudo Injective module.
- Pseudo M- Projective module and Pseudo M- Injective module.
- Weakly Projective module and Weakly Injective module.
- (P,M) – Projective module and (M, P) – Injective module.
- Small module and Co- small module.
- Radical of a module and Co–radical of a module.
- Small generated module and Co – small cogenerated module
- Generators and Co- generators.
- Noetherian module and Artinian module.
- Flat module and Co-flat module.
- Hereditary module and Co – hereditary module.
- Faithful module and Co- faithful module.
- M-Generator and M-Co generator.

A crisp set is defined in such a way that a clear distinction exists between the elements and non-elements in a given universal set. Sometimes real situations are nondeterministic and they can't be understood precisely. Vagueness or imprecision can't be described as true or false. Lofti A. Zadeh[42] 1965 introduced the notion of the fuzzy set (FS) to describe vagueness mathematically

by assigning to each possible element in the universal set a value in [0,1] representing its grade of membership in the fuzzy set. A larger grade denotes a higher degree of set membership. Mathematically fuzzy set on X is a mapping A: X—›[0,1].

J.A.Gogun[11] in 1967 introduced the notion of fuzzy set with a lattice as the membership set. This set is known as L- fuzzy set.

Fuzzy set theory has greater applications than, mathematics-based classical set. It has been applied in mathematics, computer science, neural network, etc. In a very short time, it was applied in algebra. The first paper on the fuzzy group was published by A. Rosenfeld [25] in 1971. The book of Moderson and Malik [20] gives an account of the rapid growth of fuzzy algebraic concepts. In this sequence, fuzzy module theory has been developed by many mathematicians. Consequently, some dual pairs of the module are fuzzified.

After the introduction of the fuzzy set, many new concepts of sets like Soft set, Rough set, and Pythagorean fuzzy set were proposed by many mathematicians but a very important generalization, the intuitionistic fuzzy set (IFS) of the fuzzy set was introduced by K.T.Atanassov [1] in 1986. An intuitionistic fuzzy set (IFS) A in X is an object

$$A=\{<x,\mu_A(x),\nu_A(x>:x\in X\},$$

where function μ_A:X—›[0,1], ν_A:X—›[0,1] denotes the degree of membership and non-membership respectively of each $x\in X$ and $0\leq\mu_A(x)+\nu_A(x)\leq 1$ for all $x\in X$.

Among lots of branches of pure and applied mathematics, abstract algebra was one of the first few subjects where research was carried out using the notion of IFS. IFS group theory was developed by R. Biswas [5]. In this context, IFS module theory as well as dual pair of IFS modules were developed.

It is important to discuss the development of dual pair of FS module and IFS module as well as to open the research gap in this area.

2 Discussion

2.1 Development of dual pair of module - A statement P about a class of modules and module homomorphisms then its dual P* is the statement about the same class of modules and module homomorphisms obtained by reversing the direction of each homomorphism and replacing each composite fog of module homomorphism by gof. In this context, The pairs “Projective module” and “InjectiveModule” was investigated by Cartan et al [6]. Azumaya et al [3] also discussed this dual concept. The concept of “Quasi Projective module” and “Quasi Injective module” was studied by Faith et al [8] ; Wu et al [41]. “Quasi M-Projective module” and “Quasi M-Injective module” was studied by Singh et al [36] . Singh et al [37] also studied “Pure M-Projective” and “Pure M-Injective”. The dual concepts “Weakly Projective” and “Weakly injective” was exposed by Jain et al [16]. The dual pair “(P,M)-Projective module” and “(M,P)-Injective module” has been studied by Shamsuddin[34]. Leonard [18] studied dual concepts “Small module” and “Co-small module”. An extensive study of this pair was done by Rayer[24].

Pareigis[22] studied the concepts of “Radical of a module and Co-radical of a module”. The dual concepts “Generators” and “Co-generators” were studied by Kasch et al [17]. Matlis [19] studied “Flat module” and “Co-flat module”. Shrikhande[35] studied the dual concepts of "Hereditary module" and "Co-hereditary module". The dual concepts "Faithful module" and "Co-faith module" were studied by Beachy [4].

2.2 Review of Dual pairs of the module in FS settings- After the introduction of fuzzy sets, the literature on various fuzzy algebraic concepts has been growing rapidly. In particular, Negoita and Ralescu[21] introduced and examined the notion of a fuzzy submodule of a module. Zahedi and Ameri[43] explored fuzzy projectivity. Paul Isaac [13] introduced projective L-module Fernandz[9,10] introduced the notion of fuzzy G-module and fuzzy G-module projectivity.

2.3 Review of Dual pairs of the module in IFS settings- As an important extension of fuzzy set theory, Atanassov [1,2] introduced and developed the theory of intuitionistic fuzzy sets.Stoeva andAtanassov [38] defined intuitionistic L-Fuzzy set. Using the Atanassov’sidea , Biswas [5] established the intuitionistic fuzzification of the concept of a subgroup of a group. Later on, many mathematicians worked on it and introduced the notion of intuitionistic fuzzy subring, intuitionistic fuzzy submodule etc, See [12,15,23,26]. Sharma and Kaur[27] introduced the notion of intuitionistic fuzzy G- modules and studied many properties in [28,29,30,31]. Sharma and Kaur[32,33] introduced intuitionistic fuzzy G- module projectivity and intuitionistic fuzzy G-module injectivity.Sharma [39] introduced Q-intuitionistic L-Fuzzy submodule and intuitionistic L-Fuzzy prime submodule by Sharma and Kanchan [40].

3 Conclusion

After reviewing the literature on dual pair of modules and the development of this concept in FS and IFS settings we find some research gaps in the field of IF and IFS settings of dual pairs of Projective cover and injective envelop,.M-Projective module and M-Injective module,Quasi Projective module and Quasi Injective module,Quasi M-Projective module and Quasi M-Injective module, Pseudo Projective module and Pseudo Injective module,Pseudo M- Projective module and Pseudo M- Injective module, Weakly Projective module and Weakly Injective module,(P,M) – Projective module and (M, P) – Injective module,Small module and Co- small module,Radical of a module and Co–radical of a module, Small generated module and Co – small cogenerated module, Generators and Co- generators,Noetherian module and Artinian module,Flat module and Co-flat module,Hereditary module and Co – hereditary module and faithful module and Co-faithful module. . Algebra, Fuzzy set, and intuitionistic fuzzy set plays a significant part in the development of modern science and technology. We expect that the research in this field will also be useful in the development of modern science and technology and will open new dimensions for researchers.

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Wireless Sensor Network for Environmental and Agriculture Perspective

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Abstract

It is said that the twenty first century is the era of Information and Technology. In this era we do all things which we were only imagine before some years past. From the last two decades Wireless sensor network playing a vital role to complete these imaginations in all fields such as educations, environment monitoring, agriculture sector, defense, health monitoring, commercial sector etc.

Wireless sensor network is a spatially distributed autonomous device that composed by a huge numbers of nodes which are deployed in close proximity to the phenomena to be monitored. India holds first rank in population in the world. With increasing population, it is very difficult task to maintaining a healthy environment. Wireless sensor network can provide information about environment to us at very low cost. It can provide various information about environment such as broadcasting data gathering. Computing to the administrator in any easy way. But in the way of proper monitoring there are various difficulties faced by administrator like limited battery life, coverage area, nodes deployment, overhearing etc. On the other hand India is an agriculture country. But due to lack of agricultural related information such as climate, soil etc. Farmers are neither getting proper output nor getting as much profit from agriculture. Through general knowledge of the utility of WSNs farmers can get rid of this problem.

The aim of present paper to address the phenomena of Wireless sensor network and describes its application parts for environment perspectives along with implementation in agriculture fields. So that it can become user friendly and helps us to provide a healthy environment and can increase the production in agricultural industry.

Keywords: WSN, Agriculture, Environment, Information-technology.

Introduction:-

Agriculture has play an essential role in the progress of human civilization. Outstanding to the enlarged demand of food additional labors and extraordinary techniques are being industrial to multiply food production. Contemporary agriculture requires a bigger production of food to meet the needs of the huge worldwide population. To attain this goal, new technologies and solutions are being functional in agriculture to supply an most favorable alternative for collecting and processing information to improve productivity. In adding together, the disturbing climate change and water insufficiency stipulate new and improved methods for contemporary agricultural exploitations. In this sense, technologies such as everywhere computing, wireless sensor network (WSN), radio frequency modules, cloud computing, Internet of Things (IoT), satellite monitoring, remote sensing etc are becoming gradually more popular. The increase of wireless sensor networks has encouraged a new track in agriculture. Recently WSNs have been generally applied in a variety of agricultural applications. Several articles that execute a state of the evaluation on the field of WSNs in agriculture have been selected[3,7]

Sustainability:

Sustainability means meeting our own needs without compromise the capability of future generations to meet their own requirements, human, social, economic and environmental are known as the four pillars of sustainability.

Sustainable development:

Sustainable development is essential as it saves national budget, fulfils the needs of people, conserve national resources, helps in the coordination between the national resources and people and conserve national resources for future production.

Mathematical models and methods:

Mathematical models and methods are used broadly in the natural science, engineering discipline and social science. Mathematical modeling is the process of formulating and improving a model to stand for the data and to solve real world problems. Sustainable management practice meets the needs of the present, without compromising the capability of future generations to meet their own needs [6]. Mathematical modeling plays useful roles towards sustainable development in arriving the understanding, forecast and control of development process. For sustainable management practice, it is necessary to manufacture comprehensive mathematical models through soft system methodology.

The needs Mathematical modeling:

The mathematical modeling a predictable as effective tool that could help examine economic, environmental and ecological impact of different pollution control and resources

protection actions, and thus aid planners or decision makers in formulating cost effective management politics. Managing for sustainable raise a suit of mathematical problems, from the dynamics of population development and population interactions, to the growth of sustainable energy sources to the formation of management strategy for dealing with public goods and common-pool resources [4,6].

Classification of the models are:

Group of models	Classification	Criterion of classification
I	Mechanistic	Based on mechanism/underlying phenomena
	Empirical	Based on input-output, trials or experiments
II	Stochastic	Contains Show components that are probabilistic nature
	Deterministic	Based on cause impact analysis
III	Lumped Parameters	Dependent factors not work of uncommon position
	Distributed parameters	Dependent factors are a work of special
IV	Linear	Super position standard applies
	Nonlinear	Super position rule does not applies
V	Continuous	Dependent factor characterized over persistent space time
	Discrete	Only characterized for discrete values of time/or space
	Hybrid	Containing ceaseless and discrete behavior

Sensing Technologies

Sensing technologies experience volatile creativity, activities, exciting applications, and innovations in the agricultural sector. Various technological firms and entrepreneurs show their variety and enthusiasm to enter a enormous field of agriculture. Here we discuss some sensing technologies along with their general products and their sensory role in the agricultural sector. Table 1 provides a review on different agricultural sensing technologies

Table 1 Agricultural sensors classification

Class	Type	Classification
Chemical sensors	pH sensor	Soil and water quality monitoring
	Biosensor	Glucose and acids
	Gas sensor	Pollution and air quality
Physical sensors	Temperature sensor	Soil plant, crops and environment
	Humidity sensor	Soil and environment
	Watermark sensor	Soil humidity
	Rain sensor	Environmental monitoring
	Electrical conductivity	Soil monitoring
	Solar radiation	Crops and plants
	Underwater sensor	Salinity, solvents and quality
	Underground sensor	Soil compaction and moisture
Mechanical sensor	Pest detector	Pest and bug detection
	Pressure sensor	Soil compaction
	Vibration sensor	Soil and atmosphere
	Wind sensor	Speed and direction of air
	Motion sensor	Environmental monitoring
	Water flow sensor	Irrigation
	Water level sensor	Ground and underground

Smart Pot

Parrot pot has introduce a smart pot, particularly for inside farming inside an in-situ Bluetooth communication module. This smart pot is a appropriate element for greenhouse and urban farming a variety of sensors are entrenched in this smart pot, for example fertilizer levels, which help in continuous monitoring of the plants. [8]

Future directions

Sensor network technology is increasing day by day ,and many platforms and tools are introduce to reduce and reduce human communications and contributions. The research work can be improved by using some of the following fields

Wireless Platform

We can apply different sensor network platforms, such as, wasp mote platform [2], Libelium platform [2], Fleck platform [9], and other platforms [5] [1] for future correspondence

Sensors

There are different other sensing devices like physical sensors (humidity sensor, soil moisture, watermark sensor), Mechanical sensor (flow sensor, injectors and valves) and chemical sensors (biosensor, sensor) available in the market [10]

Conclusion

Mathematical modeling the stage a very important role in sustainable management put into practice or process in all aspect such as social, environmental and economical studies. The sustainability of planet Earth depends on Mathematical science. In this paper we presented different sensing technologies that enable smart agriculture.

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Strategies for Sustainable Development: Navigating a Path Towards a Resilient Future

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Abstract:

Sustainable development, an imperative global goal, encompasses the integration of economic, social, and environmental considerations to meet the needs of the present without compromising the ability of future generations to meet their own needs. International agreements, national policies, and local governance plays crucial role in fostering a conducive environment for sustainable practices. Emphasis is placed on the need for collaboration between governments, non-governmental organizations, and the private sector to implement and monitor sustainable development goals. The technological innovations are important as key drivers of sustainability. Renewable energy, eco-friendly manufacturing processes, and smart technologies that contribute to resource efficiency and environmental conservation are important factors for sustainability. Additionally, the potential of emerging technologies, such as artificial intelligence and blockchain, are also important in enhancing the effectiveness of sustainable development strategies. Sustainable development emphasizes the significance of empowering marginalized communities, ensuring gender equality, and fostering inclusive economic growth. Sustainable business practices and corporate social responsibility as integral components of the global sustainability agenda are discussed in this article. The role of sustainable finance and investment is also scrutinized as a critical driver for fostering responsible business practices. The article provides overview of diverse strategies for sustainable development, highlighting the interconnectedness of economic, social, and environmental considerations, valuable insights for policymakers, businesses, and communities seeking to navigate the complex landscape of sustainable development.

Keywords: Sustainable development, Emerging technology, Renewable energy, Artificial intelligence.

Introduction:

In an era marked by unprecedented global challenges, the pursuit of sustainable development stands as an imperative calling for collective action and innovative strategies (Reyers and Selig, 2020). The interconnected nature of economic, social, and environmental systems requires a holistic approach that transcends traditional paradigms (Baumert and Winkler, 2005). This research endeavors to explore and illuminate strategies for sustainable development, offering insights into

the multifaceted dimensions of this critical pursuit. As the world grapples with complex issues such as climate change, resource depletion, social inequality, and biodiversity loss, the urgency of sustainable development becomes increasingly apparent (Reyers and Selig, 2020). The interconnected crises underscore the need for comprehensive strategies that not only mitigate immediate threats but also establish resilient foundations for the future. In this context, sustainable development emerges as a visionary roadmap, guiding humanity towards a harmonious coexistence with the planet and each other (Rimanoczy, 2020). At the heart of sustainable development lie holistic frameworks that transcend narrow sectoral perspectives. Recognizing the intricate interplay between economic prosperity, social well-being, and environmental integrity, effective strategies must embrace collaborative governance models (Conti et al., 2019). International agreements, national policies, and local initiatives should converge to create a cohesive roadmap for sustainable development, fostering a spirit of global cooperation (Baumert and Winkler, 2005). The role of technological innovations in steering sustainable development cannot be overstated. From renewable energy solutions and precision agriculture to smart infrastructure and data-driven decision-making, technology serves as a catalyst for transformative change (Omri, 2020). This article will delve into the ways in which cutting-edge technologies contribute to sustainability, examining their potential and challenges in reshaping the landscape of development. Sustainable development is inherently linked to social inclusivity and community empowerment. Strategies that prioritize the active involvement of communities in decision-making processes ensure that the benefits of development are equitably distributed (Dugarova, 2015). By acknowledging diverse cultural perspectives, fostering inclusivity, and addressing social inequities, these strategies lay the groundwork for truly sustainable progress that leaves no community behind. Businesses, as key actors in the global economy, play a pivotal role in shaping the trajectory of sustainable development (Dugarova, 2015). Embracing corporate social responsibility, adopting environmentally friendly practices, and integrating sustainability into core business strategies are essential facets of this endeavor. The research will scrutinize successful case studies, exploring how businesses can become agents of positive change and contribute to the broader goals of sustainability (Blowfield and Blowfield, 2013). As this article unfolds, it will emphasize the importance of cultivating a long-term vision coupled with adaptability. Sustainable development is not a static destination but a dynamic process that requires continuous reassessment and evolution. Strategies must be resilient, capable of responding to emerging challenges while staying aligned with overarching sustainability goals. Aims of this article is provide a comprehensive understanding of strategies for sustainable development in the contemporary global landscape. By scrutinizing the interconnected realms of policy frameworks, technological innovations, community engagement, and corporate practices, the research seeks to contribute valuable insights to the ongoing discourse on shaping a resilient and sustainable future for generations to come.

Policy Frameworks and Governance:

Effective governance and policy frameworks are foundational to sustainable development (Dernbach, 1998). International agreements, such as the United Nations Sustainable Development Goals (SDGs), guide global efforts. National policies and local governance structures play a pivotal role, emphasizing collaboration across sectors and stakeholders (Morita et al., 2020). The analysis underscores the importance of adaptive policies for addressing evolving challenges. Effective governance and policy frameworks are foundational to sustainable development (Morita et al., 2020). The Sustainable Development Goals (SDGs) are a set of 17 global goals established by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. These goals were designed to address a range of interconnected challenges faced by the world, aiming to improve social, economic, and environmental conditions (Fu et al., 2019). The Sustainable Development Goals (SDGs) stand as a holistic framework guiding global endeavors towards sustainability and fairness. These 17 goals encapsulate a spectrum of critical aims, spanning from eradicating poverty universally to advancing gender equality and ensuring access to clean water and sanitation (Halkos and Gkampoura, 2021). The objectives include ending hunger, promoting good health, and guaranteeing inclusive and quality education for all. Emphasis is also placed on fostering clean and affordable energy, sustainable economic growth, and resilient infrastructure (Halkos and Gkampoura, 2021). Additionally, the SDGs prioritize efforts to reduce inequality on a global scale and create inclusive, safe, and sustainable cities and communities (Halkos and Gkampoura, 2021). Moreover, the goals underscore the importance of responsible consumption and production patterns, urgent action on climate change mitigation, and the conservation and sustainable use of marine and terrestrial ecosystems. Efforts to protect and restore biodiversity, manage forests sustainably, and combat land degradation are integral parts of the agenda (Barbier and Burgess, 2017). Furthermore, the SDGs advocate for promoting peaceful and inclusive societies, ensuring access to justice, and establishing effective and accountable institutions at all levels (Sachs, 2015). Strengthening global partnerships is highlighted as crucial for achieving these ambitious goals, emphasizing collaboration and cooperation among nations, organizations, and stakeholders worldwide. In essence, the SDGs serve as a comprehensive blueprint for addressing the interconnected challenges facing humanity and the planet, aiming to create a future characterized by sustainability, equity, and prosperity for all (Barbier and Burgess, 2017).

Technological Innovations:

Technological innovations play a key role in advancing sustainability across various industries (Omri, 2020). These innovations contribute to more efficient resource use, reduced environmental impact, and the development of solutions to address global challenges. Advances in renewable energy technologies, such as solar and wind power, have significantly contributed to sustainable energy production (Demirtas, 2013). Improved efficiency, cost reductions, and energy storage innovations have made renewable energy sources increasingly viable alternatives to fossil fuels, reducing greenhouse gas emissions and dependence on non-renewable resources (Strubell et al., 2019). Technological innovations enable businesses and households to optimize energy use. Smart grids, energy-efficient appliances, and advanced building management systems contribute to reducing energy consumption and minimizing waste (Franco et al., 2023). Energy-efficient

technologies play a vital role in achieving sustainability goals and addressing climate change (Coeckelbergh, 2021). The development of electric vehicles (EVs) and associated infrastructure is revolutionizing transportation. Electric cars, buses, and bikes contribute to reducing air pollution and dependence on fossil fuels (Kumar and Alok, 2020). Innovations in battery technology enhance the range and performance of EVs, making sustainable transportation more accessible (Kumar and Alok, 2020). Technologies that support a circular economy, such as recycling robots and advanced sorting systems, help reduce waste and promote recycling (Geissdoerfer et al., 2017). Innovations in materials science enable the development of products that are easily recyclable or biodegradable, supporting a more sustainable approach to production and consumption (Moshood et al., 2022). Precision agriculture technologies, including drones, sensors, and data analytics, enable farmers to optimize crop yields while minimizing resource use (Brodhag and Talière, 2006). These technologies contribute to sustainable agriculture by improving water management, reducing pesticide and fertilizer use, and enhancing overall farm efficiency (Brodhag and Talière, 2006). Smart city technologies leverage data and connectivity to enhance urban sustainability. Intelligent infrastructure, including smart grids, waste management systems, and efficient public transportation, contributes to resource optimization, reduced emissions, and improved quality of life for city and rural residents (Shcherbina and Gorbenkova, 2018). Innovations in water management technologies help address water scarcity and improve water quality. Smart irrigation systems, water purification technologies, and real-time monitoring contribute to sustainable water use in agriculture, industry, and urban settings (Clausen and Hafkesbrink, 2005). Smart irrigation systems, water quality monitoring sensors, leak detection and monitoring, smart water meters, rainwater harvesting systems, wastewater treatment technologies, desalination technologies, aquifer recharge and storage, data analytics and decision support systems, drones and remote sensing, cloud-based water management platforms, natural infrastructure solutions are important technologies for the water management (Mpanga et al., 2023). On the other hand, Blockchain technology enhances transparency and traceability in supply chains, supporting sustainable sourcing practices (Park and Li, 2021). This is particularly relevant in industries such as fashion, food, and electronics, where consumers increasingly demand information about the environmental and social impact of products. Biotechnological innovations contribute to the development of sustainable materials (Maddela and García, 2021). This includes biodegradable plastics, alternative packaging materials, and textiles produced using environmentally friendly processes (Maddela and García, 2021). Biotechnology also plays a role in creating sustainable alternatives to traditional agricultural practices, such as lab-grown meat (Maddela and García, 2021). Technologies related to carbon capture and storage (CCS) are critical for mitigating the impact of industrial processes on climate change (Mikunda et al, 2021). CCS innovations aim to capture carbon dioxide emissions from industrial sources and power plants, preventing them from entering the atmosphere (Mikunda et al, 2021). The internet of things (IoT) facilitates real-time environmental monitoring, contributing to better decision-making for sustainability (Maheswa and Kanagachidambaresan, 2020). Sensors and connected devices monitor air and water quality, track biodiversity, and provide valuable data for conservation and environmental management.

Community Engagement and Social Inclusivity:

Community engagement and social inclusivity are integral components of sustainability initiatives (Shand, 2018). Effective engagement with diverse communities and fostering inclusivity ensure that sustainability efforts address the unique needs, perspectives, and concerns of all stakeholders. Inclusive decision-making processes involve community members in identifying, planning, and implementing sustainability projects. Seeking input from diverse voices ensures that the solutions proposed are contextually relevant, addressing the specific needs and priorities of the community (Shand, 2018). Collaboration with various stakeholders, including community organizations, local businesses, non-profits, and government agencies, enhances the effectiveness of sustainability initiatives (Brodhag and Talière, 2006). A collaborative approach fosters shared responsibility and mobilizes resources for collective action. Recognizing and respecting cultural diversity is crucial for building trust and ensuring that sustainability initiatives are culturally sensitive. Engaging with local customs, traditions, and knowledge systems helps create more inclusive and respectful partnerships. Communication strategies should be inclusive and accessible to diverse audiences. This involves using multiple communication channels, translating materials into different languages, and ensuring that information is easily understandable for individuals with varying levels of literacy (Thinyane et al., 2018). Sustainability education and awareness programs empower communities to understand the importance of sustainable practices (Draghici, 2019). These programs should be tailored to the specific needs of different demographic groups, ensuring that information is relatable and actionable. Prioritizing social equity involves addressing historical disparities and ensuring that sustainability benefits are distributed equitably. Consideration of socio-economic factors, access to resources, and opportunities for marginalized groups is essential for creating inclusive and just outcomes. Empowering community members involves building their skills, knowledge, and capacity to actively participate in sustainability initiatives (Laiphrakpam et al., 2019). Providing training, workshops, and resources enhances the community's ability to contribute to and benefit from sustainability projects (Laiphrakpam et al., 2019). Supporting and fostering community-led sustainability initiatives allows for grassroots solutions that are driven by local knowledge and needs. Empowering communities to take ownership of projects increases the likelihood of long-term success and sustainability. Identifying and addressing social barriers that may hinder inclusivity is crucial. This includes factors such as discrimination, gender inequality, and disparities in access to resources (Khan et al., 2018). Sustainable initiatives should actively work towards breaking down these barriers. Encouraging diversity in leadership roles ensures that a variety of perspectives are represented in decision-making processes. This helps avoid biases and promotes a more comprehensive understanding of community needs (Khan et al., 2018). Establishing mechanisms for ongoing feedback and communication allows communities to voice their concerns, suggestions, and feedback regarding sustainability initiatives (Karatas and El-Rayes, 2015). This iterative process ensures that projects remain responsive to evolving community dynamics (Boeri et al., 2022). Recognizing and celebrating community achievements fosters a sense of pride and ownership. Acknowledging the contributions of individuals and groups within the community reinforces a positive cycle of engagement and collaboration (Boeri et al., 2022). By prioritizing community engagement and social inclusivity, sustainability initiatives can create lasting positive impacts that address the unique needs and aspirations of diverse

communities. This approach not only strengthens the effectiveness of sustainability projects but also contributes to building resilient, vibrant, and equitable communities.

Sustainable Business Practices:

Sustainable business practices involve adopting strategies and operations that balance economic, environmental, and social considerations (Brodhag and Talière, 2006). These practices aim to create long-term value for the company, its stakeholders, and the broader community while minimizing negative impacts on the environment (Brodhag and Talière, 2006). Companies engage in Corporate Social Responsibility (CSR) by taking responsibility for the social and environmental impact of their operations. This involves contributing to community development, supporting charitable causes, and integrating ethical considerations into business decisions (Moon, 2007). Sustainable businesses prioritize environmental conservation and resource efficiency (Schillmann, 2020). They implement measures to reduce energy consumption, minimize waste, and limit their carbon footprint (Schillmann, 2020). Adopting renewable energy sources and implementing eco-friendly manufacturing processes are common practices (Fowler and Hope, 2007). Embracing a circular economy involves designing products with the end of their life cycle in mind. This includes reducing waste through recycling, reusing materials, and designing products for longevity (Fowler and Hope, 2007). Companies may also engage in take-back programs and sustainable product packaging (Steenis et al., 2017). Ensuring sustainability throughout the supply chain is crucial. Companies assess and address the environmental and social impact of their suppliers. This may involve selecting suppliers with sustainable practices, monitoring labour conditions, and promoting fair trade (Fowler and Hope, 2007). Transparency in labour practices, along with efforts to eliminate child labour and discrimination, is essential (Fowler and Hope, 2007). Sustainable businesses leverage innovation and technology to improve efficiency and reduce environmental impact. This may include adopting digital technologies, employing data analytics for resource management, and investing in sustainable technologies that align with the company's goals (Ch'ng et al., 2021). Engaging with stakeholders, including employees, customers, investors, and local communities, is a fundamental aspect of sustainable business (Bugada et al., 2020). Open communication, responsiveness to concerns, and incorporating stakeholder feedback contribute to building a positive reputation and fostering long-term relationships (Bugada et al., 2020). Sustainable businesses disclose their environmental, social, and governance (ESG) performance through sustainability reports. This transparent reporting allows stakeholders to assess the company's impact and commitments to sustainability (Bugada et al., 2020). Besides, companies focus on developing products that have a minimal environmental impact (Brodhag and Talière, 2006). This includes using sustainable materials, reducing energy consumption during production, and designing products that can be easily recycled or repurposed (Schillmann, 2020). On the other hand, promoting work-life balance, offering wellness programs, and providing opportunities for skill development is important (Fowler and Hope, 2007). Employee satisfaction and engagement are integral to the overall success of sustainable business practices (Brodhag and Talière, 2006). Sustainable business practices not only contribute to global sustainability goals but also enhance a company's reputation, resilience, and long-term viability in an increasingly conscious marketplace (Brodhag and Talière, 2006). As consumers, investors, and emp loyees increasingly prioritize

sustainability, integrating these practices becomes a strategic imperative for businesses across various industries. There are some successful case studies for sustainable business practices:

Patagonia - The Outdoor Apparel Industry Pioneer

Patagonia, a well-known outdoor apparel company, has consistently demonstrated a commitment to sustainability and environmental responsibility (Schillmann, 2020). The company's mission statement, "Build the best product, cause no unnecessary harm, use business to inspire and implement solutions to the environmental crisis," encapsulates its dedication to both quality products and a sustainable ethos. Patagonia rely on sustainable practices by actively promotes a circular economy by encouraging customers to repair and recycle their products (Schillmann, 2020). The company provides free repair services for its products, reducing the overall environmental impact and promoting a culture of longevity over disposability (Schillmann, 2020). Patagonia is a trailblazer in incorporating sustainable materials into its products. The company actively seeks eco-friendly alternatives, such as organic cotton, recycled polyester, and responsibly sourced down (Schillmann, 2020). Moreover, Patagonia places a strong emphasis on transparency within its supply chain (Krchová, 2019). By actively engaging with suppliers, ensuring fair labor practices, and tracing the origin of materials, the company aims to create a more sustainable and ethical production process (Krchová, 2019). Beyond its own operations, Patagonia engages in environmental activism. The company uses its platform to advocate for environmental policies, actively supporting grassroots movements and initiatives that align with its sustainability goals (Schillmann, 2020).

Impact:

Patagonia's holistic approach to sustainability has not only bolstered its reputation as a socially responsible business but has also proven financially successful. By aligning their brand with environmental values, they have cultivated a loyal customer base that values both quality products and ethical business practices (Schillmann, 2020). This case study highlights how a business can leverage sustainability not only for positive environmental impact but also as a key element of its brand identity.

Unilever - Sustainable Living Plan

Unilever, one of the world's largest consumer goods companies, embarked on an ambitious journey with its Sustainable Living Plan in 2010 (Siddique and Sultana, 2018). The plan outlines Unilever's commitment to improving health and well-being, reducing environmental impact, and enhancing livelihoods across its value chain (Siddique and Sultana, 2018). Unilever aims to decouple its growth from environmental impact. The company has set targets to reduce its environmental footprint, including goals to source 100% of agricultural raw materials sustainably and achieve zero net deforestation (Hu and Zeng, 2024). The Sustainable Living Plan prioritizes social impact by addressing health and well-being. Unilever's initiatives include improving hygiene practices, enhancing nutrition, and promoting sustainable living through brands that contribute to positive societal change ((Hu and Zeng, 2024). Unilever is committed to responsible sourcing of raw materials, promoting fair labor practices and supporting smallholder farmers (Siddique and

Sultana, 2018). The company works towards ensuring that its entire supply chain adheres to ethical and sustainable standards (Henderson, 2015). Besides, Unilever invests in product innovation to reduce the environmental impact of its brands. This includes developing products with lower water and energy consumption, as well as exploring alternatives to traditional packaging materials (Henderson, 2015).

Impact:

Unilever's Sustainable Living Plan has not only demonstrated its commitment to sustainability but has also shown positive business outcomes. The company has reported increased brand loyalty and market share for its sustainable living brands (Henderson, 2015). Unilever's case illustrates how a multinational corporation can integrate sustainability into its core business strategy, aligning financial success with positive social and environmental impact.

These case studies highlight how businesses, regardless of their size or industry, can become agents of positive change by adopting sustainable practices. The experiences of Patagonia and Unilever showcase that integrating sustainability into business strategies not only contributes to broader environmental and social goals but can also lead to enhanced brand reputation and financial success.

Importance of Artificial Intelligence (AI) in sustainability:

Artificial Intelligence (AI) has the potential to play a transformative role in advancing sustainability across various domains, from environmental conservation to social equity (Nishant et al., 2020). AI-powered technologies, such as satellite imagery and machine learning algorithms, can enhance environmental monitoring (Vinuesa et al., 2020). These tools enable real-time tracking of deforestation, wildlife migration patterns, and changes in ecosystems, facilitating more effective conservation efforts (Vinuesa et al., 2020). Machine learning algorithms can analyse large datasets to identify and track endangered species, helping conservationists make informed decisions about habitat protection and restoration (Vinuesa et al., 2020). Moreover, AI can optimize energy consumption and reduce greenhouse gas emissions (Henderson et al., 2020). Smart grids, powered by AI algorithms, can dynamically manage energy distribution, optimizing efficiency and integrating renewable energy sources (Hossain et al., 2016). AI models can also aid in climate modelling and prediction, helping to understand and mitigate the impacts of climate change. Besides, AI applications can improve the sustainable management of natural resources. For instance, precision agriculture leverages AI to optimize crop yields, reduce resource use, and minimize environmental impact (Nishant et al., 2020). AI-driven analytics can also aid in sustainable water management, ensuring responsible use and conservation. On the other hand, AI technologies contribute to more efficient waste management processes (Abdallah et al., 2020). Intelligent sorting systems using computer vision and robotics can enhance recycling efforts by identifying and sorting materials (Titenko, 2021). Predictive analytics can optimize waste collection routes, reducing fuel consumption and minimizing the environmental footprint (Titenko, 2021). AI also helps in renewable energy optimization. AI algorithms can enhance the efficiency of renewable energy sources (Dellosa and Palconit, 2021). Machine learning models can predict energy demand, enabling better management of energy storage and distribution in systems relying

on solar or wind power (Burnett and Kiesling, 2022). AI-driven optimization can improve the overall performance and reliability of renewable energy infrastructure (Dellosa and Palconit, 2021). AI plays crucial role in social equity and inclusion. AI applications can contribute to social sustainability by addressing issues related to accessibility and inclusivity (Rane, 2023). For example, AI-powered language translation and voice recognition technologies can facilitate communication across diverse linguistic communities, promoting inclusivity (Rane, 2023). AI can improve disaster response efforts by analysing vast amounts of data to predict and assess the impact of natural disasters (Sun et al., 2020). AI-driven systems can provide real-time information, aid in evacuation planning, and enhance the overall resilience of communities facing environmental threats (Sun et al., 2020). As we know education and awareness are an important factor towards sustainability. AI-powered tools can be utilized for raising awareness and educating the public about sustainability issues (Draghici, 2019). Virtual assistants, chatbots, and personalized content recommendations driven by AI can disseminate information and encourage sustainable behaviours (Draghici, 2019).

Conclusion:

The integration of sustainable practices into business operations, technological innovations, community engagement, and the application of Artificial Intelligence (AI) are essential components in addressing the urgent global challenges of sustainability. Through comprehensive strategies that encompass economic, social, and environmental considerations, businesses can become agents of positive change and contribute to the broader goals of sustainability. Case studies of companies like Patagonia and Unilever exemplify how sustainability can be embedded into corporate strategies, leading to both environmental stewardship and financial success. Technological innovations, including AI, offer promising solutions to sustainability challenges across various sectors. AI-powered tools facilitate environmental monitoring, optimize resource management, and enhance disaster response efforts. Moreover, AI contributes to social equity and inclusivity by addressing accessibility issues and promoting inclusive communication. Community engagement and social inclusivity are integral to the success of sustainability initiatives. By involving diverse stakeholders in decision-making processes, fostering inclusivity, and empowering communities, sustainable projects can better address the unique needs and aspirations of different groups. As we move forward, it is imperative to continue fostering collaboration among governments, businesses, communities, and individuals to achieve the vision of sustainable development. By embracing innovation, adopting sustainable practices, and prioritizing social equity, we can build a resilient and prosperous future for generations to come. Through collective action and concerted efforts, we can realize the vision of a sustainable world where the needs of the present are met without compromising the ability of future generations to meet their own needs.

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Synthesis and Characterization of Novel Activated Charcoal derived from Casuarina Cunninghamiana miq Root.

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Abstract: This work deals with synthsis and charactrization of novel activated charcoal derived from root of casuarina cunninghaminana miq. Powdered activated charcoal was synthsized by known method. carbonization was carried out at 300 ºC followed by chemical activation by impragnating with zinc chloride solution for twelve hours and further heated at 500 ºC for one hour. Synthesized charcoal was characterized by FTIR and futher studied with respect to its carbonized sample and its presursor.

Keywords: Casuarina cunninghaminana miq, Activated charcoal, characterization.

Introduction:

Biomass wastes are commonly available in our sourrounding. These are cheap and renewable. Activated charcoal preparation from renewable resources has recent interest. Activated charcoal preparation from biomass resources, includes many materials like trees, leaves, plant roots, fruit peels, and grasses. Activated charcoals are flexible adsorbents and their adsorptive properties are due to their high surface area, microporous structure. Activated charcoal means to a larg range of carbonized porous and high surface area materials. It has vary larg applications in water purification, household and industrial waste water managment, refining, desalination, colour and pollutant removal and medical applications. Activated charcoal can be prepared by both physically and chemical activation method. chemical activation is more economical because it requires low activation temperature, less processing duration and higher carbon content.[1-15]

Activted chrcoal can be able for removal of heavy, poisonous metal ions from water, adsorption of these metallic ions on to the surface of metal is due to the physisorption and chemisorption.[16-19]

Materials and Methods:

A) Sample collection and preparation.

The material which belongs to plant origin show high carbon content and low ash content. In present study Casuarina Cunninghamiana miq root used for the synthesis of activated charcoal it was collected from different area which are 15 km away from Malkapur. The roots were washed thoroughly with water in order to remove the foreign materials. After washing all roots were sun dried for 5 days. After sun drying material were ground into a fine powder using mortar and

pestle.the moisture of material removed by heating at 110 ºC for an hour in hot air oven after this carbobization achieved.

B) Carbonization and Activation

Step-I

Carbonization of well dried sample was then carried out in a muffle furnace (Bio-techno Lab, Model AI 7081) by placing a sample in a silica crucible at temperature of 300 ^{0}C for one hour.

Step-II

It was ensuring absence of oxygen during carbonization. The charcoal thus produced was removed from the furnace, washed with water after cooling and dried at 110 ^{0}C and ground with help of mortar pestle by applying moderate pressure.

Step-III

Sieved through 100-200 mesh. Finally chemical activation was done according to the methods of Grigis et al method with slight modification. The aqueous solution of Zinc Chloride ($ZnCl_2$) was mixed with 25 g sample in the ratio 1:5 the mixture was soaked for twelve hours and later heated to form a paste.

Step-IV

The paste was placed in the furnace and carbonized at 500 ^{0}C temperature for one hour. The sample was cooled to room temperatur overnight.

Step-V

Futher washed with the distilled water and dried at 110 ^{0}C in an oven and allow to cool at room temperature. The AC produced was sieved with 106 µm mesh, kept in an air tight bottle and labelled as follows.[20]

Sr. No	Sample	Code for sample
1	Casuarina Cunninghamiana miq (raw sample)	CCRR
2	Casuarina Cunninghamiana miq (carbonized sample)	CCRC300
3	Casuarina Cunninghamiana miq (Activated sample)	CCRAC500

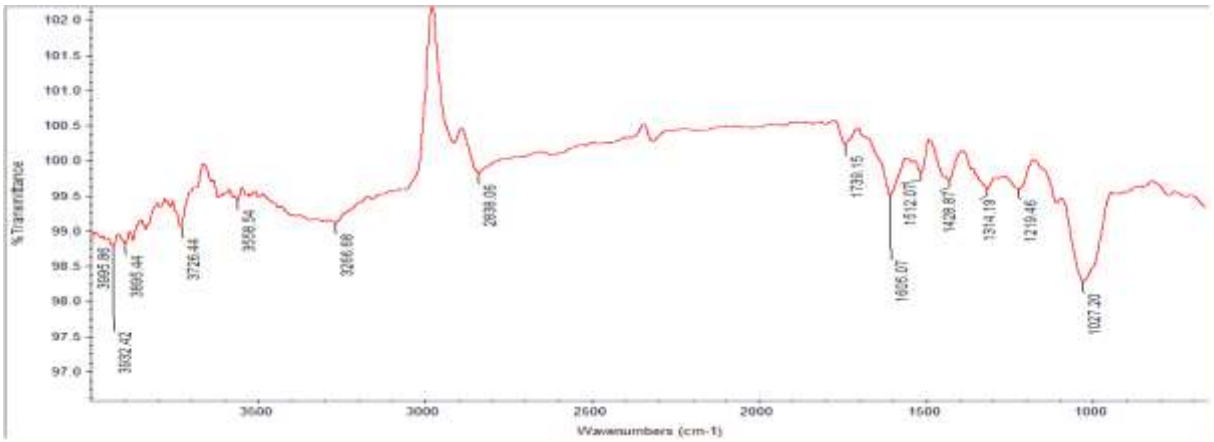
Table :1 List of sample collected and synthesized activated carbons with their code.

Result and Discussion:

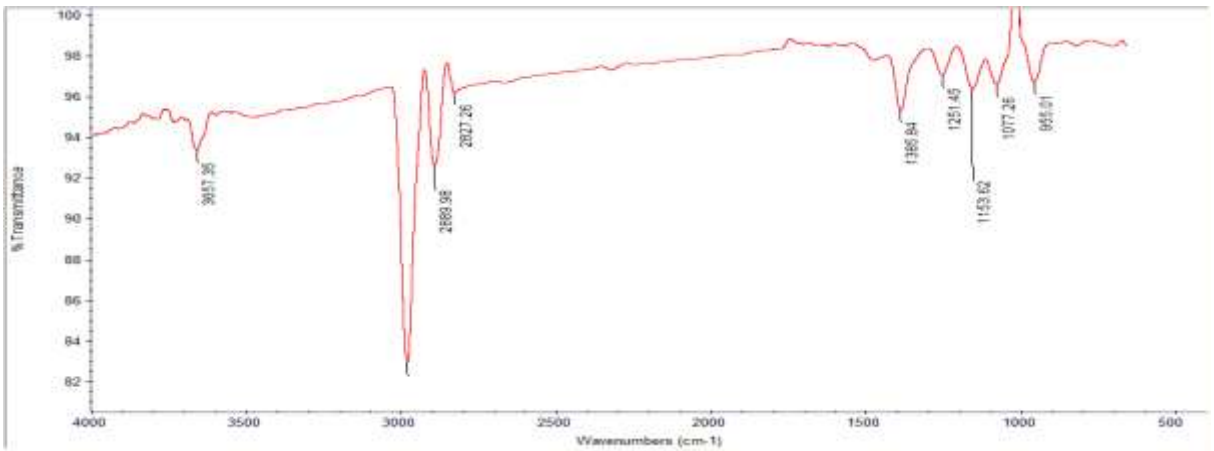
Tble:2 list of FTIR characterized samples

Sr.No.	Possible assignments (Precursors)	CCRR	CCRC300	CCRAC500
1	O-H str, -NH	3932, 3595, 3726,3558 cm^{-1}	3657 cm^{-1}	3934, 3613 cm^{-1}
2	C-H in $-CH_3$ and $-CH_2$	2838 cm^{-1}	2995,2889 cm^{-1}	3047 cm^{-1}
3	-C=O Str	1739 cm^{-1}	--	--
4	Aromatic -C=C-	1605, 1512, 1428 cm^{-1}	1385 cm^{-1}	1428,1308 cm^{-1}

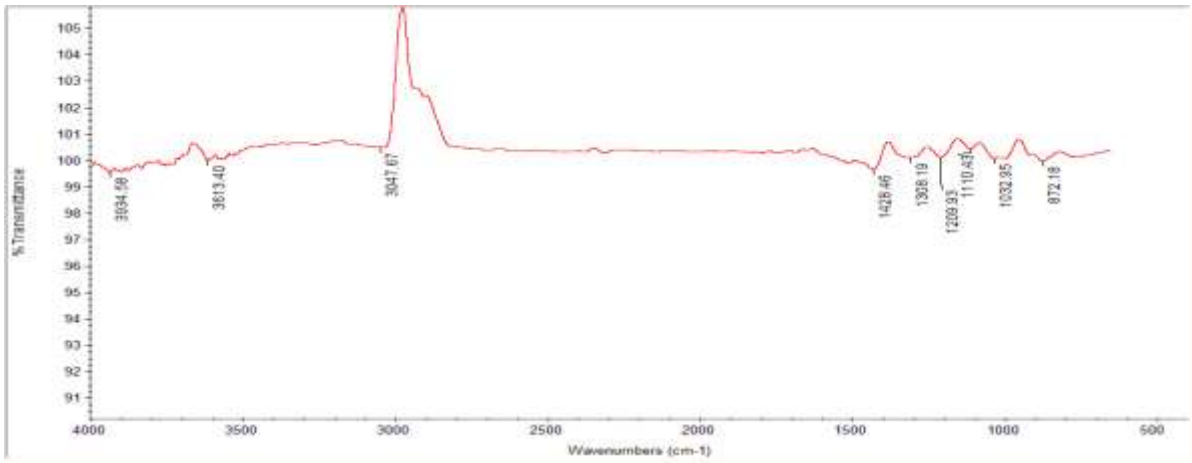
1_CCRR



2_CCRC300



3_CCRAC500



FTIR spectra were used to characterize the surface functional group on the CCRR , the CCRC300, CCRAC500 and Table 1 shows the list of sample collected and synthesized activated carbons with their code. Table 2 shows the absorption peaks observed in precursor (CCRR) and absorption peaks observed in corresponding carbonized sample (CCRC300) and activated charcoal (CCRAC500).

The precursor CCRR contained absorption band for carbonyl stretch and the same absorption bands were absent in it's corresponding synthesized carbonized sample CCRC300, and activated carbon CCRAC500 indicating that the chemical activation broke many bonds in aliphatic and aromatic species with elimination of many smallera and volatile substrate.[21]

The C-H vibration in methyl and methylene groups strechings appears at 2838 cm^{-1} in CCRR, 2995, 2889 cm^{-1} in CCRC300, 3047 $cm^{-}1$ in CCRAC500. Which shows that bands are getting weaker after activation, suggesting that carbinization of material is almost completed.[22]

The raw sample CCRR show absorption bands at 3932, 3595, 3726, 3558 cm^{-1} for O-H stretchings these bands decreased with increase in temperature that is carbocization at 300 ºC and further on impregnation with $ZnCl_2$ follwed by heating at 500 ºC shows change in intensity of O-H band in CCRAC500 is attributed to $ZnCl_2$ and heat treatment stages.[23-24]

Remarkably in newly synthsized activated carbon the absorption band intensity decreses abruptly it shows the decrease in functionality in the main matrix of raw material and confirms the formation of activated charcoal.

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"The Use of Big Data Technologies in Smart Farming toPromote Agriculture"

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Abstract -

This paper discusses the integration of big data in agriculture and its role in transforming the management of farming processes. It highlights how data-driven agriculture has emerged as a response to the challenges posed by growing food demandand climate change. By adopting data-driven approaches, the agriculture industry hasevolved into a more high-tech and efficient sector, leading to cost savings and the creation of new business opportunities. Through the utilisation of big data and analytics, agriculture professionals can make informed decisions, optimise resource allocation, and enhance overall productivity in this traditional yet increasingly modernised field.

Keywords: big data; big data analytics; agriculture; farming; data-driven agriculture.

Introduction -

The future of our contemporary society depends critically on agriculture. It is recognised as one of the earliest professions that humans have ever known. It serves asthe foundation of both the national and global economies. The majority of rural populations in various countries, including India and Africa, rely on agriculture for their livelihood. We get our food, energy, and medication from agriculture.

The agriculture sector is currently confronted with a number of challenges, including climate change, population growth, labour shortages, land and water scarcity, urbanisation, environmental degradation, changing dietary patterns, adapting to new technology, getting more done with less, etc. According to United Nations projections,there will be 9.8 billion people on the planet by the year 2050, making it urgently necessary to increase food production in order to feed the expanding population while using up less land for farming. Adopting cutting-edge technologies like the Internet of things, cloud computing Things, cloud computing, GPS, satellites, drones, robotics, and artificial intelligence can help us overcome these massive problems. These technologies are revolutionising agriculture and producing enormous amounts of big data. Big data is essential for agriculture to overcome the obstacles.

The industrial, ecological, biotechnological, and most recently, big datarevolutions are just a few of the revolutions that have affected agriculture. There is adigital revolution happening there. Big data is playing a crucial role in boosting production as traditional skill-based agriculture is quickly evolving into a digital and data-driven industry. A new generation of techniques and technologies known as "Big Data Analytics" is needed to extract usable information from the created data. As shown in Figure 1 [2], data analytics aims to derive knowledge and insight from data. Predictive data analytics and digital agriculture are fundamentally reliant on digital information on soil, weather, climate, crops, etc.

FIGURE 1: FROM DATA TO WISDOW [1].

Characteristics of Big Data -

Smart city services can be utilised using for big data (BD), a more recent technology. Big data comes from three basic sources: machines, humans, and businesses. 42 "Vs" can be used to characterise massive data, as seen in Figure 2 [3]. Volume, Velocity, Variety, Veracity, and Value are the first five “Vs”.

1. **Volume:** This term describes the amount of data being produced both inside and outside of organisations, and it is growing annually. Those who define BD as having a volume greater than one petabyte.
2. **Velocity:** This represents the data generation pace that Internet users, mobile users, social media users, etc. are producing at an unheard-of rate. To quickly collect and process data and extract meaningful, usable information. BD has movement and velocity and can be examined in real time.
3. **Variety:** Since big data may come from a variety of sources and be in a variety of formats (such as videos, photos, audio, text, and logs), this term refers to the data types. The data used in BD might be structured, semi-structured, or unstructured.

4. **Veracity:** By this, we imply the accuracy of data, i.e., if the data originates from a reliable, authentic, and responsible source. It implies that the quality of various largedata sources varies widely. The statistics might not be entirely accurate.
5. **Value:** This is the crucial component of BD. It is what BD processing aims to achieve. It alludes to the method of extracting hidden values from big datasets. It indicates the benefit obtained from the evaluation of the available data. There is no point in managing and storing data if one cannot derive any business value from it.

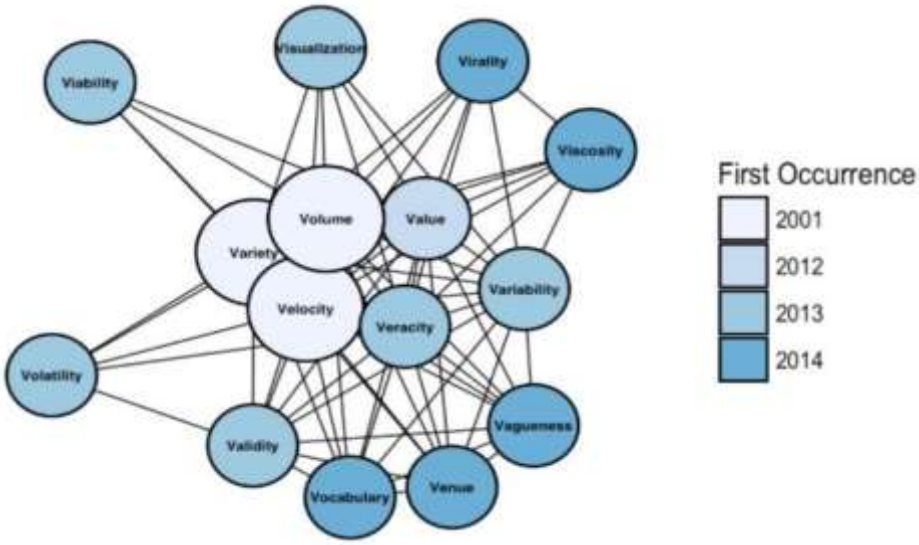

FIGURE 2: THE 42 V's OF BIG DATA [3].

On this basis, small data can be characterised as having low volume, low velocity, low diversity, poor truthfulness, and low value. There are now five more "Vs" [5]:

1. **Validity:** This describes how accurate and correct the data is. Additionally, it shows how current it is.
2. **Viability:** This determines whether the data is pertinent for each use case. To maintain the desired and exact outcome using analytical and predictive techniques, relevant data is needed.
3. **Valatility:** Data fluctuate quickly because they are produced and subject tovolatility, which controls this pace of change.
4. **Vulnerability:** Data's vulnerability is crucial because personal data must be protected at all costs, especially in terms of privacy and security.
5. **Visualisation:** Information must be presented to users in a clear and appealing manner. Finding useful insights from extensive and complex clinical records is aided by proper visualisation.

Some recommend the 5 "Vs" below as an alternative to the ones mentioned above: location, flexibility, vocabulary, ambiguity, and validity

Big data is advantageous to the healthcare, financial, airline, travel, restaurant,retail, automotive, sporting goods, agricultural, and hospitality sectors. In farming, bigdata technologies are crucial since equipment is fitted with sensors that collect data from the environment.

Analytics of Big Data -

Data is expanding daily, and big data analysis (BDA) has become essential foracquiring priceless insights into data so that businesses may make sizable profits in the worldwide market. The smart city paradigm is built on the Internet of Things (IoT) and BDA. BDA are required for smart city programmes to work. We employ cutting-edgesoftware applications like Hadoop, MapReduce, MongoDB, and NoSQL databases afterthe huge data is prepared for study. BDA describes how we can use BD as a new kind of money for information transactions by extracting, validating, translating, and using it. Itis a new field with the goal of making empirical predictions. Analytics are used by data- driven organisations to inform decisions at all levels.

Data scientists are skilled in the use of tools that reveal links and patterns thatcould otherwise go undetected. They are a component of almost every significant sector, and agriculture is no exception. BDA in agriculture are predicted to lead to better farming methods, better decision-making, and a more sustainable future for humanity. To improve farming practises and decision-making, artificial intelligence and machine learning technologies will be used.

How Come Big Data in Agriculture?

For farmers, agricultural experts, and policymakers, data has traditionally beenviewed as a crucial source of knowledge. Over a century has passed since farming was empirically based, but the data was not digitised. There is a vast amount of organisedand unstructured data that the agricultural sector must cope with. Information management is necessary in order to make decisions that are both economically and environmentally sound. Crop data only becomes useful for making profitable decisions when it is managed well.

BD is sometimes viewed as a technology and analytics combo that can gather and process data more efficiently and quickly to support decision-making. It is the centre of in-depth, cutting-edge, revolutionary business analytics. It warrants scholarly consideration from food scientists because it is poised to replicate established interactions between stakeholders in the food system [10]. The use of analytics in agriculture has been expanding, with the goal of making the analytics accessible to farmers. BD in agriculture is depicted in Figure 3 [11].

Agriculture is embracing big data in a big way, creating agricultural "big data,"which necessitates significant expenditures in infrastructure for data processing and storage. Agricultural BD refers to a large amount of data that is naturally produced at various stages, from seeding to harvesting. Agreements on data availability, data quality, access to data, security, responsibility, liability, data ownership, privacy, and cost allocation are crucial arrangements for the administration of large amounts of data. Big data's requirement for the use of analytical tools to derive value from it, increasing the productivity of farmers and agricultural experts, is a crucial factor. BD can be expensive, time-consuming, and meaningless without this analysis.

FIGURE 3: BIG DATA IN AGRICULTURE

Big Data Applications in Agriculture -

Farming methods and agro-food sector operations are about to undergo atransformation thanks to BD and the internet of things. The use of BD is a crucial instrument for digitising the agriculture industry. Digital technology is used in modern agricultural practises to transform traditional agriculture into modern agriculture. It encompasses digital agriculture, automated agriculture, precision agriculture, smart agriculture, automated farming, lean agriculture, sustainable agriculture, and more [12]. Smart farming, data-driven agriculture, precision farming, sensor deployment and analytics, and predictive modelling are examples of BD uses in agriculture [13, 14].

1. **Smart Farming and Agriculture:** Big data integration in the agricultural industry gives rise to the idea of "smart farming" or "smart agriculture." Achieving smart farming is agriculture's ultimate goal. Smart farming is the management of farms utilising data analytics, communications systems, IoT, ICT, sensors, GPS, satellites, robotics, drones, and other technological advancements. Farmers can gather data, keepan eye on field conditions without physically visiting the field, and make strategic decisions thanks to all of these tools [15]. The issues of agricultural production in termsof productivity, impact on the environment, food security, and sustainability must bemet via smart farming. A key instrument for dealing with and managing risks, dangers, diseases, and insect attacks while ensuring sustainability is smart agriculture. Smart farming is shown in Figure 4 [16].
2. **Agriculture powered by data:** Data-driven and data-enabled farming practises will become more prevalent in the future. Agribusiness potential and cost savings are provided by data-driven agriculture. It lays the foundation for future sustainable agriculture. All parties have benefited from data-driven agriculture at all stages. BDA isa crucial tool for agriculture that is driven by BD. Farmers may now analyse the likelihood of disruptive events using BD and data-driven risk assessments.
3. **Precision farming:** Precision agriculture, as the name suggests, enables precise plant and animal care. It aims to offer more precise farming methods for seeding and cultivating crops. Its main goal is to assure sustainability, profitability, and efficiency by using big data to inform current and upcoming decisions. It can be used in a variety of circumstances

where there is a lack of rainfall, infertile soil, or worsening weather. A new structure for the agriculture input sector is being pushed for by precision agriculture and data analytics, necessitating a new set of competencies. Farmers may monitor crop health and other natural occurrences with precision farming. Even before they start seeding, they can predict the yields with perfect precision. Precision farmers are seeing unprecedented visibility into their businesses [17].

4. **Increasing Innovation and Productivity:** Farmers must use data and innovation to increase production and feed a growing world population as a result of rising global food demand. Farmers can improve the management of essential resources, such as seed, fertiliser, and pesticides, while also increasing yield by implementing precision agriculture.
5. **Resolving Environmental Issues:** Farmers may find it easier to manage changes in the environment by using data-driven farming. Resolving Environmental Issues: Farmers may find it easier to manage changes in the environment by using data-driven farming. Data-driven farming enables farmers to make informed decisions by optimising resource usage, adapting to climate change, and reducing environmental impact for more sustainable agriculture.
6. **Cost savings and commercial prospects:** Data-driven agriculture has a lot to offer the agricultural industry. Farmers may be able to manage risk against the whims of domestic and international markets better as a result of the savings.
7. **Improved supply chain management:** Farmers will be able to track their products all the way through the supply chain thanks to the expanding availability ofrich data and useful insights. The ability to customise products and services to the needsof the market will benefit retailers, distributors, and other important stakeholders.
8. **Risk evaluation:** There have always been some dangers associated with farming, including unforeseen crop diseases, natural disasters, and extreme weather that may be beyond the control of the farmer. Almost any system, choice, or event may be taken into account in the risk analysis strategy thanks to big data. Every error can be explained,along with the suitable correction. Farmers may make sure that damage is kept to aminimum by using real-time data. Benchmarking, sensor deployment, analytics, and predictive modelling all use BD for risk assessment. Farmers can model and control the risks associated with producing livestock and cultivating crops by employing these methods to make forecasts using BD.

Crop management, animal care, supply chain management, crop forecasts, climate predictions, benchmarking, visualisation, and food security are other applications of BDin agriculture.

Benefits -

Big data is predicted to lead to significant changes in both traditional and non- traditional roles. It will alter how farms are run and maintained, as well as real-time forecasting and physical item tracking. The use of BD has the ability to enhance food production, implement sustainable solutions, and reverse alarming trends in food insecurity. BD and analytics may lead to the

greatest efficiency gains and improvementsin the agricultural sector. It might be the most effective strategy to transform the agriculture industry [18, 19].

Another advantage of using big data in agriculture is-

- Drive real-time operational decisions by providing predictive information aboutthe outcomes of farming.
- Boost agricultural productivity.
- Enhance farming practises and resource usage, such as water and power.
- Make sustainable agriculture appealing to young people and future generations.
- Put a stop to labour migration.
- Eliminate food waste.
- Improve fleet management to improve delivery consistency.
- Increase the amount of investment in the agricultural sector.

Challeges -

Particularly in poorer countries, agriculture has various difficulties. Although big data holds a lot of promise for the agricultural sector, its adoption and the question ofhow to make the gathered information pertinent and useful for farmers remain its two biggest obstacles. The best technique to make use of enormous volumes of data is still a huge challenge. Critics may wonder whether BD analytics may someday replace peoplein a variety of roles given its rising use. When creating predictive algorithms, which primarily rely on data, bias and variation are significant issues to handle [21]. Farmers, especially those in poor countries, are the most inexperienced participants in the application of BD to farming.

Big data in agriculture also faces the following difficulties-

- What will farmers do once agriculture has been automated and digitalized?
- Big data's potential is still mostly unrealized.
- Access to, ownership of, security of, and usage of farm data.
- Modern agriculture's culture raises several important moral and legal issues.
- There is a power imbalance between huge agribusinesses and farmers.
- Social inequality may grow as a result of unequal access to and use ofinformation.
- The "digital divide" could be a result of poorer countries' limited ICTinfrastructure and expertise.

Despite the fact that the advantages of BD in agriculture greatly exceed the risks, there are still issues that must be resolved before more BD applications in farming or agriculture are adopted.

Conclusion -

Smart farming and big data are relatively new ideas. Agriculture will inevitablyuse big data. International scholars and the industry are interested in how it may "revolutionise" the agricultural sector. Cloud computing, social media, artificial intelligence, sensor technology, the Internet of Things, robots, and mobile technologiesare some of the new capabilities supporting BD [22]. Currently, Europe and North America are the key regions where BD applications are discussed. However, it is anticipated that usage will increase quickly in nations like China and India. It is simplerfor nations that encourage the use of data-driven agriculture to meet their inhabitants' requirements. BD will have a substantial impact on a number of elements of the agriculture sector, although the extent of the impact is still unknown. The books [23, 24] contain additional details on the application of BD in agriculture.

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"Rooted in Nature: Ecofeminist Undertones in Chitra Banerjee Divakaruni's *The Mistress of Spices*"

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Abstract:

This study focuses on ecofeminism within the novel "Mistress of Spices," penned by Chitra Banerjee Divakaruni. "Mistress of Spices", within the lens of ecofeminism, intricately weaves together the realms of nature, femininity, and cultural identity. The novel explores the life of Tilo, a mistress of spices with mystical powers, who becomes a healer for the Asian community in Oakland. The story delves into ecofeminist themes, examining the interconnectedness of women and nature, as well as the exploitation of both.

Nature, symbolized by elements like fire, water, and the cycles of creation and destruction, emerges as a central character. The use of spices becomes a metaphor for the healing and nurturing aspects of femininity, echoing the ecofeminist perspective that sees women and nature as intertwined entities.

The narrative unfolds against the backdrop of underwater life, islands, and oceans, reinforcing the connection between women and the natural world. Ecofeminist principles are further accentuated through the symbolic naming of each chapter after a spice, emphasizing the holistic integration of nature into the story.

Chitra Banerjee Divakaruni's "Mistress of Spices" stands as a rich tapestry where ecofeminism permeates the narrative, exploring the profound relationship between women, nature, and cultural heritage

Keywords: Chitra Banerjee Divakaruni, Ecofeminism, Mistress of Spices, Spices, Tilo.

Introduction

Chitra Banerjee Divakaruni is an accomplished and acclaimed author known for her captivating storytelling and exploration of the human experience, particularly through the lens of the South Asian diaspora. Born on July 29, 1956, in Kolkata, India, Divakaruni has seamlessly woven her cultural heritage into her literary works, creating a rich tapestry of narratives that resonate with readers worldwide.

After completing her education in India, Divakaruni moved to the United States to pursue a master's degree in English and a Ph.D. in English from the University of California, Berkeley. Her

academic journey laid the foundation for her deep understanding of literature and culture, which she skillfully incorporates into her writing.

Divakaruni's literary career took off with the publication of her first collection of short stories, "Arranged Marriage," in 1995. The book garnered widespread acclaim and established her as a formidable voice in contemporary literature. She further solidified her reputation with the release of novels such as "The Mistress of Spices" (1997), "Sister of My Heart" (1999), and "The Palace of Illusions" (2008), a reimagining of the Indian epic, the Mahabharata, from the perspective of Draupadi.

Her works often explore themes of identity, magic realism, gender discriminations, ecofeminism, immigration, family, and the intersection of tradition and modernity. Divakaruni's prose is imbued with lyrical beauty and a keen insight into the human condition, making her novels and short stories both emotionally resonant and thought-provoking.

The Mistress of Spices

‘The Mistress of Spices’ is Chitra Banerjee Divakaruni’s debut novel shortlisted for Orange Prize. Published in 1997, this novel unfolds within the aromatic confines of an Indian spice bazaar, where the protagonist, Tilo, assumes the role of the Mistress of Spices, wielding the power to heal and transform lives through the magic of her enchanted herbs.

The narrative navigates a delicate dance between the mystical and the human, as Tilo grapples with the responsibility of maintaining the ecological balance of the spice bazaar and safeguarding the vitality of the Earth. Divakaruni's evocative prose not only paints a vivid picture of the bustling bazaar but also underscores the profound connection between the feminine and the natural world. The spices, personified and revered as ancient guardians, become symbols of nature's resilience and the strength inherent in femininity.

Set against the backdrop of an immigrant community in Oakland, California, "The Mistress of Spices" subtly explores ecofeminist themes by delving into the ways in which Tilo, as the Mistress of Spices, navigates the delicate equilibrium between her supernatural responsibilities and her human desires. Her role embodies a symbiotic relationship with nature, emphasizing the idea that the well-being of the earth is intricately linked with the empowerment of women.

In this novel, Divakaruni skillfully intertwines the threads of magical realism and ecofeminism, inviting readers to contemplate the broader implications of human actions on the environment and the feminine aspects of creation. "The Mistress of Spices" becomes not only a tale of enchantment but also a subtle exploration of the ecological and feminist undercurrents that flow through the narrative, making it a compelling and thought-provoking read.

Ecofeminism

Ecofeminism, situated at the confluence of feminism and political ecology, employs a gender-based framework to scrutinize the intricate relationships between humans and the natural world. The term "ecofeminism" was coined by Françoise d' Eaubonne in her 1974 work, "Le Féminisme ou la Mort". Core to ecofeminist theory is the application of a feminist perspective to Green politics, advocating for an egalitarian and collaborative society devoid of dominant groups. Presently, distinct branches of ecofeminism, includes liberal ecofeminism, spiritual/cultural ecofeminism, and social/socialist ecofeminism (or materialist ecofeminism), which offer varied approaches and analyses. Ecofeminism's implications extend to diverse areas such as art, social justice, political philosophy, religion, contemporary feminism, and poetry, showcasing its relevance in multiple spheres of social thought.

Prominent ecofeminist scholars have contributed significantly to this discourse. Vandana Shiva, an Indian scholar and environmental activist, emphasizes the symbiotic relationship between women and nature. Shiva's work critiques the commodification of resources and the impact of globalization on marginalized communities.

Carol J. Adams, known for her influential work "The Sexual Politics of Meat," explores the intersections between sexism and speciesism. Adams argues that the objectification of women and animals is interconnected, drawing parallels between the consumption of meat and the subjugation of women.

In her seminal work, "The Death of Nature," ecofeminist philosopher Carolyn Merchant traces the historical roots of the exploitation of nature and women, highlighting how the Scientific Revolution and Enlightenment period contributed to the objectification and domination of both.

Ecofeminism contends that addressing the ecological crisis necessitates dismantling patriarchal structures and fostering a holistic understanding of the interconnectedness between gender and the environment. Ecofeminist scholar Ynestra King emphasizes that ecofeminism involves linking various forms of oppression, adopting an approach centered on interconnected systems, and seeking resolutions that emancipate everyone.

The Ecofeminist Study of “The Mistress of Spices”

Ecofeminism within the realm of Indian English literature unfolds as a nuanced exploration at the convergence of environmental awareness and feminist perspectives. Across the passage of time, Indian literary figures have crafted intricate narratives that establish connections between the exploitation of women and the deterioration of the environment. Early literary contributions by Raja Rao and R.K. Narayan subtly paved the way for ecofeminist themes, incorporating elements of nature into traditional societal frameworks. In contemporary literary works, the resonant voices of Shashi Deshpande, Anita Desai, Arundhati Roy, Kamala Markandaya have delved deeply into the complexities of women's lives while concurrently addressing ecological concerns.

Chitra Banerjee Divakaruni's "The Mistress of Spices" emerges as a poignant exemplar, intricately weaving nature, femininity, and cultural identity into a narrative where spices serve as metaphors

for healing. The protagonist Tilo, an expert in the mystical potency of spices, dedicates herself to aiding the South Asian community in California. Tilo undergoes training under the guidance of the First Mother amid nature, honing her skills in utilizing spices for their healing properties.

Tilo, entered the world as the third daughter in a lower-class family, burdened with the weight of being perceived as yet another dowry liability by her father. Tilo recounts the circumstances of her birth with a vivid portrayal, describing a tumultuous night marked by a "steel-blue thunder, and jagged lightning" (7). Originally named Nayan Tara, meaning "the star of the eye", star seer, and the blossom flourishing by the dusty road at birth, Tilo's unique circumstances unfold as she is nourished with ass milk due to the scarcity of cow's milk during her infancy, hastening her acquisition of sight and speech. She narrates her birth

Initially Nayantara, uncovered her enigmatic abilities, rendering assistance to the villagers in resolving their predicaments and locating lost possessions. In acknowledgment of her benevolence, she was showered with opulent gifts as tokens of gratitude. During her childhood, in a moment of frustration and discontent, Nayantara projected a telepathic call with a golden hook over the waters, resulting in a tragic turn of events where she unintentionally caused the demise of her parents and the conflagration of her village. She narrates the coming of pirates in her village using the following words:

"They arrived at dusk. Later I would think it a fitting time, that moment when day cannot be told apart from night, truth from longing. A black mast cleaving through evening mist, a score of torches flickering their avid red over hut and grainstack and cowbarn, already smelling of charred flesh. And later, the flared eyes of villagers, mouths open to scream and only smoke billowing out" (Divakaruni, 18).

The pirates set ablaze the village and carried Nayantara with them. Fire, in this context, marks the inception of Nayantara's transformative journey. The anguish stemming from the loss of her parents and the devastation of her village *"stung (her) like live coals*" (*Divakaruni,* 19). She successfully dethrones the pirate chief, ascending to the position of queen among the seafaring marauders. Embracing the throne, Tilo assumes the mantle of a spectral architect, wielding the dual forces of creation and demise. Transitioning into a phase of her life as a pirate queen under the moniker Bhagyavathi, she reflects upon her past and endeavors to discern her aspirations. The narrative gracefully unfolds, painting Tilo's extraordinary journey as a vivid tapestry intricately woven with the threads of various natural elements. This complex interplay casts a chiaroscuro upon her character, revealing the profound consequences etched by her choices and actions in the grand theater of life.

As Tilo traverses her narrative, her trajectory intertwines more intimately with the elemental endowments of nature. Reflecting on her stint as a pirate queen, Tilo, like a seeker of celestial truths, hungers for profound self-discovery. In a metaphysical ripple across the waters of fate, she sends forth another telepathic call, evoking the elemental dance of a typhoon. The response, akin to an otherworldly ballet, manifests in the salvation orchestrated by serpentine guardians beneath the waves. Water and fire, those alchemic architects of her metamorphosis from pastoral ingenue to maritime monarch, now serve as ethereal guides steering her towards a clandestine realm

governed by the enchantment of spices and the alchemy of serpentine sorcery. As she immerses herself in the water, Tilo awakens the following morning, finding herself disrobed on the shore *"sea-wet, naked, and stumbling on the sharp slippery stones"* (*Divakaruni,* 42), a symbolic rebirth marking the continuation of her mystical and transformative expedition.

Chitra Banerjee skillfully weaves a mesmerizing narrative, blending the world of spices with the intricacies of nature. The setting becomes a character in itself, with the First Mother residing on an island where Tilo lands. Chosen by the First Mother as the spice girl, Tilo undergoes a profound transformation under the mentorship of the First Mother. Immersed in the serene yet mystical ambiance of the island, Tilo dedicates her time to learning from the ancient wisdom of the First Mother. The tale unfolds against the backdrop of a world steeped in mystery, set within the dark, lustrous confines of an island surrounded by water, a place that feels both tangible and unsettling.

Divakaruni, employs a rich tapestry of similes, metaphors, and nature-inspired adjectives to infuse depth into her narrations and descriptions. Describing the other spice girls, they are vividly portrayed as "*water wraiths, spirits of mist and salt, crying in the voice of the gulls*" (*Divakaruni,* 34). Tilo adopts her new name Tilotama, signifying "*Life giver, restorer of health and hope."(Divakaruni,* 42) The name Tilo, associated with sesame seeds, holds significance, with the flower of sesame seeds being a symbol of beauty, and mothers often praying for their children to have a nose resembling it. Golden brown under the influence of the planet Venus, Til, or sesame, possesses healing properties. Tilotama, further, is likened to the most beautiful Apsara in the court of God Indira, renowned for her elegance and skill in dance. Alongside her companions Aparajita, a flower with victory-inducing qualities when its juice is applied to eyelids, and Pia, a tree whose ashes, when rubbed on limbs, rejuvenate vigor, Tilotama's identity becomes intricately woven with the transformative magic of nature's elements.

As the mistresses depart the island, Divakaruni paints a poignant picture, evoking the sensory experience of rain falling “like pomegranate seeds” on their skin and the enchanting ambiance of birdcalls and the First Mother's singing, where shameless naked swims occur “in lakes of blue lotus” (54). Tilo articulates her sensory experience upon entering the Shampati Fire, describing "*Flametongues licking like a dream at my melting skin, flamefingers pressing down my eyelids"* (*Divakaruni,* 58). Shampati, a mythical bird, serves as a symbolic entity within the lore shared with the mistresses of spice in the novel, embodying the transformative nature of conflagration and the subsequent rebirth from ashes. Tilo, alongside her fellow mistresses, undergoes a ritualistic immersion into this fire, resulting in their collective vanishing, only to awaken anew in diverse locations across the world, be it in any country, town, or village, to fulfill assigned roles. This ritual echoes the cyclical motif of destruction and regeneration, reminiscent of poetic lines where flames dance like ephemeral dreams against her skin. The enigmatic journey through the Shampati Fire thus encapsulates a profound metamorphosis, encapsulated in both the tangible and metaphorical realms. Her profound love for spices goes beyond mere culinary appreciation; she possesses an intimate knowledge of their origins, the symbolism of their colors, their aromas, and even their true names. The very essence of these spices courses through her veins, as they willingly submit to her command, revealing their properties and magical powers.

Transported from the natural haven, where she had learnt under the guardianship of The Old Mother, through the fire of Sampati, the Eastern phoenix, Tilo finds herself in Oakland. Chitra Banerjee masterfully employs the elements of nature to transcend the confines of the natural world, crafting a narrative that blurs the lines between reality and the mystical, offering readers a captivating journey into the heart of a world shaped by spices and the enigmatic forces of nature.

Operating her shop named *Spice Bazaar,* strategically located at the corner, Tilo curates a collection where every Indian spice finds a place. These spices, when in her hands, not only communicate with her but guide her in crucial moments. The novel unfolds with each chapter named after a specific spice, uncovering their unique powers and origins. In each chapter of the novel, the timeless essence of nature is encapsulated in the names of various spices, serving as eternal components of the natural world.

Throughout the protagonist's journey from Nayan Tara to Bhagyavati and eventually Tilotamma, nature plays a vital role. The snakes befriended her in the childhood, shielding her from the sun in childhood to playing with her. She describes her friendship with snakes as "*the river snakes swam with me skin to skin, arrows of gold cutting through sun-flecked water, telling stories"(Divakaruni, 21).* In her tenure as a pirate queen, yearning for a fresh beginning, serpents respond to her telepathic summons. They intervene, rescuing her from the clutches of the pirates, unveiling the existence of an island of spices under the watchful guardianship of the Old Mother. Even in her role as the Mistress of Spices, known as Tilotamma, she intuits the invisible presence of these serpentine beings in her Spice Store. To acknowledge their existence, she maintains earthen bowls filled with milk in her store, a subtle tribute to the ethereal companions of her mystical world. The ritualistic placement of earthen bowls filled with milk serves as a tactile homage, embodying a silent covenant with these unseen denizens of her mystical domain. This act transcends mere symbolism, assuming the character of a poetic gesture, where milk becomes an offering to the ethereal guardians inhabiting the interstices of her enchanted world.

The narrative is intricately interwoven with the five elements—air, water, earth, space, and fire—essential components of nature. The fire of Sampati, the water through which messages are sent, the names of mistresses, and the figurative language employed all emerge as eternal facets of the natural world. The novel's denouement, marked by a devastating earthquake symbolizing the Indian philosophy of creation, preservation, and destruction, completes the cyclical narrative. This event bonds Raven, the male protagonist, to Maya, the name given to Tilo by Raven, revealing the tumultuous and violent side of nature

In the pursuit of an elusive "earthly paradise," Tilo and Raven embark on a quest for a utopian existence. The vivid imagery of their surroundings paints a picture of this dream world, "high in the mountains pine and eucalyptus, and the damp odour of redwood, bark and cone, a stream so cool and fresh to the mouth you feel you'he never tasted water before" (199). However, the realization dawns that the creation of a new world is possible amidst the ruins of devastation. As Tilo contemplates her return to the assigned role as the Mistress of Spices in Oakland, she dispels the notion of an idyllic sanctuary, asserting that true transformation emerges from the ashes of destruction, amidst the soot, rubble, and crisped remnants of what once was. In a poignant dialogue

with Raven, she dismantles the romanticized notion of paradise, articulating a reality tainted by the weaponry of hate and the intoxicating allure of dreams leading to suffering. She *says "there is no earthly paradise, except what we can make back there, in the soot in the rubble in the crisped-away flesh. In the guns and needles, the white drug-dust, the young men and omen women lying down to dreams of wealth and power and waking in cells. Yes, in the hate in the fear."(Divakaruni, 315)* The refusal to abandon the anguish and despair left in the wake of destruction underscores an ecofeminist ethos, resonating with the interconnectedness of women, nature, and societal structures. Tilo's insistence on addressing suffering, even if she wasn't the direct cause, aligns with the ecofeminist imperative to confront and rectify the environmental and societal consequences of human actions.

Commencing with Nayantara's inception as a foreseer, unwittingly becoming a crucial asset for sea pirates due to her unintentional telepathic call, the cycle unfolds. Bestowed with the name Bhagyamati (bringer of luck) by the pirates, an irony surfaces as her presence inadvertently leads to the plundering of her village and the tragic demise of her parents at the hands of the marauders. This exploration underscores the cyclical nature of creation, preservation, and destruction inherent in the narrative. As the narrative progresses, Nayantara's transformation into Tilo continues with her initiation as the spice girl by the First Mother. Towards the conclusion, a pivotal turning point emerges as all bestowed powers are reclaimed and destroyed. Tilo, formerly Nayantara, disrupts the established order by violating rules through forming emotional attachments, leading to her rebellion and eventual transformation into a beautiful lady. The devastating earthquake, symbolizing destruction, unfolds, wiping away everything. However, even in destruction, there is an implicit promise of renewal, as life sprouts anew from the rubble. This cyclical pattern reflects the profound resilience of nature and the inherent capacity for regeneration, even in the face of overwhelming destruction

Conclusion:

This paper has aimed to shed light on the ecofeminist undertones in Chitra Banerjee Divakaruni's novel "The Mistress of Spices." While Divakaruni's literary oeuvre is often scrutinized through the prisms of feminism and diaspora, this exploration highlights her adept incorporation of ecofeminist elements, enriching the narrative with layers of depth, intrigue, and stylistic nuance. The novel intricately weaves together the threads of nature, femininity, and cultural identity, presenting a nuanced exploration at the intersection of environmental consciousness and feminist perspectives.

Divakaruni's portrayal of Tilo, the Mistress of Spices, unveils a symbiotic relationship between the protagonist and the natural world, emphasizing the interconnectedness of women and nature. The incorporation of serpentine symbolism, the island of spices, and Tilo's intimate connection with the elements exemplify the ecofeminist themes threaded into the narrative. Tilo's role as a guardian of spices and her responsiveness to the unseen serpentine entities in her spice store underscore the importance of acknowledging and preserving the delicate balance between humanity and the environment.

While this paper focuses on "The Mistress of Spices," Divakaruni's extensive body of work offers a plethora of avenues for further exploration of ecofeminist themes. Future studies could delve into

the recurring motifs of nature and feminism in her other novels, providing a comprehensive understanding of how these themes manifest across her literary landscape. Additionally, comparative analyses with works by other Indo-American and Indo-Anglian authors may offer valuable insights into the broader context of ecofeminism within South Asian literature.

As literature continues to serve as a mirror reflecting societal values and concerns, the exploration of ecofeminism in Divakaruni's works not only contributes to the understanding of her artistic vision but also stimulates broader conversations on the intricate relationships between women, nature, and societal structures within the context of the Indian diaspora.

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Green Chemistry Important Role in Sustainable Development

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Abstract:

Green chemistry is one of the most explored topics these days. Major research on green chemistry aims to reduce or eradicate the production of harmful bi-products and maximizing the desired product in an eco-friendly way. The green chemistry is required to minimize the harm of the nature by anthropogenic materials and the processes applied to generate them. Green chemistry indicates research emerges from scientific discoveries about effluence responsiveness. Green chemistry involves 12 principals which minimize or eliminates the use or production of unsafe substances. Scientists and Chemists can significantly minimize the risk to environment and health of human by the help of all the valuable ideology of green chemistry. The principles of green chemistry can be achieved by the use environmental friendly, harmless, reproducible and solvents and catalysts during production of medicine, and in researches. Green chemistry could include anything from reducing waste to even disposing of waste in the correct manner. All chemical wastes should be disposed of in the best possible manner without causing any damage to the environment and living beings. This article presents selected examples of implementation of green chemistry principles in everyday life.

Keywords: Green Chemistry; Environment; Sustainability; Sustainable Development

INTRODUCTION

Chemistry plays a prominent role in our daily lives in production of food products, medicines and other useful things like cosmetics, dyes agrochemicals, paints, polymers etc. but during the synthesis of these useful products some unwanted harmful substances are also formed in large quantity. They impart adverse effects on environment and on human health. Thus, clean or green chemical substances are needed. Concept of Green chemistry incorporates a new approach to synthesis, processing and application of substances in such a manner so as to minimize the hazards to health and environment. This green approach may be called as eco-friendly chemistry, environmentally benign chemistry, clean chemistry, benign design chemistry. First initiative was carried out by environmental protection agency of US (EPA) in 1991 for sustainable development

[1]. Green chemistry has been proved to be an advanced and challenging branch of chemistry with negligible threats to life and environment.

Sustainable development has become the accepted orthodoxy for global economic development and environmental protection since the end of the twentieth century. Sustainable development means many things to many people and the range of actions and their implications is as varied. “Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Green Chemistry is the universally accepted term to describe the movement towards more environmentally acceptable chemical processes and products. It encompasses education, research, and commercial application across the entire supply chain for chemicals. Green Chemistry can be achieved by applying environmentally friendly technologies – some old and some new. While Green Chemistry is widely accepted as an essential development in the way that we practice chemistry, and is vital to sustainable development, its application is fragmented and represents only a small fraction of actual chemistry. The concepts of “Green Chemistry” and “Sustainable Chemistry” have meanings that, while different, are not in contrast with each other, especially in recent times. The two adjectives, “green” and “sustainable,” often have a somewhat different connotation according to the country or region where they are used. Currently, Green/Sustainable Chemistry is present in all countries around the world, playing a central role in research, cooperation, initiatives, networks, education, and university courses. Chemistry has a central role in evolution, especially in the slow but spectacular transition from the robust inorganic continental crust to the more and more sophisticated and fragile biosphere in the aqueous environment, frequently immobilized on and within the cracks and interstices of the landscape. While it is impossible to identify the exact time when a mixture of chemicals has formed the first living system, The long-term physical conditions of the Earth have become the concerns of more and more people due to the local, regional, and global environmental impacts of private and commercial activities of the rapidly growing population. Consequently, chemistry has blossomed, many different molecules and materials such as mono-, di-, and poly-carbohydrates, aromatics and lignin, amino acids and proteins, nucleic acids and DNA/RNA were synthesized by Nature [2,3]. Some of these have become building blocks of life, others have been serving Nature as simple to sophisticated reagents and catalysts, or become part of the control and information systems. In the early phase of evolution, the outcomes of chemical reactions were depended only on the local environmental parameters (temperature, pressure, light, acidity, concentrations, etc.) and proceeded according to the rules of thermodynamics and kinetics. The term represents the assumption that chemical processes that carry environmental negatives can be replaced with less polluting or nonpolluting alternatives. Green Chemistry is utilization of a set of principles that reduce or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. Green chemistry involves the design and redesign of chemical syntheses and chemical products to prevent pollution and there by solve problems.

OVERVIEW OF GREEN CHEMISTRY

Green chemistry is a field of research that seeks to investigate ways to reduce the environmental impact of chemical products and processes. These processes and products include the development of "greener" technologies, such as the use of renewable energy and the design of new, more efficient chemicals. Through green chemistry, scientists attempt to create more efficient systems that require fewer hazardous chemicals and fewer emissions of air and water pollutants. One example of green technology is the use of biocatalysis, which is the use of catalysts that are found naturally in the environment. The development of green chemistry has started slow by sporadic activities of concerned scientists and engineers to prevent environmental or health issues caused by chemicals, reactions or processes, some of which were discussed in the previous section. While the oldest examples of green chemistry were not labeled green, some of the early green concepts and strategies were practiced under the name of environmentally friendly molecules and materials, reactions, and processes. While water is the medium of life, its use in organic chemistry only started in 1980 for the hydrophobic acceleration of Diels–Alder reactions. The fundamentals of the first aqueous process for the hydroformylation of propylene to normal and isobutanal was invented in 1975 and commercialized in 1984 [4,5].

GREEN CHEMISTRY AND SUSTAINABLE DEVELOPMENT

"Green chemistry" and "sustainability" are not just sound bites, but a new paradigm that promises to have a deep and lasting impact on the science of chemistry. Green chemistry and sustainability essentially go hand in hand. Sustainable development is meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. We need greener chemistry- chemistry that efficiently utilizes renewable raw materials, eliminates waste and avoids the use of toxic and or hazardous solvents and reagents in both products and processes-in order to achieve this noble goal. Green chemistry embodies two main components. First, it addresses the problem of efficient utilization of raw materials and the concomitant elimination of waste. Second, it deals with the health, safety and environmental issues associated with the manufacture, use and disposal or re-use of chemicals. Green chemistry is one of the most fundamental and powerful tools touse on the path to sustainability. In fact, without green chemistry and green engineering, there is no path to sustainability [6,7].

THE 12 BASIC PRINCIPLES OF GREEN CHEMISTRY

The concepts of green and sustainable chemistry have gained significant attention around the world, given their potential to innovate and advance chemistry to help achieve the SDGs and their targets. In the past, chemistry has caused many environmental problems but chemical industry is now trying to address some of these issues by applying the Twelve Principles of Green Chemistry [8].

1. **Prevention** – it is better to prevent waste than to treat or clean up waste after it has been created.
2. **Atom Economy** – synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. **Less Hazardous Chemical Syntheses –** wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals –** chemical products should be designed to affect their desired function while minimizing their toxicity.
5. **Safer Solvents and Auxiliaries –** the use of auxiliary substances (e.g. solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.
6. **Design for Energy Efficiency –** energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible synthetic methods should be conducted at ambient temperature and pressure.
7. **Use of Renewable Feedstock –** a raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
8. **Reduce Derivatives –** unnecessary derivatization (use of blocking groups, protection/deprotection, and temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
9. **Catalysis –** catalytic reagents are superior to stoichiometric reagents.
10. **Design for Degradation –** chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
11. **Real-time Analysis for Pollution Prevention –** analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention –** substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions and fires.

Fig -1 : The Basic Principles of Green Chemistry

OPPORTUNITIES AND GOALS FOR SUSTAINABLE DEVELOPMENT

Recent innovations in chemistry and advanced materials have created new opportunities throughout the value chain to advance sustainability. These include, for example: revolutionizing energy storage and battery development; creating sustainable building materials; improving the recyclability and biodegradability of a number of products; or turning carbon dioxide (CO_2) and wastes into chemical feedstocks and valuable products. The Sustainable development Goals also knows as the Global Goals were adopted by the United nation in 2015 as a universal call to action to end poverty, protect, and ensure that but 2030 all people enjoy peace and prosperity [5,6]. The important sustainable goals are:

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. 12 Responsible consumption and production
13. Climate change
14. Life below water
15. Life of land
16. Peace, justice and strong institutions
17. Partnership for the goals.

Fig-2: The Sustainable development Goals (SDGs)

It can be achieved through new designs and innovations in chemistry that provide desirable functions and services of chemicals, materials, products, and production processes without causing harm to human health and the environment, while meeting broader development objectives.

FUTURE TRENDS AND CHALLENGES FOR SUSTAINABLE DEVELOPMENT

This section summarizes some key areas in the future relationship between sustainable development and regulation and their implications for producers, researchers, and society as a whole. Although differences exist in the characterization of green and sustainable chemistry, available - albeit limited - data suggests that supply and demand for greener and more sustainable chemistry products have significantly grown over the past years. Environmental performance in OECD (The Organization for Economic Cooperation and Development) countries had improved in several respects since 1990, it argued that this improvement had come at the expense of the economic aspects of sustainable development. The OECD also argued that the cost of achieving these improvements could have been less [9].

GREEN CHEMISTRY EDUCATION FOR SUSTAINABLE DEVELOPMENT

Modern chemistry education is challenged by both the political aim of a sustainable development of our society in general as well from the call for green chemistry strategies in chemical research and industry in particular. School chemistry education should promote competencies of the young generation to become scientifically literate. This means chemistry education has to contribute to making students capable of actively participating in society. Competencies need to be promoted to allow students to understand and participate in societal debate about applications of chemistry and technology. One prerequisite is that students should achieve substantial chemistry knowledge in the context of respective sustainability issues to understand the underlying developments, alternatives and dilemmas. But, subject matter knowledge will not be enough. The students as future citizens also need to learn how societal debate about questions related to chemistry, industry and the environment functions as well as develop skills to involve themselves together with others in the societal processes of democratic decision making [10,11].

GREEN CHEMISTRY IN DAY-TO-DAY LIFE

Green chemistry widely used in the chemical, pharmaceutical, paper, polymer, clothes and colour industry. It plays a key role in different energy science, and the manufacture of innovative technique to make solar cells, fuel cells, and batteries for storing energy [12-16].

1. **Green dry cleaning of clothes:** Perchloroethylene (PERC) used for dry cleaning of clothes is now known to contaminate ground water and suspected to be carcinogenic. Micelle technology developed by Joseph De Semons, Timothy R mack and James Mc Clain introduced use of liquid CO_2 and a surfactant thus eliminating the use of halogenated solvents [.
2. **Versatile bleaching agents:** Paper is manufactured from wood (Contains 70% Polysaccharides and 30% lignin). To obtain good Quality Paper lignin should be removed completely.

3. **Turbid water clear:** Tamarind seed kernel powder, discarded as agriculture waste, is an effective agent to make municipal and industrial waste water clear. The present practice is to use Al-salt to treat such water. It has been found that alum increase toxic ions in treated water and could cause diseases like Alzheimer's on the other hand kernel powder is not-toxic and is biodegradable and cost effective. For the study, four flocculants namely tamarind seed kernel powder, mix of the powder and starch, starch ad alum were employed. Flocculants with slurries were prepared by mixing measured amount of clay and water. The result showed aggregation of the powder and suspended particles were more porous and allowed water to ooze out and become compact more easily and formed larger volume of clear water. Starch flocks on the other hand were found to be light weight and less porous and therefore didn't allow water to pass through it easily. The study establishes the powder's potential as an economic flocculant such as $K_2SO_4Al_2$ $(SO_4)_3 24H_2O$ (potash alum).
4. **In production of chemicals from glucose:** Glucose is alternative for product chemicals. Biotechnological strategies are used to control the production of fragrant compounds. Compounds inclusive of catechol, hydroquinone, and adipic acid, every compound of which be able to be vital, may be synthetic.
5. **Polysaccharide Polymers:** They are an essential group of compounds that include widespread packages. They have got their dangerous consequences. The big range of compounds can be exploited. Polysaccharide because the feedstock has to be used as beginning materials due to the fact that it's far extra environmentally feedstock.
6. **Solar Array:** One of the best-known examples of green technology would be the solar cell. A solar cell directly converts the light energy into electrical energy through the process of photovoltaics, thus reducing greenhouse gases.
7. **Reusable water bottle:** Another simple invention that can be considered green is the reusable water bottle. Drinking lots of water is healthy. Reducing plastic waste is great for the environment. Trendy reusable water bottles are health- promoting, eco-friendly, and green.
8. **Green building technology:** Green buildings use various environmentally friendly techniques to reduce their impact on the environment. Reclaimed materials, passive solar design, natural ventilation and green roofing technology can allow builders to produce a structure with a considerably smaller carbon footprint than normal construction. These techniques not only benefit the environment, but they can produce economically attractive buildings.
9. **Pharmaceutical Applications:** Ibuprofen is nonsteroid and anti-inflammatory drug used to relieve pain in arthritis, muscle champs, headache & dental pain. Original & conventional methods of Synthesis of ibuprophene lead to lot of unwanted by products and atom economy of the synethesis was 60% but the new green route of this drug lead less by products & atom economy was 77% Setraline used as antidepressant, was conventionally prepared by coupling of benzophenone with diethyl succinate but green & smart method of its preparation involves isolation of tetrolone using simulated moving bed chromatography followed by racemization of unwanted enantiomer & conversion of racemic tetralone into desired enantiomer by using green solvent. sitaglipin used to treat

type 2 diabetes is also being synthesized by practicing metal catalysts by biocatalysts, thus safer to environment. Pyridenyl imidazole-based drugs acting as protein kinase inhibitor is now-a-days being synthesized by dimethyl acetone-1,3- dicarboxylate which is cheaper, recoverable & recyclable.

CONCLUSION

Green chemistry is a technology that is closely linked to the goals, since it can directly contribute to the achievement of many of them. Specifically green chemistry can lead to a reduction of hazardous chemicals and emissions from production, as well as cost reductions and the development of safer products and processes. Additionally, green chemistry can be used to develop innovative methods of chemical synthesis that are safer for humans and the environment. These regulatory strategies have the potential to help sustainable development by encouraging industrialists to take proactive steps to prevent pollution before it happens rather than by policing the pollution that has already occurred. This is likely to be balanced with a greater use of consumer-based environmental taxes to encourage individual citizens to appreciate the real costs of sustainable development. The way that regulation contributes to sustainable development is changing significantly. Europe and the OECD (The Organization for Economic Cooperation and Development) countries are moving towards a regulatory system that combines the historic "command and control" with a system that makes greater use of economic instruments. The debate is more about what economic instruments will be used for what pollution load and how quickly rather than whether it happens.

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Analysis of Water Quality Parameters and Techniques

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Abstract: Water is perhaps the most precious natural resource after air. Though the surface of the earth is mostly consists of water, only a small part of it is usable, which makes this resource very limited. This precious and limited resource, therefore, must be used with prudence. As water is required for different purposes, the suitability of it must be checked before use. Nowadays fresh water cannot be used directly for drinking purposes due to contamination and pollution. So, treatment is used before it is used for drinking or for industrial processes. Also, sources of water must be monitored regularly to determine whether they are in sound health or not. Poor condition of water bodies are not only the indictor of environmental degradation, it is also a threat to the ecosystem. In industries, improper quality of water may cause hazards and severe economic loss. Thus, the quality of water is very important in both environmental and economic aspects. Thus, water quality analysis is essential for using it in any purpose. The quality of water depends upon its source of history. The history of water signifies the terrain through which water is flowing, its origin and most important the extent to which it is contaminated on its way by impurities, sediments and industrial waste. The solubilisation and fragmentation of the terrain through which it flows determines its quality. The extent of dissolved solid materials present in water decides its quality. Such quality is also decided by the solubility of the geological deposits, contact of water with sediments, time of interaction and special factors related to environment. To ascertain suitability of water for consumption, it is necessary to undertake examination of quality of water. Major information on the quality of water is obtained by physical examination. Such examination includes the study of colour, conductivity, odour, turbidity and hardness, alkalinity TDS, BOD, COD, OD.

Keywords -Water quality- monitoring, analysis and Physical examination - Colour, Conductivity, Odour, Turbidity and Hardness.

INTRODUCTION

India is blessed with a rich and vast diversity of natural resources, water being one of them. Water is Mother Earth's most wonderful, abundant and useful compound. Water is rated to be of the greatest importance. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. Groundwater is an important source of water supply throughout the world.

Water of good drinking quality is of basic importance to human physiology and man's continued existence depends very much on its availability [1]. The provision of portable water to the rural and urban population is necessary to prevent health hazards [2,3]. Before water can be described as potable, it has to comply with certain physical, chemical and microbiological standards, which are designed to ensure that the water is palatable and safe for drinking [4,5].

Most of the water on the Earth's surface is found in oceans and seas, which constitute about 97% of the water on Earth. The rest 3% is present in rivers, glaciers and underground water [6,7]. Due to hydrological cycle on water, earth is in constant circulation by evaporation, precipitation, percolation and run off. There is natural balance between evaporation and precipitation. The ground water i.e., aquifiers is mainly used for drinking. Limnology is the study of fresh water. The knowledge on chemistry of natural water has developed enormously with development of chemical sciences. In ancient times whole civilization had disappeared due to water scarcity by climatic variations. In olden days the water-born diseases like cholera and typhoid killed several people [8,9]. The increase in population has resulted in large amount of the consumption of water. The microorganisms are indicators of the quality of water. The study of water is called 'hydrology'. The main supply of water from earth is called 'hydrological cycle'. Hydrosphere and lithosphere (earth) interaction is of great significance. The human consumption relates to fresh water and ground water. There is however nonuniform distribution of water. Water has excellent characteristics such as good solvent properties, high dielectric constant and surface tension; transparent appearance, maximum density at 4^{o}C, high heat of evaporation with higher heat of fusion of ice and higher heat capacity. In such water the marine organisms thrive very well. Unfortunately, this fresh water does not remain pure but gets polluted by several agencies. Sewage and oxygen demanding waste is main culprit. In addition, infections agents, plant nutrients, exotic organic chemicals, inorganic materials and compounds sediments and heat totally spoil the quality of water [10]. The important sources of water pollution are domestic waste, industrial waste, agricultural and shipping waste. To ascertain suitability of water for consumption, it is necessary to undertake examination of quality of water [11].

Such quality is ascertained by examination including

1. Physical examination of water,
2. Chemical characterisation of water
3. Biological investigation of water.

The principal objectives of municipal water are the production and the distribution of safe water that is fit for human consumption [12]. A good knowledge of the chemical qualities of raw water is necessary so as to guide its suitability for use. Thus, regular physico-chemical analysis of water at source must be carried out to determine or check the effectiveness of treatment process. This work is aimed at evaluating the microbiological quality and physico-chemical parameters of water sources used for drinking and cooking purposes in India [13].

WATER QUALITY ANALYSIS

Water Quality can be defined as the chemical, physical and biological characteristics of water, usually in respect to its suitability for a designated use. Water can be used for recreation, drinking, fisheries, agriculture or industry. Each of these designated uses has different defined chemical, physical and biological standards necessary to fulfil the respective purpose. For example, there are stringent standards for water to be used for drinking or swimming compared to that used in agriculture or industry [14].

After many years of research, water quality standards are put in place to ensure the suitability of efficient use of water for a designated purpose. Water quality analysis is to measure the required parameters of water, following standard methods, to check whether they are in accordance with the standard.

Water quality analysis is required mainly for monitoring purpose. Some importance of such assessment includes:

1. To check whether the water quality is in compliance with the standards, and hence, suitable or not for the designated use.
2. To monitor the efficiency of a system, working for water quality maintenance
3. To check whether upgradation / change of an existing system is required and to decide what changes should take place
4. To monitor whether water quality is in compliance with rules and regulations. Water quality analysis is of extremely necessary in the sectors of Public Health (especially for drinking water) and Industrial Use.

DRINKING WATER QUALITY TESTING STANDARDS PARAMETERS

Water is a vital natural resource which is essential for multiplicity of purpose. Drinking water quality standards describes the quality parameters set for drinking water. Drinking water or potable water is water safe enough to be consumed by humans. In most developed countries, the water supplied to households, commerce and industry meets drinking water quality standards, even though only a very small proportion is actually consumed or used in food preparation. Typical uses (for other than potable purposes) include toilet flushing, washing and landscape irrigation.

Table – 1 As Per Indian Standard Specifications for Drinking Water Quality standards [14,15]:

1	Color	5	May be extended up to 50 if toxic substances are suspected
2	Turbidity	10	May be relaxed up to 25 in the absence of alternate
3	pH	6.5 to 8.5	May be relaxed up to 9.2 in the absence
4	Total Hardness	300	May be extended up to 600
5	Calcium as Ca	75	May be extended up to 200
6	Magnesium as Mg	30	May be extended up to 100
7	Copper as Cu	0.05	May be relaxed up to 1.5
8	Iron	0.3	May be extended up to 1
9	Manganese	0.1	May be extended up to 0.5
10	Chlorides	250	May be extended up to 1000
11	Sulphates	150	May be extended up to 400
12	Nitrates	45	No relaxation
13	Fluoride	0.6 to 1.2	If the limit is below 0.6 water should be rejected, Max. Limit is extended to 1.5
14	Phenols	0.001	May be relaxed up to 0.002
15	Mercury	0.001	No relaxation
16	Cadmium	0.01	No relaxation
17	Selenium	0.01	No relaxation
18	Arsenic	0.05	No relaxation
19	Cyanide	0.05	No relaxation
20	Lead	0.1	No relaxation
21	Zinc	5.0	May be extended up to 10.0
22	Chromium as Cr +6	0.05	No relaxation

WATER QUALITY TESTING PARAMETERS

Here is a list of water quality testing parameters and the Water quality testing methods which are used to analyse the quality of water [16]. These are some of the common parameters analysed to test the water quality and on comparison with the standards an overall idea of the quality of water can be achieved.

Table - 2

S.No	Water Testing & Analysis Parameter	Water Testing and Analysis Method
1	Colour	Visual comparison, Spectrophotmetric method
2	pH	pH paper, Universal indicator or pH meter
3	Turbidity	Nephelometric method
4	Dissolved Oxygen (DO)	Winkler method
5	Biological Oxygen Demand (BOD)	Winkler method
6	Chloride (Cl)	Argentometric method
7	Hardness – Ca and Mg	EDTA method
8	Total Dissolved solids	Gravimetric method
9	Sulphate as SO_4	Turbidimetric method
10	Nitrate as NO_3	Colorimetric method
11	Iron (Fe)	AAS
12	Sodium (Na)	AAS
13	E.Coli	MPN – completed test for E.coli
14	Total Coliform Bacteria	MPN
15	Total Bacteria	Enumeration method

PROCEDURES OF WATER QUALITY ANALYSIS

The steps for water quality analysis in general is mentioned in Figure-1.

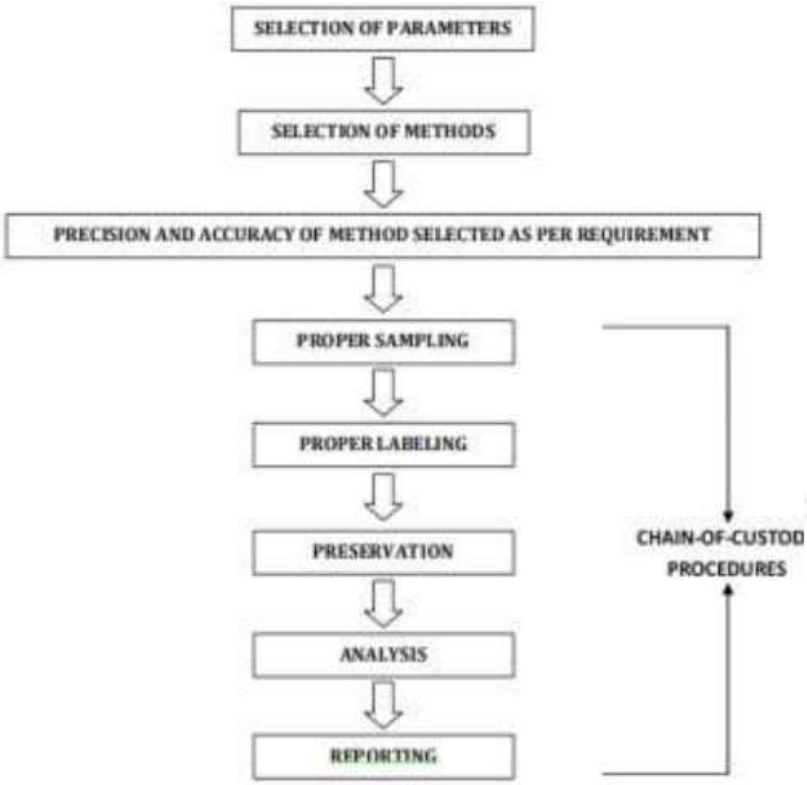

Figure -1: Steps for Water Quality Analysis

Water quality testing procedures play a crucial role in ensuring the safety and suitability of water for various purposes. These procedures involve a series of steps to assess the physical, chemical, and biological characteristics of water. By analyzing different parameters, such as temperature, pH, dissolved oxygen, and contaminants, these tests provide valuable information about the quality of water sources. In this article, we will delve deeper into water quality testing procedures, covering sampling techniques, physical and chemical parameter measurements, biological indicators, laboratory analysis, and data interpretation [17,18].

SELECTION OF PARAMETERS

The parameters of water quality are selected entirely according to the need for a specific use of that water. Some examples are: Drinking: As per WHO/CPCB Standards, Irrigation, pH, Conductivity, Sodium and Potassium, Nutrients, Specific compounds [19].

Industries: As per specific requirement

Domestic Consumption: As per BIS Standards

Water Bodies: As per CPCB guidelines However, some of the most common parameters assessed for checking potability and industrial use in India are in Figure-2.

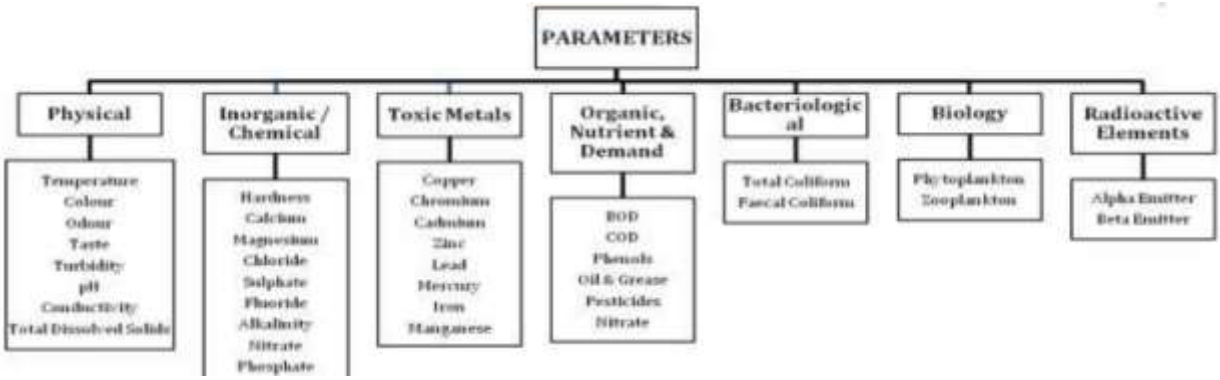

Figure -2: Parameters for Water Quality Analysis

I. Physical Parameters

Physical parameters are assessed to understand the appearance and clarity of the water. These parameters provide initial indications of water quality issues. Measurements may include temperature, turbidity (cloudiness), colour, odour, and taste. Temperature can influence the biological processes in water bodies, and abnormal readings may indicate pollution sources. Turbidity is a measure of suspended particles and can affect light penetration, thereby impacting aquatic ecosystems. Unusual colour, odour, or taste may suggest the presence of contaminants or pollutants [20].

Table: 3 Physical characteristics of typical sample of water

S.N.	Parameters
1	Acidity- no definite data
2	Alkalinity -10-500 mg/litre as $CaCO_3$
3	Colour-50 platinate units
4	Hardness- 5-1000 mg/litre $CaCO_3$
5	pH- 6.0-9.0
6	Specific Conductance 30-1000 micro-ohms or sieman
7	Temperature 0-30^{0}C
8	Turbidity 0-1000 JU
9	Odour- 3 TON

1. Colour

The colour of the water is due to presence of metallic ions, peat and humus materials from decaying vegetable matter. Industrial waste also contributes to colour of water. This colour is classified into two categories, viz., true colour and apparent colour. True colour is the real colour of water. Such colour does not depend upon background when viewed. While apparent colour is colour due to reflection of sky, e.g., blue colour of sea or reflection of trees as green colour of well water [20]. The classical method of measurement of colour consisted of the comparison of colour with one prepared by dissolving known weight of dipotassium hexachloroplatinate or cobalt chloride. This

is called as the platinum-cobalt method of comparison. The unit of colour is one produced by 1 mg platinum/litre in the form of chloroplatinate ion. Thus, 1.25gm of k_2PtCl_6 and 1 gm of $CoCl_2$. $6H_2O$ are dissolved in 100 ml of water and concentrated hydrochloric acid and made upto one litre with distilled water. The resulting stock solution has colour of 500 units. This method of analysis involves personal error. The spectrophotometric method is the most reliable method, wherein the absorbance of water is measured between 400 and 700 mm. The colour may be due to metallic ions also. It is sometimes necessary to remove turbidity before colour measurement, but is not always advisable as many a times filtration remove colour hence centrifugation is considered to be best method for removal of turbidity. Cobalt-platinum method is valid only for potable water and not for industrial waste water. It is always necessary to specify pH when colour is measured. The colour is identified in terms of (e.g., red/green/yellow) in terms of the dominant wavelength and degree of brightness by luminance. Tristimulus calorimeter with three filters is also used to measure the transmittance of sample of water.

2. Temperature

It is measured immediately after collecting the water sample preferably on the site itself. This parameter is useful for calculating various factors such as alkalinity or acidity of water. The elevated temperature has adverse ecological consequences on water. All thermometers must be calibrated before measurement. The depth temperature is required for limnological studies, which may be measured with a reversing thermometer or thermophone or thermistor. The last devise, viz., thermistor is the most reliable amongst measuring instruments.

3. Odour and Taste

The volatile compounds produce odour. The dilution of sample at which odour is just perceptible is a measure of its intensity. The odour is qualitatively described as medical (phenolic) and fishy (duke to algae), earthy (decaying matter) or chemical (chlorine). Odour is quality factor influencing acceptability of potable water. In spite of advancement of science and technology no instrument has so far been developed for the measurement of odour. Such measurement largely depends upon contact of a stimulating substance with appropriate human receptor cell. Such stimuli are chemical in nature and hence termed as chemical sense. The details of odour, its sampling measurement and control is very well described elsewhere in this book. The odour of water is measured in terms of TON i.e., threshold odour number, indicating the number of times the dilution one should carry out with odour free water, (in order to get no perceptible odour) e.g., TON = 4.0 indicate if we dilute with water in the ratio of 1:4, no odour will persist. Obviously, smaller the value of TON, better is its quality. Accepted average value of TON = 3. The chemical senses are used to characterize odour and taste. Food, beverage and pharmaceuticals preparations necessarily need odour free water. The odour is measured at 600 or 400C. Odour free standard water can be obtained by passing water over activated charcoal. For good results panel of at least 5 and not more than 10 members is needed for smelling. Threshold odour number (TON) is the dilution ratio at which odour is just detectable. Now taste refers to sensation by tongue to soft palate as flavour needs nose for comparison. The profile threshold test (FTT), flavour is needed for comparison. The flavour threshold (FTT) flavour rating assessment (FRA) profile analysis

(FPA) are used in food industry. FRA is used to assess mineral contents. FPA is used to ascertain offensive flavour against background of recorded sensory quality which is an judged acceptable.

4. Tubridity:

It is a measure of the light absorbing properties of the water sample. It can be measured either with nepheloturbidimeter or by conventional Jackson candle Turbidimeter. Usually, turbidity is caused by suspended matter. It is an expression of optical quantity of water. The standard method for determination of turbidity has been based on Jackson candle turbidimeter, but lower turbidity measurement, a candle turbidimeter (similar to measuring cylinder with reverse graduations) is kept on ground glass. The candle is lighted and held below the cylinder. Water is then continuously poured in turbidimeter and the flame is viewed from top. When flame disappears reading on the cylinder is noted. The units on cylinder indicates turbidity units of water. Alternatively, it is very easy to measure turbidity of water by nephelometer in terms if NTU units. The instrument permits measurement from 100 NTU, while Jackson model permits 25 to 1000 JU limits. The turbidity is bad for water used for human consumption. The process of coagulation and sedimentation can remove turbidity. It is caused by clay, slit, finely divided organic and inorganic contents. Turbidity is also an expression of the optical property of water which causes light to be scattered and absorbed rather than transmitted. The main cause for the variation in turbidity analysis results of the use of suspension of different types of matter having different optical properties, refractive indices and varying particle size. The hydrazinc sulphate or methylene tetramine are used to prepare standard turbid solution for comparison [21]. The mixture of 1 gm hydrazinc and 10 gm hexamethylene tetramine in 100 ml sample of water gives a turbidity of 400.

Table: 4 Classification of Turbidity

S.N.	Range	Value NTU
1	0-10	0.05
2	10-40	1.0
3	40-100	5.0
4	100-400	10
5	400-1000	50
6	1000 above	100

II. Chemical Parameters

Chemical parameters are crucial in determining water quality. Various tests are conducted to assess the composition and contamination levels in the water. These determine the amount of mineral and organic substances that affect the quality of water. pH, BOD, DO, Ca, Mg, Cl are some of the parameters which are grouped under chemical tests [22,23,24,25].

1. pH

The pH level measures the acidity or alkalinity of the water and can affect the solubility of substances and the survival of aquatic life.

2. Hardness

The total hardness is defined as the sum of calcium and magnesium concentration expressed both as the calcium carbonate hardness in milligram per litre. It is greater than the sum of bicarbonate and carbonate alkinity. This is terme4d as carbonate hardness. The calculated hardness is obtained from amount of calcium and magnesium present while hardness is experimentally evaluated by titration technique. The heavy metal inferences in complexometric titration. They are eliminated by use of EDTA as inhibitor. Various indicators like Erichrome black T, calmagite, mureoxide are used in EDTA titration for determination of calcium and magnesium.

Classification of hardness: As a matter of fact, hardness should have been classified as the chemical property of water. Hardness of water is caused due to the presence of sulphates and chlorides of calcium and magnesium. Hardness sometimes is attributed due to sulphates or chlorides of iron, manganese and aluminium. This causes what is called the permanent hardness, while temporary hardness is caused due to the presence of bicarbonates of calcium and magnesium and can be eliminated by mere boiling of water. In order to ascertain the hardness of water, one has to use soap test. Water will form soft and beautiful lather with soap if water is soft. However, if water is hard than Ca and Mg will combine with stearates of form soap to form curd or insoluble lather of calcium-sterate or magnesium-sterate. Alkali metal sterates are soluble. Usually, hardness is expressed in terms of $CaCO_3$/litre. Thus, water with 25mg/litre $CaCO_3$ is considered soft water, while water with 500mg/litre of $CaCO_3$ is termed as hard water. The usual method for analysis of hardness is titration method, one involving $KMnO_4$ titration, while another method is involving the use of EDTA for the purpose, latter is more popular.

The indicator used is Eriochrome black T, where pH is maintained at 10.0. EDTA combines first with Ca from water; then magnesium can be first precipitated as Mg (OH)2. So, titration value gives the amount of calcium only. Solochrome dark-blue can also be used instead of mureoxide indicator, with equal efficiency for calcium. When erichrome black-T is used, one gets reading for both Ca and Mg. Usually, EBT is grounded with solid NaCl in the ratio of 1:1, and is used during titration. A new indicator called Patton Reeder indicator is best for determination of calcium in hard water. It permits simultaneous analysis of both calcium and magnesium in water. So far, we have considered physical properties of water. Such as colour, conductivity and turbidity. However, physical properties alone cannot give definite information on quality of water. Most of the methods so far discussed are largely physical with few exceptions like hardness based upon the physiochemical properties. Similarly, acidity/alkalinity or salinity is classified in chemical composition of the water.

Table : 5 Classification of Hardness

S.N.	Hardness $CaCO_3$ mg/litre	Remark
1	0-40	Soft
2	40-100	Moderately hard
3	100-300	Hard
4	300-500	Very hard
5	500-1000	Extremely hard

3. Alkalinity

Alkalinity is a chemical measurement of a water's ability to neutralize acids. Alkalinity is also a measure of a water's buffering capacity or its ability to resist changes in pH upon the addition of acids or bases. Alkalinity of natural waters is due primarily to the presence of weak acid salts although strong bases may also contribute (i.e. OH-) in extreme environments. Bicarbonates represent the major form of alkalinity in natural waters; its source being the partitioning of CO2 from the atmosphere and the weathering of carbonate minerals in rocks and soil. Other salts of weak acids, such as borate, silicates, ammonia, phosphates, and organic bases from natural organic matter, may be present in small amounts. Alkalinity, by convention, is reported as mg/L $CaCO_3$ since most alkalinity is derived from the weathering of carbonate minerals. Neither alkalinity nor acidity, have any known adverse health effects. Nonetheless, highly acidic and alkaline waters are considered unpalatable.

Knowledge of these parameters may be important because:

1. The alkalinity of a body of water provides information about how sensitive that water body will be to acid inputs such as acid rain.
2. Turbidity is frequently removed from drinking water by coagulation and flocculation. This process releases H+ into the water. Alkalinity must be present in excess of that destroyed by the H+ released for effective and complete coagulation to occur.
3. Hard waters are frequently softened by precipitation methods. The alkalinity of the water must be known in order to calculate the lime ($Ca(OH)_2$) and soda ash (Na_2CO_3) requirements for precipitation.
4. Alkalinity is important to control corrosion in piping systems.
5. Bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) may complex with other elements and compounds, altering their toxicity, transport, and fate in the environment.

To determine the alkalinity, a known volume of water sample is titrated with a standard solution of strong acid to a pH value in the approximate range of 4 to 5. Titrations can distinguish between three types of alkalinity; carbonate, bicarbonate, and total alkalinity. Carbonate alkalinity is determined by titration of the water sample to the phenolphthalein indicator endpoint, or approximately a pH of 8.3. Total alkalinity is determined by titration of the water sample to the endpoint of the methyl orange indicator, or an approximate pH of 4.5. The difference between the two is the bicarbonate alkalinity

4. Dissolved oxygen (DO)

Dissolved oxygen (DO) indicates the amount of oxygen available for aquatic organisms, and low levels can lead to the death of sensitive species. Since Oxygen is necessary for all living/non-living organisms, but dissolved oxygen in water is vital to fish and other aquatic life. Oxygen is transferred from atmosphere to surface water as well as produced by aquatic plants, algae and phytoplankton as a bye product of photosynthesis. After dissolving in water oxygen diffuses or distributed throughout the water body. Distribution depends on movement of water, currents and thermal upwelling. Oxygen in water measured as dissolved oxygen (DO). It is measured as parts

per million (ppm), which is the number of oxygen (0_2) molecules per million total molecules in a sample.

It is also defined as the number of moles of molecular oxygen (O_2) dissolved in a litre of water at a temperature. It is expressed as mg O_2/1. Dissolved oxygen can range from 0-18 mg 02/1. Most natural water systems require 5-6 mg O_2/1. The oxygen is used by plants and animals for respiration and by the aerobic bacteria which consume oxygen during the process of decomposition. A high percentage of dissolved oxygen is conducive to aquatic flora & fauna. A low percentage indicates a negative impact on a body of water which results in a abundance of worms and fly larvae.

5. Conductivity

Conductivity measures the ability of water to conduct electrical current, which can indicate the presence of dissolved solids or salts. The equivalent conductance of various ions is listed. The conductance is the measure of concentration of mineral constituents present in water. It gives a rapid method to get an idea about dissolved solids in water. The conductance is reciprocal of resistance, which is measure usually between two electrodes kept one cm apart, with area of cross-section as one cm2 . The value depends upon presence of total concentration of ions. It also checks quality of distilled water. The average value should be less than 2 μ ohms. The self-contained conductivity instruments are available for such measurements. In conductivity cell, first it is necessary to evaluate cell constant. Usually, conductivity is measured at a fixed temperature. The conductivity is numerical index of ability of an aqueous solution to carry an electric current. This ability depends upon the presence of ions in the sample of water as well as on their total concentration, mobility, valance and temperature. The values used to assess degree of mineralization, variation in dissolved mineral levels, or estimate total dissolved solids. Since conductivity depends upon temperature latter must be kept fixed. KCl is used as the standard during such measurements.

6. Total Dissolved Solids (TDS)

Total dissolved solids (TDS) measure the concentration of inorganic and organic substances dissolved in water, including salts, minerals, and other compounds.

TDS were found in overall study area between 100ppm to 9000ppm.According to BIS (IS: 10500-1991) the agreeable value of TDS is 500mg/l and maximum is 2000 which is suitable for a drinking water. The samples that we have taken from different sites of our study area having a TDS less than its permissible value and greater than the permissible value therefore it is quite visible that the water is suitable for drinking in few areas and the water has to be treated in areas whose values are greater than the permissible limit.

7. Biological Oxygen Demand (BOD)

Biological Oxygen Demand (BOD) is a measure of water quality. It is an important property. It is defined as a measure of oxygen needed (in mg/litre or ppm) by bacteria and other micro- organisms oxidise the organic matter present in water sample over a period. It may also be defined as the

quantity of dissolved oxygen required by aerobic bacteria for the to oxidation of organic matter under aerobic conditions. The BOD of drinking water is less than one while sewages have more than several hundreds. BOD is high, the dissolved oxygen becomes low. The greater the BOD, greater the pollution. Thus, BOD is an indication of extent of pollution.

Micro-organisms such as bacteria and fungi are responsible for decomposing organic waste i.e., dead plants, leaves, grass, manure, sewage or food waste. In this process much of the available dissolved oxygen is consumed by aerobic bacteria, robbing other aquatic organisms of the oxygen they need to live. The temperature of the water can also contribute to high BOD levels. Similarly Nitrates and Phosphates in a body of the water can contribute to high BOD levels.

Limitations of BOD

Effluents of industries like paper, pulp rayon & chemicals, have low value of BOD, although they contain enough organic matter. Thus, BOD values should not be used as equivalent to organic load. In these cases COD reveals the real pollution potential.

8. Chemical Oxygen Demand (COD)

Chemical Oxygen Demand is a useful measure of water quality. It is defined as the amount of oxygen consumed under specified conditions in the oxidation of organic and oxidizable inorganic matter. COD expressed in milligrams per litre (mg/l or ppm). COD of waste water is the number of mg of oxygen required to oxidise the impurities present in 1000 ml of waste water using strong oxidising agent like acidified $K_2Cr_2O_7$.

COD represents the total amount of oxygen required to oxidise all oxidisable impurities in a given sample. Thus, COD value for a sample is always higher than BOD value. Since time required for COD test is less, therefore it is always advantageous. In environmental chemistry COD test is indirect measure of organic compounds present in water.

Limitations of COD

- COD test does not differentiate between bio-inert and biodegradable materials. It also not indicates the rate at which the biologically oxidisable material stabilize.
- COD represents the total amount of oxygen required to oxidise all oxidisable impurities in a sample of sewage wastes COD is always greater than BOD since in COD measurement both biodegradable and non-biodegradable load are completely oxidised. The difference in COD and BOD is equivalent to the quantity of biologically resistant organic matter.

9. Nutrients

Nutrient testing is important to identify excess levels of nitrates, phosphates, and other nutrients that can cause eutrophication, leading to harmful algal blooms and oxygen depletion.

10. Heavy Metals

Heavy metals such as lead, mercury, arsenic, and others are tested due to their potential toxicity even at low concentrations.

III. Biological Parameters

Biological parameters provide insights into the presence of microorganisms, including bacteria, viruses, and parasites. Fecal coliform or E. coli bacteria are commonly used as indicators of fecal contamination, which can originate from human or animal waste. Presence of these indicators suggests a potential health risk to humans if the water is used for drinking, swimming, or irrigation [26,27].

Table :6 Physical, Chemical and Biological examination of water:

Chemical Characteristics		Physical properties	Biological Investigations
Major: Ca^{2+}	Minor: Al	Colour	Total coliforma
Mg^{2+}	Ba	Conductivity	Faecal coliforma
Na^{+}	B	Temperature	Faecal streptococci
K^{+}	F	Odour	Crenothrix
Cl^{-}	NO_3	Turbidity	Plankton, Diatmalgae
SO_4^{2-}	NO_2	Hardness	Algae, Protozoa
CO_3^{2-}	PO_4		NItrosomonas; E coli
HCO_3^{2-}	Fe		
	Mn		

Water quality testing procedures are vital for monitoring and managing water resources. They help identify potential risks to human health, assess the impact on aquatic ecosystems, and guide decision-making for water treatment and resource management. Qualified professionals with expertise in water quality analysis should perform these tests to ensure accuracy and reliable results. Continuous monitoring and periodic testing are recommended to ensure ongoing water quality control and protection of public health and the environment.

WATER QUALITY ASSESSMENT AND MANAGEMENT

There is a problem with water quality around the world. The preservation of public health, food security, biodiversity, and additional ecosystem services are progressively endangered by the intensifying and escalating pollution of fresh water in both developed and developing nations [28]. A noteworthy association exists between pollution and economic advancement, with population growth, agricultural expansion, industrial expansion, and energy production all contributing to the

discharge of untreated or uncontrolled wastewater into surface and groundwater bodies. Despite recent preliminary evaluations of water quality worldwide, the extent of the predicament remains uncertain [29]. Water quality needs to be protected and improved effectively and efficiently with better information about the issues involved. Government and private agencies are working on water quality assessment and management [30].

1. The development and implementation of a comprehensive water resources plan, policy formulation, coordination, and guidance.
2. Irrigation, flood control, and multi-purpose projects need to be closely monitored, supervised, inspected, cleaned, and monitored for their effectiveness.
3. Groundwater development is the process of developing groundwater resources, establishing utilizable resources, and formulating policies for their exploitation, along with the supervision of state-level groundwater development activities and the support that is provided to them.
4. The development of a comprehensive perspective regarding the water resources of a nation and the assessment of the water balance across various basins and sub-basins are key considerations in the evaluation of inter-basin transfer feasibility.

The primary initiatives that are currently being undertaken involve a comprehensive investigation into the management of groundwater, both at macro and micro levels. These measures play a crucial role in ensuring the sustainable management of groundwater resources. It is of paramount importance to prioritize these initiatives to guarantee the long-term viability of groundwater resources [31]. Furthermore, the Board, in collaboration with concerned state government agencies, conducts periodic evaluations of replenishable groundwater resources in the country. This collaborative approach ensures a comprehensive and informed understanding of the current state of groundwater resources [32].

The Central Pollution Control Board (CPCB) of India and the Environmental Protection Agency (USA) are authoritative bodies, that exercise their oversight over the numerous state boards by setting emission standards and establishing ambient standards [33]. These bodies play a crucial role in mitigating the adverse effects of pollution by conducting nationwide surveys to evaluate the existing state of pollution. To achieve this goal, the Environmental Protection Agency has implemented two comprehensive monitoring programs for inland water quality. Through these programs, a network of 480 measurement stations such as tanneries, chemical plants, textile mills and distilleries has been established across the primary river basins in the country [34,35]. These measurement stations serve as crucial points of data collection and analysis, enabling a comprehensive understanding of water quality [36,].

Moreover, it is essential to recognize the significance of the field of International Environmental Law (IEL) in safeguarding our planet's environment, which is a shared resource. At AIDA, it is necessary to actively engage with this field daily, utilizing its principles and frameworks to support individuals and communities in their efforts to protect the environment. Preserving the environment is closely intertwined with the protection of foundational human rights [37]. Therefore, our work in the field of IEL not only seeks to safeguard the environment but also aims

to uphold and promote these fundamental rights that are inextricably linked to the environment. Through our commitment to the principles and practices of IEL, to strive to contribute to a sustainable and equitable future for all [38].

CONCLUSION

Assessment of water quality is essential to check the suitability of a water source for the designated use. Several water quality parameters are assessed and compared with their standard values to determine the acceptability of the water to be used. Water is such as important commodity that we cannot afford to pollute it. In order to ascertain such pollution, the physical, chemical and biological examination is necessary. The physical examination covers, colour, conductivity, temperature, odour, and taste turbidity and hardness. In the last decades environmental pollution has grown by leaps and bounds needing immediate attention from mankind. To understand this problem one needs basic knowledge of environmental chemistry and specially of environmental chemical analysis. The impact of man on the environment and interaction with various sphere of environment originated pollution. The ecology and environment are closely related. In last one decade pollution has reached a level in alarming proportion all over the world. The transportation is the main culprit leading to photochemical smog. The water pollution was known to man since ages with reference to the quality of drinking water. Most of the rivers are highly polluted. Waste water generated after use of water in industry causes serious problem of the pollution. It depends upon the source of the effluent. Pollution due to sewage is rampant in India. India since 1962 Maharashtra was the first state to enact Water Pollution Act, followed by preparation of the draft proposal for Air Pollution Control in 1980. Fortunately, the central government is aware of the problems. It passed comprehensive environmental protection bill in 1986 to include legislation on abatement of noise pollution. We have now state boards for abatement and control of air and water pollution in every state of India, including union territories. However, these control measures shall not be effective, unless environmental education is imparted from primary school to college and university level. We have the department of Environment and Forest of the Central Government under the Ministry of Environment. Agencies to control environmental pollution which will be effective only if we properly monitor pollution. No doubt future is certainly bright for India, provided we are alert.

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पर्यावरण संरक्षण एवं सतत् विकास

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भूमिका

पर्यावरण से आशय है हमारे चारों ओर की दशाओं से है, अर्थात वनस्पतियों, प्राणियों, मानव जाति हित सभी जीवों और उनके साथ संबंधित भौतिक परिवेश से है । आज से ही नहीं अपितु प्राचीन काल से पर्यावरण का महत्व रहा है ।

पर्यावरण संरक्षण

पर्यावरण की गुणवत्ता में सुधार करना प्रबंधन एवं संरक्षण करना और उसे बनाये रखना पर्यावरण संरक्षण है। हर एक मनुष्य का दायित्व है कि पर्यावरण संरक्षण पर ध्यान दें, उसे बनाये रखें, क्योंकि पर्यावरण और प्राणी दोनों एक दूसरे पर आश्रित हैं। पर्यावरण संरक्षण हमारी संस्कृति का अंग है । यह सर्वविदित है अधिक जनसंख्या जल साइंटिफिक इश्यूज, ओजोन डिप्लेशन, ग्लोबल वार्मिंग से लेकर वनों की कटाई, डिजार्टिफिकेशन और प्रदूषण ने पर्यावरण संकट की नई चुनौतियों को जन्म दिया है, कोविड–19 महामारी ने हमें साफ हवा की कीमत समझा दी है, आज जरूरत है मानव को हरित मानसिकता विकसित करने की ।

सतत विकास

सतत विकास का तात्पर्य कई शर्तों की पूर्ति से है, समग्र सुतुलन बनाये रखना, पर्यावरण के प्रति सम्मान और प्राकृतिक संसाधनों की समाप्ति को रोकना, कचरे के उत्पादन को कम करना और उत्पादन तथा ऊर्जा खपत के वैकल्पिकों को लागू करना। सतत् विकास में विकास के तीन मुख्य तत्व शामिल होना चाहिये–निष्पक्षता, पर्यावरण की सुरक्षा और आर्थिक दक्षता। सतत् विकास प्रौद्योगिकी और समाज द्वारा वर्तमान और भवी आवश्यकताओं को पूरा करने की पर्यावरण की क्षमताओं पर लगायी गई सीमाओं की अवधारणा है।

विश्व पर्यावरण और विकास आयोग के अनुसार–सतत् विकास को परिवर्तन की ऐसी प्रक्रिया के रूप में परिभाषित किया गया है, जिसमें संसाधनों का दोहन, निवेश की दिशा, प्रौद्योगिकी विकास एवं संस्थागत परिवर्तनों की दिशा में सामंजस्य हो ताकि मानवीय आवश्यकताओं और अपेक्षाओं को पूरा करने की वर्तमान एवं भावी क्षमताओं में वृद्धि हो । ब्रेटलैण्ड आयोग सतत् विकास की अवधारणा में भावी पीढ़ी को पर्याप्त और अच्छी गुणवत्ता वाले पर्यावरण सुलभ करने के विचार पर बल देता है, जैसा कि हम सभी ने अपनी पूर्व पीढ़ी से प्राप्त किया है।

पर्यावरण संरक्षण की आवश्यकता

पर्यावरण संरक्षण हमारी संस्कृति का एक अंग है, पर्यावरण का संरक्षण करना मतलब उसकी पूजा करने के समान है, हमारे देश में पर्वत, नदी, वायु, ग्रह–नक्षत्र, पेंड़, पौधे इत्यादि कहीं न कहीं मानव के साथ जुड़े हुए हैं। पर्यावरण संरक्षण का उद्देश्य ही यही है कि स्वस्थ्य नैसर्गिक वातावरण को बनाये रखना तथा आवश्यकता पड़ने पर पुनर्प्राप्ती की संभावना को जीवित रखना परन्तु पर्तमान समय में अस्थिर एवं असंतुलित

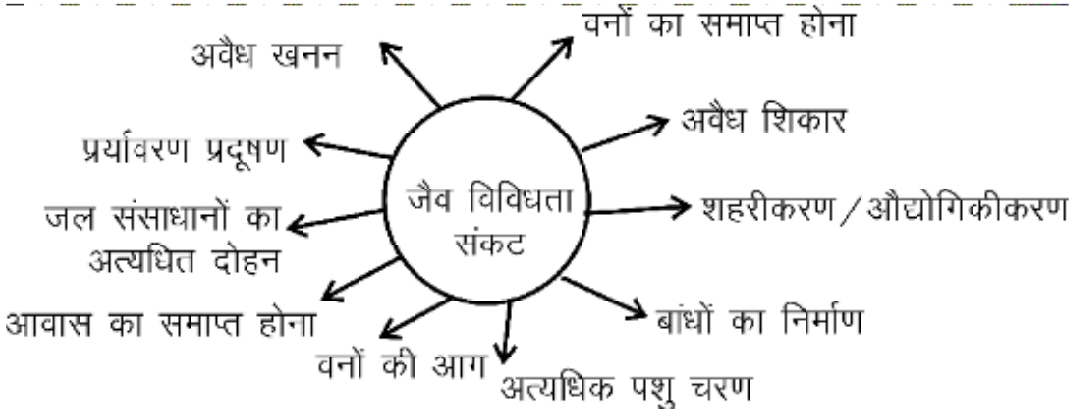
विकास में विकास के केवल एक पक्ष पर बल दिया जाने लगा है, जबकि दूसरा पक्ष (पर्यावरण संरक्षण) उपेक्षित हुआ है। अतः पर्यावरण संरक्षण अत्यावश्यक है।

पर्यावरण संरक्षण और सतत् विकास

आज समुचे विश्व में विकास की दौड़, व्यापारिकता एवं भौतिकता ने प्रकृति के साथ खिलवाड़ करना प्रारंभ कर दिया है, सच तो यह है आज हमें विनाश रहित विकास अर्थात सतत् विकास की जरूरत है, पर्यावरण संरक्षण की महत्ता को स्वीकारते हुए टिकाऊ विकास की दिशा में उन्मुख होना पड़ेगा । मनुष्य अपने पर्यावरण का रचयिता एवं उसे ढालने वाला दोनों है । जिसमें उसे भौतिक स्थिरता, बौद्धिकता, नैतिक, सामाजिक और आत्मिक विकास के अवसर मिलते हैं । पर्यावरण संरक्षण के लिये हमें अपने क्रिया कलापों में विवेकपूर्ण परिवर्तन आवश्यक है, इस दिशा में हर स्तर पर नागरिकों समुदायों एवं समस्त संस्थाओं को सार्वजनिक प्रयासों में नयायसंगत भागीदारी निभानी होगी । जैव विविधता को नुकसान पहुँचाने के कारण वनस्पतियों और जीव जन्तुओं की बहुत सी प्रजातियां विलुप्त होती जा रही है । रेड डाटा बुक के अनुसार लगभग 5000 वनस्पति पिछले 30 वर्षों में लुप्त हो चुकी है तथा 139 पक्षियों की प्रजाति एवं 600 से अधिक प्राणी प्रजातियों विलुप्ती के कगार पर है, इस दिशा में जैव विविधता संरक्षण के दो उपाय उपयोगी माने गये। पहला–स्व आवासीय संरक्षण तथा दूसरा–कृत्रिम आवासीय संरक्षण ।

भारत विश्व का बारह सर्वाधिक जैव विविधता वाले देशों में से है, जहॉ विश्व की कई प्रजातियॉ मिलती है, भौगोलिक परिस्थितियों की भिन्नता के कारण विभिन्न स्थानों की जलवायु भिन्न हैं, जैव विविधता मानव के लिए अत्यन्त उपयोगी है, बावजूद जैव विविधता का संकट बढ़ा है। जैसे आवासों का विनाश, वन्य जीवों का शिकार, मानव तथा वन्य जीवों में संघर्ष।

जैव विविधता पर मानव जनित कारणों से संकट



पर्यावरण संरक्षण एवं सतत् विकास के पक्ष में आवश्यक पहल

सतत् विकास को प्रभावशीला बनाने के लिए प्राकृतिक संसाधनों के संरक्षण तथा पर्यावरण समस्याओं पर नियंत्रण हेतु पर्यावरण शिक्षा द्वारा 3त के सूत्र– REDUCE (कम करना) RECYCLE (पुनर्चक्र) तथा REUSE (पुनरूपयोगी) सिद्धान्त को बढ़ावा दिया जाना आवश्यक है । प्राकृतिक संसाधनों के उपयोग के फलस्वरूप निकलने वाले व्यर्थ पदार्थ को ऐसे पदार्थ में परिवर्तित कर दिया जाये जो तुलनात्मक रूप से कम हानिकारक हो । उद्योगों के ऐसे उत्पाद, जसे प्लास्टिक, रबड़ इत्यादिद्ध जिनका जैविक रूप से विघटन नहीं होता है उन्हें पुनर्चक्र द्वारा बार बार उपयोग में लाया जाये ताकि हमारा पर्यावरण सुरक्षित रहे । पर्यावरण संस्था के लिये हमें अपने क्रियाकलापों में विवेकपूर्ण परिवर्तन आवश्यक है इसके लिये हर स्तर पर नागरिकों, समुदायों

सभी संस्थाओं को सार्वजनिक प्रयासों में न्यासंगत भागीदारी निभाना चाहिए । विकासशील देशों को इस क्षेत्र में अपने उत्तरदायित्व निर्वाहन किये जाने हेतु आवश्यक संसाधन जुटाने के लिए अन्तर्राष्ट्रीय सहयोग की आवश्यकता है । आर्थिक विकास की योजना में यह ध्यान रखा जाये कि उनके कितने नवीकरणीय या गैर नवीकरणीय संसाधन है । प्राकृतिक संसाधनों की कीमत में उस भूमि को पुनः उपयोग के लायक बनाने का खर्चा भी समाहित किया जाये । सतत् विकास के लिये जनसंख्या परिमाण एवं परिस्थितिकी तंत्र की उत्पादन क्षमता में सामंजस्य होना चाहिये । सतत् विकास में प्राकृतिक संसाधनों का संरक्षण, नवीकरणीय संसाधनों के अधिक उपयोग, पुनः चक्रण करके दुबारा प्रयोग से प्राकृतिक संसाधनों की काफी बचत हो सकती है ।

पृथ्वी पर प्राकृतिक संसाधनों का वितरण असतत एवं अनियमित है । बढ़ती जनसंख्या के कारण प्राकृतिक संसाधनों का अति दोहन करने से प्राकृतिक संसाधनों के भंडार तेजी से कम हुए हैं । प्राकृतिक संसाधनों को दो भागों में विभक्त किया गया है । नवीकरणीय संसाधन एवं गैर नवीकरणीय संसाधन । नवीकरणीय संसाधन वह है, जिसे पुनः उपयोग में लाये जा सकते हैं, जबकि गैर नवीकरणीय संसाधन का उपयोग/दोहन एक बार किये जाने के बाद पुनः पुर्ति अथवा पुनःनिर्माण भविष्य में संभव नहीं है । अतः प्राकृतिक संसाधनों का नियोजन संरक्षण तथा प्रबंधन जरूरी है ।

प्रर्यावरण संरक्षण में आम आदमी की भूमिका

अविवेकपूर्ण दोहन प्राकृतिक संसाधनों के ह्रास का प्रमुख कारण है हमें भावी पीढ़ी के लिए भी संसाधन बचाने होंगे । प्राकृतिक संसाधनों का उचित एवं विवेकपूर्ण उपयोग करके सतत् विकास की ओर अग्रसर होना होगा लम्बे समय तक संसाधन की उपलब्धता बनी रहे इस कड़ी में आम आदमी को महत्वपूर्ण भूमिका निभानी होगी। हमें पर्यावरण संरक्षण के लिए निम्न पहल करने होंगे –

1. हर नागरिक केवल अपने बारे में न सोंचकर भावी पीढ़ी के उपयोग हेतु भी इन संसाधनों को बचाकर रखे ।
2. सादगीपूर्ण जीवनचर्या अपनाएं एवं परिवार का आकार छोटा रखें ।
3. वैकल्पिक उर्जा श्रोत (सौर उर्जा, पवन उर्जा, गोबर गैस) के उपयोग पर बल दें ।
4. वाहनों का उपयोग छोटी–छोटी दूरी के लिए न करें ।
5. संसाधन संरक्षण संबंधी सरकारी एवं गैर सरकारी योजनाओं में सहयोग करें । तथा बच्चों को प्राकृतिक संसाधनों के संरक्षण हेतु प्रेरित करें ।
6. कृषि के क्षेत्र में जैविक खाद के उपयोग को बढ़ावा दें ।

सुस्थिर जीवन शैली

सुस्थिर जीवन शैली संसाधनों के उचित उपयोग द्वारा संभव है । प्राकृतिक संसाधनों को साझी विरासत मानते हुए आवश्यकता अनुसार इसका उपयोग करना होगा । ऐसे संसाधन जो तेजी से समाप्त हो रहे हैं, उनके उपयोग को नियंत्रित करना होगा तथा लम्बे समय तक निर्बाध रूप से संसाधनों का उपयोग करने के लिए वर्तमान उपभोग की दर में कमी लानी होगी । ताकि हमारी आवश्यकताएँ भी पूरी होती रहे, भावी पीढ़ी की आवश्कताओं की पूर्ति की सम्भावनाएँ भी जीवित रहे । किसी भी देश में संसाधनों की मांग दो बातों पर निर्भर करती है।

1. प्रति व्यक्ति मांग

2. कुल जनसंख्या द्वारा मांग

अतः यह स्पष्ट है कि संसाधनों को बचाए रखने के लिए दो प्रभावी उपाय हो सकते हैं– पहला जनसंख्या वृद्धि पर नियंत्रण तथा दूसरा प्रति व्यक्ति संसाधनों के उपयोग में कमी करना । आज समुच विश्व उर्जा संकट का हल ढूंढने में प्रयासरत है, भारत में सरकार द्वारा 14 दिसम्बर सन् 1990 को संसद के द्वारा ऊर्जा संरक्षण प्रस्ताव पास कराया गया । इसी कड़ी में प्रतिवर्ष 14 दिसम्बर को ऊर्जा संरक्षण दिवस एवं सप्ताह मनाया जाता है, जिसके माध्यम से ऊर्जा के संरक्षण, प्रबंधन एवं वैकल्पिक श्रोतों के बारे में जन सामान्य को जानकारी शुलभ करने तथा उपयोग में लाने के लिए जागरूक किया जाता है । ऊर्जा संकट के समाधान के लिए वैकल्पिक श्रोतों का उपयोग आज समय की मांग बन चुकी है । ऊर्जा के वैकल्पिक श्रोत निम्न स्वरूपों में हो सकते हैं :– सौर ऊर्जा, पवन ऊर्जा, जल शक्ति, भू–तापीय, गोबर गैस/बायोगैस तथा पशुओं एवं कृषि के अपशिष्ट । वैकल्पिक ऊर्जा के श्रोतों का सबसे बड़ा फायदा यह है कि यह कभी समाप्त नहीं होने वाला है और दूसरा ऐसे श्रोत से किसी प्रकार का कोई प्रदूषण नहीं होगा । यद्यपि आर्थिक दृष्टि से ये श्रोत मंहगी जरूर है ।

पर्यावरण नैतिकता

प्रदूषण को होने से रोकने तथा प्रदूषित होने पर कोई संभावित उपाय तभी लागू किये जा सकते हैं,जब मनुष्य की सोंच में समस्या के प्रति चिंता हो और उसे दूर करने के लिए उसका मन मस्तिष्क तैयार हो, पर्यावरण संरक्षण से संबंधित नियमों का पालन करना ही पर्यावरण नैतिकता कहलाती है, हमें पर्यावरण नैतिकता विकसित करने के लिए अपने आप में कुछ अच्छी आदतों को विकसित करना होगा जैसे– जीवाश्म ईंधन के जगह वैकल्पिक ईंधन का उपयोग, जनसंख्या वृद्धि को रोकने में सहयोग, सी.एन.जी. चलित वाहनों का उपयोग, मनोरंजन के साधनों का कम से कम आवाजों में उपयोग, प्रकृतिक संसाधनों का बुद्धिमतापूर्ण उपयोग, जल के दुरपयोग पर रोक एवं पॉलीथिन का कम से कम उपयोग । ये सारी आदतें स्वयं में विकसित करना हम सबकी प्राथमिक जिम्मेदारी है, और नयी पीढ़ी को भी उसका अनुसरण करने के लिए प्रेरित करना होगा, जिससे पर्यावरण सुरक्षित रह सके । सबसे बड़ी बिडम्बना तो यह है कि आज के परिवेश में मनुष्य स्वयं को पर्यावरण के साथ जोड़ने में सदा कतराता रहा है ।

आज दुनियां का हर देश आर्थिक विकास की होड़ में लगा हुआ है तथा कई ऐसी योजनाएं एवं आर्थिक विकास नीतियां अपनायी जा रही है जो पर्यावरण सुरक्षा के लिये प्रतिकूल है । जलवायु परिवर्तन ऊर्जा खपत, उपशिष्ट पदार्थ उत्पादन, गरीबी प्राकृतिक संसाधनों का प्रबंधन, जैव विविधता की हानि एवं भूमि उपयोग इत्यादि सतत् विकास के मार्ग में एक बड़ी चुनौती है ।

पर्यावरण कानूनों को लागू करने में चुनौतियाँ

प्रदूषण के कारण पर्यावरण के बिगड़ते स्वरूप को देखकर कई कानून निर्मित किये गए हैं, जिनमें से कुछ एक–दूसरे के पूरक हैं और कुछ सम्पूरक । राष्ट्र संघ द्वारा जून 1972 मे स्टॉक होम (स्वीडन) में आयोजित मानव पर्यावरण अंतराष्ट्रीय सम्मेलन में गहन विचार किया गया । कई अधिनियम भी पारित किये गए, यद्यपि कानून तो बनाए गए, परन्तु उनका अनुपालन सही ढ़ंग से नहीं हो रहा है, ये नियम तबतक कोई प्रभाव नहीं ला सकते जबतक की इन्हें आम जनता द्वारा अमल में नही लाया जाएगा । अतः पर्यावरण संरक्षण के लिए जनजागरूकता की आवश्यकता है, जिससे कि ये नियम सिर्फ लिखित दस्तावेज बनकर न रह जाए बल्कि यह हमारे जीवन शैली में शामिल हो जाए । कानून के अनुपालन में कई चुनौतियां मौजूद है –

1. सिर्फ लिखित रूप से कानून बनाये गए उनके अनुपालन के संबंध में कोई भी मॉनिटरिंग कमेटी नहीं है ।

2. देश में फैले भ्रष्टाचार के कारण दोषी मुक्त हो जाते हैं, इसीलिए कानून के प्रति कोई भय नहीं होता है ।

3. किसी भी कानून का पालन तभी संभव है, जब नागरिक स्वयं समस्या को समाप्त करना चाहे । सच्चाई तो यह है कि आज भी हम लोग पर्यावरण को स्वयं के साथ नहीं जोड़ पाए हैं और ''मेरे एक के करने से क्या होगा'' की भावना से हम सभी ग्रसित हैं,

4. विभिन्न जनजातियॉ अपने जीवन यापन के लिए वन्य जीव एवं वनों पर ही आश्रित है, और उनका उपयोग अवैज्ञानिक ढंग से करते हैं।

5. हमारे सामाजिक रीति–रिवाज एवं धार्मिक क्रियाकलाप जैसे शवों को नदियों में विसर्जन, मूर्तियों एवं ताजियों का विसर्जन, पूजा सामग्री का नदी में बहाना, आदि के कारण कानून कुछ नहीं कर पाता है।

निष्कर्ष

उद्योगों एवं तकनीकी के अंधाधुंध विकास ने प्रदूषण, वनों की कटाई, मृदा क्षरण अम्लीय वर्षा, वन्य जीवन का ह्रास, ग्लोबल वार्मिंग जेसी समस्याऍ उत्पन्न कर दी है । अतः यह आवश्यक है कि उद्योग एवं तकनीकी विकास की दिशा में चिंतन हो, उन वैकल्पिक युक्तियों एवं संसाधनों की खोज हो, जिसके फलस्वरूप आर्थिक विकास एवं पर्यावरण के मध्य समरसता एवं सामंजस्य कायम हो सके, जिससे दुनियां के सभी देश आर्थिक विकास सतत् रूप से बिना पर्यावरण को नुकसान पहुँचाये कर सके । सतत् विकास के लिए जनसंख्या परिमाण एवं परिस्थितिकी तंत्र की उत्पादन क्षमता में सामंजस्य रखना आवश्यक है । सतत् विकास के लिए संसाधनों का संरक्षण एक प्राथमिक कर्तव्य है । नवीकरणीय संसाधनों के अधिक उपयोग से प्राकृतिक संसाधनों का संरक्षण हो सकता है, पुनः चक्रण करके और दुबारा प्रयोग से प्राकृतिक संसाधनों की काफी बचत की जा सकती है ।

संदर्भ सूची

1. मल्होत्रा डॉ. बी.एम. पर्यावरण अध्ययन विश्व विद्यालय प्रकाशन।

2. त्रिवेदी पी.सी. एवं गुप्ता गरिमा पर्यावरण अध्ययन अविष्कार पब्लिशर्स डिस्ट्रीब्यूटर्स जयपुर।

3. जोशी डॉ. रतन पर्यावरण अध्ययन साहित्य भवन पब्लिकेशन्स, आगरा ।

4. सुराणा डॉ. नरेन्द्रमल एवं सुराणा डॉ. राजकुमारी पर्यावरण अध्ययन एस.बी.पी.डी. पब्लिशिंग हॅउस, आगरा ।

5. भारद्वाज जे.एल. भारत के आर्थिक विकास एवं नियोजन रामप्रसाद एण्ड सन्स प्रकाशन, अस्पताल रोड, आगरा ।

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टिकाऊ कृषि एवं पर्यावरण संरक्षण

डॉ. क्रेसेन्सिया टोप्पो

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प्रस्तावना

पर्यावरण से अभिप्राय हमारे चारो ओर फैले हुए उस वातावरण एवं परिवेश से है जिससे हम घिरे रहते हैं प्रकृति में विद्यमान समस्त जैविक तथा अजैविक घटक मिलकर पर्यावरण की रचना करते हैं। जर्मन वैज्ञानिक एच. फिटिंग के शब्दों में ''जीवों के पारिस्थितिक कारकों का योग पर्यावरण है।'' ए.जी. टांसले '' प्रभावकारी दशाओं का वह सम्पूर्ण योग जिसमें जीव रहते हैं पर्यावरण कहलाता है।

पर्यावरण संरक्षण

मनुष्य विभिन्न प्राकृतिक संसाधनों का उपयोग अपनी आवश्यकताओं की पूर्ति के लिए करता आ रहा है। खाद्यानों और अन्य कच्चे पदार्थों की पूर्ति के लिए भूमि को जोता है, सिंचाई और शक्ति के विकास के लिए उसने वन्य पदार्थों एवं खनिजों का शोषण और उपयोग किया है। बढ़ती जनसंख्या की आवश्यकताओं की पूर्ति के लिए प्राकृतिक संसाधनों का तेजी से गलत एवं विनाशकारी ढंग से शोषण करते आ रहे हैं।

पिछली दो शताब्दियों में करोड़ों हेक्टेयर भूमि से प्राकृतिक वनस्पतियों वन आदि को साफ किया गया जिससे मिट्टी का कटाव बढ चला। भूमि के गलत उपयोग से उसकी उत्पादन क्षमता घट गई विभिन्न खनिज भी समाप्त प्राय हो गई है। हम हवा और पानी को भी प्रकृति की मुक्त देन समझकर प्रत्यक्ष या अप्रत्यक्ष रूप से दूषित करने लगे हैं। अनेक जीव जन्तुओं का भी मनुष्य ने सफाया कर दिया है आशय यह है कि प्राकृतिक संतुलन बिगड़ने लगे हैं। अतः मानव के अस्तित्व एवं प्रगति के लिए पर्यावरण संरक्षण अत्यावश्यक हो गया है।

वर्तमान उत्पादन तकनीक ने पर्यावरण प्रदूषण की गंभीर समस्या को जन्म दिया है। अनेक उत्पादन क्रियाएँ जल, वायु एवं भूमि को प्रदूषित कर रही है जो आज एक चिंता का विषय है अनुमानतः सभ्यता के आदि काल से सारे विश्व में चाहे वह विकसित हो या विकासशील, पर्यावरण असंतुलन और उससे जनित समस्याओं से दुष्प्रमाणित हो रहे हैं। पर्यावरण असंतुलन से जहां एक ओर वैश्विक ताप वृद्धि, ओजोन परत क्षरण तथा अम्ल वर्षा जैसी समस्याएं पैदा हुई हैं, वहीं दूसरी ओर सूखा, बाढ़, भूमि की उर्वरा शक्ति में ह्रास, भूस्खलन, भूक्षरण , रेगिस्तानीकरण तथा जल संकट जैसी समस्याएं भी पैदा हुई हैं। वस्तुतः विकास की अंधी दौड़ में हमने आर्थिक विकास के पर्यावरणीय पहलू को भूला दिया गया है। फलतः पर्यावरण का अनवरत हास हमारे समक्ष एक संकट के रूप में प्रकट हुआ है अर्थात पर्यावरणीय प्रदूषण की गम्भीर समस्या पैदा हो गई है। समय रहते पर्यावरण संरक्षा पर चिंता को व्यावहारिकता में लाना आवश्यक है।

कृषि

कृषि समस्त उद्योगों की जननी, मानव जीवन की पोषक, प्रगति की सूचक तथा समानता का प्रतीक समझी जाती है। तीव्र आर्थिक विकास की ओर उनमें वर्तमान गतिशील विश्व के समस्त विकसित एवं विकासशील देश अपने उपलब्ध संसाधनों का अपनी परिस्थितियों एवं क्षमताओं के अनुरूप यथासंभव अनुकूलतम उपयोग कर कृषि उत्पादों में परिमाणात्मक एवं गुणात्मक सुधार तथा प्रगतिशील एवं व्यावसायिक कृषि के विकास हेतु सचेत एवं प्रशस्त है।

अल्पविकसित राष्ट्रों में प्रधान व्यवसाय होने के कारण कृषि राष्ट्रीय आय का सबसे बड़ा स्त्रोत , रोजगार एवं जीवन यापन का प्रमुख साधन, औद्योगिक विकास, वाणिज्य एवं व्यापार का आधार है।

विभिन्न पर्यावरणीय तत्वों जिनका कृषि कार्य में प्रयोग होता है जानना आवश्यक है। इन पर्यावरणीय तत्वों के प्रयोग की स्थिति निम्नवत है। मिट्टी एक आधारभूत संसाधन है जो स्थल की उपरी सतह का वह भाग है। जहां चट्टानें बार –बार फैलकर एवं सिकुड़कर टूटती है। मानव का मिट्टी से अटूट संबंध है मानव की कृषि संबंधी समस्त क्रियाओं का आधार मिट्टी ही है। मिट्टी के कण बारीक, असंगठित एवं मुलायम होते हैं इसमें पौधों की जड़े सरलता से चली जाती हैं।

फिंच एवं ट्रिवाथी ने मिट्टी की व्याख्या की है '' पृथ्वी के ऊपरी आवरण का वह भाग जो खनिज और जीव पदार्थों के प्राकृतिक संयोग से पौधों के उत्पादन के लिए उपयुक्त हो मिट्टी कहा जाता है। डी.एन. वाडिया –'' मानव उपयोग की दृष्टि से सभी देशों की मिट्टियां वहां के आवरण स्तर का सबसे अधिक मूल्यवान अंग होती है और उनकी प्रायः सबसे बड़ी सम्पत्ति होती है।'' मिट्टी मानव के व्यवसायों को निर्धारित करती है उर्वरक मिट्टी वाले क्षेत्रों में मानव का व्यवसाय कृषि है। कृषि कार्य में कीटनाशक एवं रासायनिक उर्वरकों के प्रयोग से मिट्टी की उर्वरता नष्ट होती जा रही है जो चिंता का विषय है।

जल संसाधन विश्व में सबसे महत्वपूर्ण एवं अमूल्य निधि है । यह प्राकृतिक संसाधन है यह सभी जैव जगत को जीवन देता है। जल स्वयं एक संसाधन है। भूतल पर जैविक एवं अजैविक प्रक्रियाएं भौतिक एवं रासायनिक चक्र मानव का अभूतपूर्व विकास एवं सांस्कृतिक दृश्य भूमि, स्वयं मानव जीवन बिना जल के अधूरे एवं निस्सार हैं। जैव जगत की समस्त आर्थिक क्रियाएं बिना जल के संभव नहीं है। कृषि से लेकर उद्योगों द्वारा आज नदियों, झीलों, दलदल, भूमिगत जल प्रदूषित हो रही है। जल संरक्षण निश्चित ही आवश्यक हो जाता है।

वन संसाधन का हास का कारण भी मानव है मानव हस्तांतरित कृषि द्वारा बड़े पैमाने पर वनों को नष्ट करता है । वनो को पशुओं के चराने के लिए चारागाह के रूप में उपयोग किया जाता है विभिन्न कारणों से वनों का विनाश हो रहा है जो पर्यावरण संतुलन में बाधक हैं।

ऊर्जा संसाधन को जीवन का संचार भी कहा जाता है । शक्ति संसाधनों का उपयोग विभिन्न रूपों में किया जाता है इनमें से कृषि फार्मिंग एवं पशुपालन भी है। आधुनिक कृषि में सिंचाई की सुविधाओं के लिए बिजली की खपत बढ़ती जा रही है । इसे भावी पीढ़ी के लिए बचाना आवश्यक है। ऊर्जा चाहे जीवों से प्राप्त हो या निर्जीवों से पारिस्थितिक तंत्र में ऊर्जा का महत्वपूर्ण स्थान है। अतः पर्यावरण में ऊर्जा संसाधन का संरक्षण अनिवार्य है।

हवा एवं सूर्य प्रकाश प्रकृति के निःशुल्क उपहार हैं मानव ने अपनी भौतिकवादी संस्कृति को बढ़ावा दिया है। औद्योगीकरण और नगरीकरण से फैलती प्रदूषण हवा एवं रोशनी को प्रभावित कर रही है। खेतों के फसल एवं हरे पेड़ पौधे क्लोरोफिल की सहायता से प्रकाश संश्लेषण की क्रिया द्वारा अपना भोजन बनाते हैं।

पर्यावरण भी कृषि व्यवसाय एवं कृषि आधारित उद्योगों के कारण भी प्रदूषित हो रही है। इसे टिकाऊ कृषि के माध्यम से कम किया जा सकता है। रासायनिक खादों के स्थान पर जैविक खाद का प्रयोग, कीटनाशक दवाईयों, खरपतवार नाशक दवाईयों पर रोक लगाकर जैव विविधता का संरक्षण करते हुए पर्यावरण संतुलन बनाया जा सकता है। टिकाऊ कृषि से भूमि की उर्वराशक्ति को भविष्य में भी बनाए रखना संभव होगा और मृदा में जो खतरनाक रसायन प्रवेश कर उसे प्रदूषित करते हैं उससे मुक्ति भी मिलेगी।

सतत् विकास –

पर्यावरण की रक्षा व मानव का सतत् विकास की सहगामी अवधारणा को सतत् विकास के नाम से जाना जाता है। इस शब्द का सर्वप्रथम प्रयोग 1980 में 'विश्व संरक्षण रणनीति' में किया गया। संयुक्त राष्ट्र संघ द्वारा 1983 में पर्यावरण एवं विकास पर गठित ब्रंटलैण्ड आयोग ने सम्पोषित विकास को परिभाषित किया – '' मानव की भावी पीढ़ी की आवश्यकताओं को पूरा करने की क्षमता में ह्रास किये बिना वर्तमान पीढ़ी की आवश्यकताआें की पूर्ति करना ही धारणीय विकास है।'' अर्थात् प्राकृतिक संसाधनों का दोहन वर्तमान व भावी पीढ़ी दोनों के हितों को ध्यान में रखते हुए किया जाना चाहिए। इस संकल्पना में प्राकृतिक पर्यावरण में मानवीय हस्तक्षेप को न्यूनतम स्तर तक स्वीकार किया गया है।

टिकाऊ कृषि – टिकाऊ कृषि से तात्पर्य ऐसी कृषि पद्धति से है जिसमें मानव की बदलती आवश्यकताओं की पूर्ति हेतु कृषि में लगने वाले साधनों का इस प्रकार सफल प्रयोग किया जाए, जिससे प्राकृतिक ह्रास न हो एवं पर्यावरण भी सुरक्षित रहे।

सतत् कृषि पद्धति के प्रमुख तत्व – पर्यावरण सुरक्षा आर्थिक लाभदायकता, सामाजिक एवं आर्थिक समता लाना है । नई कृषि तकनीक के कारण उर्वरक , कीटनाशक दवाईयों, सिंचाई हेतु जल का अधिक प्रयोग करना पड़ रहा है इसे रोक लगाकर पर्यावरण सुरक्षा को ध्यान देते हुए आज कृषि के सतत् विकास हेतु एक ऐसी तकनीक की आवश्यकता है जो संसाधनों के उपयोग में बचत करती हो तथा जो प्रदूषण से मुक्त हो।

वर्तमान समय में रासायनिक पदार्थों का प्रयोग एक सामान्य प्रक्रिया है इससे मिट्टी को प्रदूषित करके उसके भौतिक, रासायनिक तथा जैविक गुणों पर प्रतिकूल प्रभाव को रोकना। सतत् कृषि से संभव है। फसलें रासायनिक पोषक तत्वों को पूर्ण रूपूण उपयोग नहीं कर पाती और मिट्टी में इसका सान्द्रण बढ़ जाता है । कीटनाशक द्वारा भी जल प्रदूषित होता है ये खाद्यान फसलों के माध्यम से मानव शरीर में पहुंच कर घातक रोग उत्पन्न करते हैं, इसे रोकना। उत्तम किस्म के बीजों से अधिक उपज के लिए सिंचाई सुविधाओं का अधिक प्रयोग से भूमिगत जल स्त्रोत नीचे जा रहा है। इसे बचाना। इस तरह नवीन कृषि तकनीक में मिट्टी, हवा, पानी प्रदूषित हो रही है। संसाधनों का अंधाधुंध उपयोग हो रहा है। अतः इसे रोकने के लिए सतत् कृषि का महत्व बढ़ गया है। इससे कृषि पैदावार में वृद्धि के साथ –साथ पर्यावरण संरक्षण संभव होगा। सतत् कृषि प्राकृतिक संसाधनों का उद्देश्य अनुरूप प्रयोग की बात करता है जैसे –

(1) भूमि पर जैविक दबाव को कम करना।

(2) बेकार भूमि को कृषि तथा वानिकी के लिए उपयोग करना।

(3) बहुफसल एवं मिश्रित फसल की तीव्रता को बढ़ाना।

(4) सरकारी बेकार भूमि पर चारागाह एवं वानिकी के कार्यक्रमों के विकास के लिए किसानों एवं भूमिहीन मजदूरों को वित्तीय प्रोत्साहन, वृक्षों एवं चारागाहों का स्वामित्व प्रदान करना।

(5) भू जल का विवेकपूर्ण प्रयोग को बल देना । निश्चित ही सतत् कृषि से पर्यावरण संरक्षण को बल प्राप्त होगा।

उपसंहार –

मानव विकास की प्रारंभिक अवस्था में सीमित जनसंख्या तथा सीमित आवश्यकताओं के कारण प्राकृतिक संसाधनों के उपयोग के उपरान्त भी उसका पर्यावरण से सामंजस्य बना रहा, किन्तु बढ़ती जनसंख्या तथा तकनीकी प्रगति के साथ –साथ प्रकृति के शोषण की दर में वृद्धि होती गई। निरंत विकास मानव की स्वाभाविक प्रकृति है पर्यावरणीय समस्याओं के कारण विकास को रोका नहीं जा सकता तो पर्यावरण हास के कारण समस्त जीव जगत पर बढ़ते संकट की उपेक्षा भी नहीं की जा सकती है। अतः पर्यावरण को बचाते हुए सतत् कृषि की अवधारणा जो विकसित हुई है प्रतिपालनीय आवश्यक है। गुरू चरक ने कहा था – '' स्वास्थ्य जीवन के कारक हैं'' सरकारी प्रयास और स्वयं व्यक्ति मिलकर ही पर्यावरण के तत्वों की गुणवत्ता को सुरक्षित रख सकते हैं।

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हलफनामे उपन्यास में जल संकट

श्रीमती स्नेहलता खलखो

सहायक प्राध्यापक (हिन्दी), शासकीय श्यामा प्रसाद मुखर्जी महाविद्यालय सीतापुर, जिला–सरगुजा, (छ0ग0)

राजू शर्मा कृत हलफनामे जल संकट सवेरा गाँव का है। उपन्यास का मुख्य पात्र स्वामी रामप्रसाद का सम्पूर्ण जीवन कृषि पर आधारित है। जल ही जीवन का आधार हैं, क्योंकि कोई भी कार्य ऐसा नहीं है जो जल बिना संभव हो, जल पीने के अलावा धुलाई–सफाई, कृषि, उद्योग, विद्युत उत्पादन आदि के लिए आवश्यक है। स्वामी रामप्रसाद कठिन मेहनत करके कृषि कार्य करता है, परन्तु उसका मेहनत रंग नहीं ला पाता है। क्योंकि इस मेहनत में रंग फेरने का काम उस गाँव का पर्यावरण है। पर्यावरण असंतुलन के कारण सवेरा गाँव का जल स्त्रोत नीचे चला गया है। जिससे पूरा गाँव परेशान है। अधिकतर किसान इस समस्या का संर्घष कर रहा है।

स्वामी रामप्रसाद अपने बेटे मकई को खेती करने के लिए प्रेरित करता था, लेकिन उसका पुत्र मकई कृषि कार्य पर अपना रूझान नहीं दिखाता था। मकई शहर में रहकर बिजली साज का कार्य करके अपनी पत्नी सुधा, बच्चा सुनील और रमा का पालन पोषण करता था। इलेक्ट्रानिक्स की दुनिया विकट तेजी से बदलती रही, पर मकई के लिए यह दिक्कत नहीं थी। भिखारी और मजदूरों के जख्मी, पुरातन ट्राजिस्टर रेडियो से लेकर इलाके के सांसद का मठरी के आकार का डी.वी.डी. प्लेयर और आई–पॉड, जो उसने हाल में ही विदेश से मंगवाये थे, ये सब सर्विस और मरम्मत के लिए पहले या आखिर में मकई के पास पहुंचते थे। आखिरी इलाज के रूप में मकई की मरम्मती को बेपनाह ख्याति मिली। ऐसा अपसानों को सुनकर एल जी और सेमसंग जैसी कम्पनियों ने दो–तीन बार अपने तकनीशियन मकई के पास भेजे किन्तु तकनीशियन मकई से सीख नहीं पाए। मकई अपने बिजली साज के कार्य में व्यस्त रहता। अपने परिवार के साथ शहर में रहकर जीवन यापन करता था। ''एक सुबह यह दहलाने वाली खबर आई कि स्वामीराम नहीं रहा उसकी मौत हो गई है। किसी वक्त रात में उसने जहर पी लिया। जब तक पता चला, बहुत देर हो चुकी थी। स्वामी रामप्रसाद ने खुदखुशी कर ली थी।''

मकई राम का सब कुछ–उसका वजूद, संसार, ऐतबार एकाएक गड़बड़ हो गया–चरमरा गया। उसकी अस्मिता और आत्म गौरव का अतीत की गठन और आने वाले कल के ख्वाब (सपना) चकना चूर हो गए–उसका जीवन मानो रेत के टीले की तरह भरभरा कर उसके ही कदमों में ढेर बन गया था। वह बस हड्डियों का ढाँचा ही बच रह गया था और अब कैसे वह रेत के एक–एक कण को एकट्ठा कर खुद का पुनःनिर्माण करेगा, वह प्रकृति की हर ताकत से लड़ने जैसा है। बाप की असमय मौत खुदखुशी की शरम, मकई यंत्रणा और शोक के गहरे सागर में ढूबने लगा। फिर अज्ञात का अंधेरा था, अनिष्ट का आतंक इनके सामने मकई निहत्था और बेबस था।

जल की लगातार कमी इस उपन्यास की केन्द्रीय समस्या है किसान आत्महत्या का बवाल उसी से जुड़ा हुआ है। मकई का पिता लगातार पानी की कमी या सूखे की समस्या से जूझ रहा है। कर्ज लेकर लगातार तीन बोरवेल लगवाये, फिर भी उनमें पानी न आने पर वह विचलित होने लगा, क्योंकि लाला का कर्ज भी बन गया और पानी की कमी दूर नहीं हुई। सरकार द्वारा इस गांव को डार्क एरिया घोषित किये जाने के बाद भी लाला किसानों की जानकारी के आभाव का फायदा उठाकर उन्हें कर्ज देता था। स्वामी रामप्रसाद, पादरी और

पनिया बाबा के सहयोग से इस जल संकट के कारणों से परिचित होने पर हाथ में नीला नक्शा लिए घूमता और लोगों को आगे बोअरवेल न डलवाले की सलाह देता था। लाला का व्यवसाय संकट में पड़ा तो लाला ने स्वामी रामप्रसाद की हत्या करा दी और बात फैली आत्महत्या की। इस प्रकार मीडिया को एक मसालेदार खबर लगती है और प्रशासन तंत्र को धन कमाने का एक सुनहरा अवसर।

प्रस्तुत उपन्यास में बदली सामाजिक वास्तविकताओं को बड़ी ही सूक्ष्मता से उभारा गया है, जहाँ सामाजिक संबंधों में आए बदलाव और मानवीय संवेदना के स्थान में हुए परिवर्तन प्रमुख है। उपन्यास में ऊपरी तौर पर देखने पर जल की समस्या ही अन्य समस्याओं का कारण दिखाई देती है, किन्तु इस समस्या की वास्तविक जड़ है देश का ऐशो आराम से जीवन जीने वाले शासक–प्रशासक वर्ग जो गंभीर समस्याओं की विकाराल घड़ियों में भी सिर्फ अपना उल्लू सीधा करते है। प्रदेश का मुख्यमंत्री चुनाव की नजदीकियों को देखते हुए अपनी दूरदृष्टि का प्रयोग करते हुए शतरंज की विसात के रूप में किसान आत्महत्याओं के बदले प्रदेश सरकार द्वारा मुवाअजा दिए जाने की योजना–किसान विपदा (आत्महत्या व अन्य कष्ट) निवास योजना की घोषणा करता है क्योंकि अन्य राज्यों में किसान आत्महत्या की बहुत सारी घटनाएँ घट चुकी थी। पर जहाँ अभी तक इस प्रकार की आत्महत्या की घटना सामने नहीं आयी थी इस प्रकार मुख्यमंत्री के मन में यह योजना किसानों से सहानुभूति जताने के नाम पर राजनीति की रोटी सेकने वाली भट्टी के रूप में थी। किसी की आत्महत्या स्वार्थ सिद्धि का साधन बन जाए, अवसरवादी राजनीति का इससे सटीक उदाहरण और क्या हो सकता है। पिता की आत्महत्या के बाद मुआवजे मांग करते ही साधारण बिजली साज नहीं रह जाता बल्कि कामरेड मकई हो जाता है और गोष्ठियों से उसे स्टेज पर सम्मन दिया जाने लगा है। जिस मकई को कल तक वे जानते नहीं थे उसी पर बड़ी आत्मीयता से आज घण्टों भाषण दे रहे थे, दरअसल उसके द्वारा सरकार से की गई मुआवले की अपील, मार्क्सवादी संगठनों की राजनीति को जीवित करो का साधन हैं। वर्तमान दौर की मार्क्सवादी पार्टियों और उनके द्वारा किये जाने वाले क्रान्तिकारी कृत्यों के विषय में खुद मकई से कहता है अब क्रांति का रंग लाल नहीं रहा, अब क्रांति मखमली होती है। नारंगी या जामुनी क्रांति फूलों के नाम की क्रांति और यह तर्क संगत भी है। क्योंकि यह प्रयोजित है, इसका इरादा बदलता नहीं बल्कि विपरित पार्टी को निगलना है। क्रांति के बाजार में अगर तुम दुश्मन हो तो तुम्हें खरीदा जायेगा और बदकिस्मती से अगर दोस्त हो तो बेच दिया जायेगा।

वर्तमान युग में मानव आर्थिक विकास की लालसा एवं सुख साधनों में वृद्धि के प्रयास मे पर्यावरण के समस्त अव्यवों भूमि, जल, वायु, वनस्पतियों एवं अन्य प्राकृतिक संसांधनों एवं ऊर्जा के स्त्रोतों का मनमाना उपयोग एवं विदोहन कर रहा है। पर्यावरण के तेजी से हो रहे उपयोग एवं शोषण से आज विश्व को पर्यावरण असंतुलन की भीषण विभीषिका का सामना करना पड़ रहा है।

भारतीय कृषकों के संबंध में कहा जाता है कि – ''भारतीय किसान ऋण मे जन्म लेता है, ऋण में पलता है तथा ऋण में ही मरता है।'' कृषक महाजनों के चंगुल में इतना फंसा होता है कि ऋण के बोझ से अपने आपको मुक्त करना उसके लिए मुश्किल होता है। अतः वह कृषि में पूंजी का विनियोजन नहीं कर सकता है। उसे पुराने ढंग से ही कृषि करनी पड़ती है। पह कृषि के विकास के लिए नवीन प्रयोग नहीं कर पाता है। संगठित एवं व्यवस्थित कृषि बाजार का पूर्ण आभाव है। कृषक अपनी उपज का उचित मूल्य प्राप्त नहीं कर पाता हैं। उसे गांव के महाजन के हाथ ही आनाज बेचना पड़ता है। जिससे महाजन पुराने ऋण के हिसाब से ही चुकता करता है तथा कम मूल्य प्रदान करता है। इसके लिए आवश्यक है कि कृषि विपणन समितियाँ तथा मण्डियों की पर्याप्त स्थापना की जाए। जब तक ऐसा व्यवस्था नहीं हो पाती है कृषकों को अधिक उत्पादन हेतु प्रोत्साहित नहीं किया जा सकता है। खेती में अधिक फसल प्राप्त करने के लिए उचित प्रेरणा मिलना भी आवश्यक होता है। जिससे प्रेरित होकर किसान और खुशी से मेहनत करता है। भारत में

जमींदारी प्रथा होने के कारण कृषकों का शोषण होता था परन्तु वर्तमान में जमींदारी प्रथा समाप्त हो चुकी है।

तकनीक कारण भी कृषि उत्पादकता कम होने के लिए उत्तरदायी है। इसके अन्तर्गत उत्पादन की पिछड़ी तकनीक तथा सिंचाई के साधनों का अभाव भी सम्मिलित है जो इस प्रकार है –

कृषक ज्यादा पढ़ा लिखा नहीं होता है। अभी तक ये कृषि कार्य पुरानी पद्धिति से करते है नई आधुनिक कृषि पद्धिति एवं तकनीकी विषय में वे अनभिज्ञ है। अतः वे इसे अपनाने से डरते है इसके अतिरिक्त अन्य कारण यह भी है कि वे वित्तीय कठिनाईयों के कारण भी इसे अपना नहीं सकते है। कृषि उर्वरकों का प्रयोग नए कृषि यंत्रों का प्रयोग तथा कीटनाशक दवाइयों का प्रयोग बिना पूंजी से करना मुश्किल कार्य है। परिणाम स्वरूप उन्हें परम्परागत खल–पतवार आदि से ही कृषि करनी होती है। नए बीजों का प्रयोग उर्वरकों मशीनों तथा दवाईयों का उपयोग हमारे कृषक भंली–भांति करने लगे हैं, परन्तु वित्तीय कठिनाइयों के कारण पर्याप्त सुधार नहीं हो पा रहा है। इसके लिए सरकार का ध्यान आकर्षित करना है और कृषकों के लिए सुविधाएँ उपलब्ध कराना होगा।

सिंचाई साधनों का प्रभाव

कृषि की न्यून उत्पादकता है सिंचाई साधनों की कमी, हमारे देश में बहुत ही कम क्षेत्रफल सिंचाई के अन्तर्गत आता है। पर्याप्त सिंचाई के साधनों की कमी होने के कारण कृषि उपज में कमी रही है। कृषक पूर्णरूपेण वर्षा पर निर्भर रहते है। जिस वर्ष अच्छी वर्षा होती है पैदावार भी अच्छी हो जाती है और कम वर्षा होने पर फसल भी कम होती है। मानसून पर निर्भर रहने के कारण खेतों पर केवल एक फसल प्राप्त की जाती है। यदि सिंचाई के पर्याप्त साधन उपलब्ध हो जाए तो दो या तीन फसले उपलब्ध की जा सकती है। भारत में केवल उपलब्ध भूमि के लगभग 23 प्रतिशत भाग में ही सिंचाई की जाती है। जबकि सिंचाई सुविधाएँ नहीं बढाई जायेगी कृषि उत्पादकता को बढाना कठिन कार्य है। मानसून की कमी के कारण देश में खाद्य संकट उपस्थित होता है। जिसका विपरीत प्रभाव कृषक पर पड़ता है।

अतः कृषक की आर्थिक स्थिति सुदृढ़ करने के लिए शासन को किसानों की ओर विशेष ध्यान देते हुए सिंचाई के साधनों का पर्याप्त नहर, तालाब, बांध, बोरवेल की उचित व्यवस्था करना होगा। जिससे स्वामी रामप्रसाद जैसे किसानों का घर परिवार सुधर जायेगा और उन्हें आत्महत्या जैसे विषम परिस्थितियों का सामना करना नहीं पड़ेगा। यद्यपि खाद्य सम्बन्धी कमी पूर्ति हेतु खाद्य आयात विदेशों से किया जाता है परन्तु इसके लिए आत्मनिर्भर होना आवश्यक है। अतः किसानों की आर्थिक स्थिति में सुधान करने एवं उनका जीवन स्तर उन्नत बनाने के लिए सरकार का सहयोग नितान्त आवश्यक है।

कृषि की उपज बढाने का उपाय –कृषक की पिछड़ी दशा को देखते हुए आवश्यक हो जाता है कि इनकी स्थिति में सुधार किया जाये। उन कारणों की ओर ध्यान केन्द्रीत करना होगा जिसके कारण फसल गिरता है। कृषि में विकास के लिए सामान्य संस्थागत तथा तकनीक उपाय किया जाना चाहिए। सिंचाई योजनाएँ छोटी, मध्य एवं बड़ी सभी प्रकार की होनी चाहिए एवं उनका क्षेत्र विकेन्द्रित होना चाहिए जिससे सभी क्षेत्रों के कृषकों को लाभ मिल सके। हमारे देश की स्थिति को देखते हुए यहां पर छोटी–छोटी सिंचाई योजनाएँ क्रियान्वित की जानी चाहिए ताकि उनसे अल्पकाल में लाभ मिलना प्रारंभ हो जाए। कम भूमि के क्षेत्रफल में से यदि 50 प्रतिशत क्षेत्र ही सिंचाई के अधीन आ जाए तो देश में कृषि उत्पादकता काफी मात्रा में बढ जाएगीं।

कृषि कार्य एवं उनके विकास के लिए बड़ी मात्रा में धन की आवश्यकता होती है। किसानों को ऋण आवश्यकता को पूरा करने के लिए सहकारी बैंक, भूमि विकास बैंक, ग्रामीण बैंक एवं वाणिज्य बैंक स्थापित की गई है, किन्तु इसका लाभ केवल बड़े किसानों को ही मिलता है इसके अतिरिक्त इन बैंकों से किसान की एक तिहाई ऋण की आवश्यकताही पूरी हो पाती है। दो तिहाई ऋण वे गांव के महाजनों एवं साहुकारों से लेते है। इन महाजनों पर सरकार का कोई नियंत्रण नहीं है। ये महाजन किसानों का अनेक प्रकार से शोषण करते हैं। वे ऋण पर ऊँची दर पर ब्याज वसूलते है। कृषि उपज को कम कीमत पर स्वयं को बेचने के लिए बाध्य करते हैं तथा जमीन को प्रतिभूति के रूप में रखकर ऋण देते हैं और उस पर कब्जा करने का प्रयास करते हैं। गरीबी के कारण वे कृषि क्षेत्र में उन्नत विधियों का न तो प्रयोग कर पाते है न तो ऋण से मुक्त हो पाते है। इससे कृषि उपज का स्तर निम्न बना ही रहता है। सामाजिक एवं सांस्कृतिक संस्थाओं के कारण लोग निर्धनता के दुश्चक्र में फंस जाते है। सामाजिक उत्तरदायित्व निभाने तथा धार्मिक रस्मों–रिवाज पूरे करने के लिए लोग जन्म से मृत्यु तक फिजुलखर्च करते हैं। आय स्तर पहले ही बहुत नीचे रहता है इसलिए उन्हें बचत रोकनी पड़ती है या उधार लेना पड़ता है क्योंकि बचत नहीं के बराबर होता है इसलिए उधार लेने की संभावनाएँ बहुत अधिक है उसके अपेक्षा फसल औसतन कम होता है।

जल सबसे महत्वपूर्ण एवं अमूल्य निधि है यह प्राकृतिक संसाधन है यह सभी प्रकार के गतिशील एवं स्थिर जैव जगत को जीवन देता है। भूतल पर जैविक एवं अजैविक प्रक्रिया भौतिक एवं रासायनिक चक्र मानव का अभूतपूर्व विकास एवं सांस्कृतिक दृश्यभूमि स्वयं मानव जीवन बिना जल के अधूरे एवं निस्सार है।

जिस क्षेत्र में न तो कोई समुद्री किनारा है और न कोई बन्दरगाह, वह उस आवास की भांति है जिसमें सड़क पर निकलने के लिए कोई द्वार ही नहीं। जल हमें निम्न रूप में मिलता है –

1. नदियाँ
2. झीलें व दलदल
3. भूमिगत जल।

शासन को चाहिए की जल संरक्षण का प्रारंभ वर्षा की बूंद के पृथ्वी तल पर गिरने के साथ ही कराना चाहिए। यदि वर्षा की बूंद की सतह पर बने न देकर भूमिगत होने को प्रेरित किया जाय तो इससे वाष्पीकरण कम होग, भूमिगत जल की मात्रा में वृद्धि होगी तथा मिट्टी में नमी बढेगी और उसका कटाव रूकेगा। वर्षा के भूमि के अन्दर प्रवेश करने के लिए आवश्यक है कि सतह पर गहरी पीली मिट्टी घास की परत अथवा चौड़ी पत्ती वाले वनों के नीचे पत्ती आदि पदार्थ हो उसमें पानी अधिक प्रवेश कर सकता है। ऐसे ही भूमि में स्वामी रामप्रसाद जैसे किसान खेती करेंगे और उनकी फसल में वृद्धि होगी। किसानों की आर्थिक स्थिति में परिवर्तन लोने के लिए किसानों की छोटी–बड़ी आवश्यकताओं को पूरा करने वाली योजनाओं का लाभ देना होगा तभी हमारे भारत देश में रहने वाले लगभग 70–80 प्रतिशत किसान का जीवन स्तर सुधर सकेगा। वनों की कटाई रोकना होगा नये पेड़–पौधे लगाने होंगे तभी पर्यावरण संतुलित होगा।

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पर्यावरण का अति दोहन और सामाजिक समस्याएं व समाधान

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स्वच्छ वातावरण किसी भी समुदाय के समुचित विकास के लिए अत्यन्त जरूरी है। मनुष्य अपनी त्वरित आवश्यकता को ध्यान में रखते हुए प्राकृतिक साधनों का दोहन करता जाता है, जिससे जो विकास परिलक्षित होती है वह अल्पकालिक होता है एवं भविष्य हेतु साधना उचित मात्रा में उपलब्ध नहीं होते हैं। उसका परिणाम आज हमारे सामने पर्यावरणीय समस्याओं के रूप में प्रकट हो रहा है। बढ़ते शहरीकरण से कस्बों में बेतहाशा भीड़ है जिसके कारण ध्वनि प्रदूषण, जल प्रदूषण, वायु प्रदूषण, नाभिकीय रसायनिक एवं प्लास्टिक प्रदूषण इत्यादि के कारण मनुष्य के स्वास्थ्य एवं जीवन के लिए हानिकारक बन रहें है। वन विनाश से मौसमी चक्र में परिवर्तन हुआ है और भूजल सतह और गहराई में चली गई है। मनुष्य ने अपने निजी स्वार्थ के लिए समुद्रों, नदियों तथा अन्य जल स्त्रोतों को प्रदूषित कर दिया है, जिससे जल की पर्याप्त मात्रा होते हुए भी उसके गुणात्मक ह्रास से जल संकट उत्पन्न हुआ है। तीव्र औद्योगिक क्रियाओं के कारण ओजोन परत के विनाश से वातावरण को गंभीर खतरा बन गया है।

विभिन्न प्राकृतिक संसाधनों के अविवेकपूर्ण तथा अतिदोहन से पर्यावरण विभिन्न रूपों से असंतुलित हो गई है। वर्तमान में मानवीय गतिविधियों के कारण पर्यावरण के प्रति अति दोहन की प्रवृति अपनाने के कारण पर्यावरणीय समस्याएं उत्पन्न हुई हैं, जिनका पृथ्वी पर विभिन्न रूपों में अत्यधिक प्रभाव परिलक्षित हो रहा है। जैसे – ऊर्जा संकट, जलवायु में परिवर्तन, ओजोन परत में कमी, हिम का पिघलना, परमाणु विनाश, विश्व तापमान में वृद्धि (Global warming), अम्लीय वर्षा ; ।बपक त्पदद्धए इत्यादि। विश्व शब्दकोश (The Universal Encyclopedia) में पर्यावरण की परिभाषा निम्न रूप से दी गई हैं –:

''पर्यावरण उन सभी दशाओं, प्रणालियों तथा प्रभावों का योग है जो जीवों व उनके प्रजातियों के विकास, जीवन एवं मृत्यु को प्रभावित करता है।'' (डॉ. मालती शर्मा–पर्यावरण मानव संसाधन और विकास, पृ.क्र.–5)

वैज्ञानिकों का मानना है कि अम्ल वर्षा सल्फर डाई ऑक्साइड और नाइट्रोजन ऑक्साइड उगलने वाले औद्योगिक एवं परिवहन स्त्रोतों के क्षेत्रों तक सीमित नहीं होता है वरन् वह स्त्रोत क्षेत्रों से दूर अत्यधिक विस्तृत क्षेत्रों को प्रभावित करती है, क्योंकि अम्ल वर्षा के उत्तरदायी कारक प्रदूषक (जैसे सल्फर डाई ऑक्साइड) गैसीय रूप में होते है, जो हवा एवं बादलों द्वारा दूर तक फैल जाते है। उदाहरण के लिए जर्मनी तथा इग्लैण्ड में स्थित उद्योगों से निकली सल्फर डाई ऑक्साइड तथा नाइट्रोजन ऑक्साइड के कारण नार्वे तथा स्वीडन में अम्लीय वर्षा के कारण जैविक सम्पदा समाप्त हो गई है। ऐसी झीलों को अब जैविकीय दृष्टि से मृत झील कहते हैं। भोपाल की गैस त्रासदी से निकली गैस मानव के जीवन को आज भी प्रभावित करती है।

कोई भी प्राणी अपनी इच्छाओं और आवश्यकताओं के अनुसार पर्यावरण में परिवर्तन करने में सक्षम नहीं है लेकिन प्रकृति ने प्रत्येक जीव के लिए जो निर्धारित किया था, व्यक्ति ने उस भौगोलिक क्षेत्र का अपने स्वार्थ के लिए वितरण किया है। इस प्रकार व्यक्ति अपने व्यापारिक लाभों और स्वार्थों के लिए पृथ्वी के प्रत्येक भाग पर सफलता पूर्वक पहुँच रहा है। यह सब उसकी बुद्धि और औजारों का निर्माण करने की क्षमता के कारण सम्भव हुआ है। अपनी आवश्यकताओं, आराम और सुखी जीवन के लिए प्रकृति से प्राप्त कच्चे माल का मनुष्य ने उपभोग किया है। स्त्रोत के विपरित मनुष्य ने प्रकृति का उपयोग निर्ममता के साथ किया है। विशेष रूप से यह जीवाश्म कोयले और तेल के संदर्भ में देखा जा सकता है। ये पदार्थ सीमित मात्रा में है और मनुष्य इनके सुरक्षित भण्डारों को रिक्त करने में लगा हुआ है।

वनों एवं वनों के अन्य उत्पादों को भी मनुष्य तीव्र गति से दोहन करने में लगा हुआ है। अनियोजित शहरीकरण, औद्योगीकरण व कृषि में उर्वरकों का प्रयोग भी प्रकृति पारिस्थितिकी में होने वाले सन्तुलन के उत्तरदायी हैं। जब कभी मनुष्य ने प्रकृति के संतुलन में अनावश्यक व्यवधान पैदा किये हैं, उसने समस्याओं को भी उत्पन्न किया है। मनुष्य ने निम्न प्रकार से प्रकृति संतुलन में व्यवधान पैदा किये हैं :–

1. वनों का विनाश।
2. भूमि का समतलीकरण।
3. नदियों के प्रवाह को मोड़ना।
4. समुद्र का भूक्षेत्रों में विस्तार।
5. उर्वरकों व कीटनाशकों के प्रयोग से भूमि व जल का प्रदूषित होना।
6. औद्योगिक कचरा एवं शहरी जल का निकास।
7. धुँए से वायु का प्रदूषण होना।
8. रेडियोधर्मी अवशिष्टों और परमाणु विस्फोटों से वायुमण्डल का प्रदूषित होना।
9. आनन्द के लिए जंगली जानवरों का शिकार।
10. स्वयं जनसंख्या में वृद्धि।
11. शोर।

इस प्रकार पर्यावरणीय प्रदूषण में विज्ञान और तकनिक की भूमिका–वायु, जल और भूमि मानव और उसकी औद्योगीकरण वृत्ति ने अनेक प्रकार के प्रदूषणों को जन्म दिया है। प्राकृतिक पारिस्थितिकी पर्यावरण को स्वच्छ करती है जबकि मानव जनसंख्या प्रदूषण एंव जहरीले अवशिष्टों को उत्पन्न करती है। सबसे अधिक चुनौती पूर्ण वायु प्रदूषण की समस्या, चट्टानी कोयले की ऊर्जा, तेल आदि द्वारा जमा की गई ऊर्जा के ज्वलन से छोड़े जाने के कारण हैं। वायु की शुद्धता को नष्ट करने वालों में आग और चिमनियों से निकलने वाला धुआँ प्रमुख है।

आज वैज्ञानिक, राजनीतिक और आम लोग ऊर्जा की बचत और जनसंख्या पर प्रदूषण के खतरों के प्रभावों के प्रति अधिक से अधिक जागरूक हो रहे हैं। जनसंख्या जिनको – शुद्ध भोजन का अधिकार, शुद्ध पानी पीने का अधिकार, साफ हवा में साँस लेने का अधिकार, खुले और सौम्य वातावरण में रहने का अधिकार,

प्राकृतिक छटा के उपभोग का अधिकार, उर्वरकीय जहर से बचने का अधिकार, ताप नाभकीय युद्ध से स्वतंत्र रहने का अधिकार इत्यादि। यदि मनुष्य अपने लिए इन सभी अधिकारों की इच्छा रखता है तो उसे अपने चारों ओर रहने वाले सभी प्राणियों को इसमें हिस्सेदार बनाना होगा। यही उचित समय है जबकि मानव इन 'वाणीहीन' जीवों की वाणी को सुनना होगा और 'जियो और जीने दो' की अवधारणा को मूर्त रूप देना होगा।

अतः प्रत्येक व्यक्ति का यह कर्तव्य है कि वह पर्यावरणीय शुद्धता तथा संरक्षण पर सर्वाधिक महत्व व ध्यान दे। पर्यावरणीय समस्याओं को समझने के लिए शिक्षित और जागरूक होना भी आवश्यक है। सभी मनुष्यों में पर्यावरणीय नैतिक मूल्यों का होना भी आवश्यक है। जन साधारण के द्वारा ऐसा कोई भी कार्य नहीं किया जाना चाहिए जिससे पर्यावरण को क्षति पहुँचे जैसे – पॉलिथीन थैलियों को उपयोग में नहीं लेना, जल को अनायास नहीं बहाना, वृक्ष लगाना तथा बाग–बगीचों एवं वनों का संरक्षण करना, अपशिष्ट पदार्थों को ऐसी जगह डालना जिससे कोई नुकसान न हो तथा उनको परिवर्तित कर अहानिकारक बनाना आदि पर विशेष ध्यान देना चाहिए। इन सभी बातों पर गंभीरता से ध्यान देने पर पर्यावरण संरक्षण अपने आप हो सकता है। इस प्रकार सभी के प्रयास से अपने ज्ञान तथा बुद्धि द्वारा पर्यावरण संरक्षण के प्रति सजग रहना ही पर्यावरण नैतिकता है।

इस प्रकार हम कह सकते है कि मानव अपने क्षणिक लाभ के लिए मदान्ध होकर प्रकृति का इतना शोषण और दोहन करता है कि प्रकृति अस्वस्थ्य हो जाती है। कभी–कभी वह यह भी भूल जाता है कि कल फिर इसकी आवश्यकता पड़ेगी। जब प्रकृति उल्टी दिशा में चलने लगती है तब मानव को अपनी गलती का अहसास होता है। अतः पर्यावरण संरक्षण की जिम्मेदारी हम प्रत्येक जन की है और यह जागरूकता से ही संभव हो सकेगा। जब आप एक जंगल की सुरक्षा करते हैं तब आप केवल कुछ वृक्षों की ही रक्षा नहीं करते, अपितु लोगों के भविष्य की भी रक्षा करते है।

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अध्यात्म उपचार द्वारा पर्यावरण परिशोधन

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अध्यात्म उपचार द्वारा पर्यावरण परिशोधन

वातावरण जिसमें हम रहते हैं, चेतनात्मक है। मनोविज्ञानी पाश्चात्य मनीषी भी स्वीकारने लगे हैं कि– पर्यावरण का प्रभाव न केवल स्वास्थ्य पर, बल्कि मानव के मन–विचारों तक को प्रभावित करता है। भारतीय ऋषियों का तो कहना है कि परिस्थिति ही मनःस्थिति को प्रभावित नहीं करती बल्कि मनस्थिति भी परिस्थिति को प्रभावित करती है। तात्पर्य यह है कि, लोकचिंतन व विचार प्रवाह न केवल अदृश्य वातावरण को प्रभावित करता है बल्कि स्थूल पर्यावरणों पर भी उसका कम प्रभाव नहीं होता। अध्यात्म प्रयोगों द्वारा अदृश्य का अनुकूलन संभव है। सूक्ष्मदर्शियों का कहना है कि स्वतंत्रता संग्राम में न केवल नरम गरम दल के नेता और शहीदों का योगदान रहा है बल्कि महर्षि रमण अरविंद विवेकानंद आदि के आध्यात्मिक प्रयास भी उतने ही महत्त्वपूर्ण रहे थे।

वास्तव में देखा जाए तो आज तक की गई भौतिक प्रगतिए सुख, सुविधाओं साधनों से भरे पूरे संसार के लिए केवल और केवल मानव समुदाय द्वारा इस क्षेत्र में किया गया कठोर श्रम ही जिम्मेदार है। मनुष्य ही है, वह संसार का सिरमौर प्राणी, जिसने जब भी जिस किसी क्षेत्र में अपने सोचने समझने और काम करने की क्षमता का उपयोग किया, तो उसे सफलता मिलकर रही। उसकी संकल्प भरी साहसिकता के सामने न कभी कोई अवरोध टिक सका और न कभी टिक सकेगा।

परंतु आज वर्तमान में पर्यावरण पर नजर डालें तो पता चलेगा किए हमारे अपने ही अंग्रेजों ने ज्यादा पाने बटोरने की हवस में मुरगी का पेट ही फाड़ दिया। अपनी माँ जैसी प्रकृति के चीथड़े कर दिए। उन्हें मालूम है कि हम अपने बच्चों को कूड़े, कचरे और गंदगी से भरी पृथ्वी माँ की गोद देने वाले हैं फिर भी क्या करें? लाचार हैं अपनी वहसियत से हैवानियत से स्वार्थ से ज्यादा बटोरने की आदत से आरामतलबी से। उन्हें मालूम है कि वे तो ''पी'' के मरेंगे ही साथ ही अपनों को अपने बच्चों पत्नी माँ पिता परिवार के सभी को। बिना पियेश् मरने पर आलीशान घर छोड़ जाएँगे पर करें क्या अपने हाथों ही अपने परिजनों को मौत की नींद सुला देने के लिए जिम्मेदार ''हम मनुष्य'' संभलें तो कैसे? चेतें तो कैसे? उपाय है जिसे हम सभी जानते तो हैं, पर आज तक उपयोग में, अभ्यास में लाए नहीं है। हर परिस्थिति और मनःस्थिति के लिए जिम्मेदार यदि हम ही हैं– यदि मनुष्य ही हैए तो क्यों न इस मूल कारण का ही वास्तविक समाधान कर लिया जाए। कैसे? मानवीय व्यक्तित्व से संबंधित विज्ञान और अध्यात्म–विज्ञान के प्रयोग द्वारा।

पर्यावरण संरक्षण में आस्तिकता का योगदान

जन्म–जन्मांतरों के संचित कुसंस्कारों का प्रभाव, अभ्यास मनुष्य जीवन में भी बना रहता है, निम्न योनियों का स्वभाव जड़ जमा, बैठा रहता है और मानवी प्रवृत्तियों को अभ्यास में सम्मिलित करने के मार्ग में अनेकांनेक बाधाएँ उपस्थित करता है।– पानी का स्वभाव नीचे की ओर बहना है। गुरुत्वाकर्षण शक्ति किसी भी वस्तु को अवसर मिलते ही नीचे खींच लेती है। ठोस पदार्थों को नीचे की ओर गिरने और प्रवाहों की ओर बहने में तनिक भी कठिनाई नहीं होती, पर जब उन्हें ऊपर उठाना या बहाना होता है, तो साधन जुटाने और प्रयत्न

करने पड़ते हैं। मन की प्रवृत्ति भी ऐसी ही है। उसकी मरजी चलने दी जा,, तो फिर नर–पशुओं और नर–कीटकों से अधिक उपयुक्त चिंतन और आचरण बन पड़ना संभव नहीं हो सकता। क्रोध सहज है, स्नेह कठिन। क्रोध बिना किसी प्रशिक्षण के आरंभ से ही प्रकट होने लगता है। पर प्रेम को स्वभाव का अंग बनाने के लिए सुसंस्कारी वातावरण और तद्नुरूप अभ्यास की आवश्यकता पड़ती है। ईर्ष्या और अपहरण, अहंता और आक्रमण, वासना और आधिपत्य का आचरण करते हुए सभी प्राणी पाए जाते हैं, मनुष्य भी। किंतु संयम और सद्भाव को जीवन–क्रम में सम्मिलित करने के लिए स्भयता और संस्कृति को, धर्म और अध्यात्म को गले उतारना कितना कठिन पड़ता है, यह किसी से छिपा नहीं है। यौनाचार की पूर्ति हर प्राणी बिना किसी प्रशिक्षण के संचित अभ्यास के आधार पर स्वयमेव करने लगता है, किंतु ब्रह्मचर्यपालन के तत्त्व ज्ञान को ह्रदयंगम कराने से लेकर तपसाधन करने तक के उपाय अभ्यास अपनाने होते हैं। बस्तुस्थिति देखते हुए इस निष्कर्ष पर पहुँचने में किसी को कोई कठिनाई नहीं होनी चाहिए कि पतन सरल और उत्थान कठिन है। इस कठिनाई को पार करना ही परम पुरुषार्थ कहलाता है। अनेकानेक साधन. विधानों का आविर्भाव इसी दृष्टि से आ है। विधार हुआ विचार करने के लिए आज हम से लेकर अगर उत्कृष्टता की धुरी आस्तिकता है। यों विकृतियों के घुस पड़ने से मध्यकाल के अंधकार युग में इस क्षेत्र की दुर्गति भी कम नहीं हुई है। इतने पर भी तथ्य और सत्य अपने स्थान पर अडिग है। आस्तिकता को आस्था में सम्मिलित किए बिना आत्मिक प्रगति का आधार बनता नहीं। दार्शनिक पर्यवेक्षण करने पर आदर्शवादिता और आस्तिकता एक ही तथ्य के दो पक्ष हैं। उच्चस्तरीय आदर्शों का समुच्चय ही ईश्वर का वह स्वरूप हैए जिसकी उपासना की जाती है। परब्रह्म तो नियामक सत्ता भी हैए सृष्टि प्रवाह को सुव्यवस्थित रीति से चलाने के अतिरिक्त मानवीय चेतना को वह उच्चस्तरीय चिंतन और चरित्र अपनाने के लिए बाधित करती है। इसी को अंतःप्रेरणा या ईश्वर की वाणी कहते हैं। कर्मफल के दंड–पुरस्कार की विधि–व्यवस्था परब्रह्म के द्वारा संचालित होती है, किंतु मानवीय गरिमा विशुद्ध रूप से आस्तिकता के तत्त्व ज्ञान से जुड़ी हुई है। आस्तिकता के अनेक स्वरूप हैं। उनमें से एक ईश्वर–उपासना का अवलंबन लेकर पर्यावरण में व्याप्त चेतना के दिव्य परतों को सुविकसित और सशक्त बनाना भी है।

आस्तिकता एक आस्था–दर्शन है और उपासना उसे परिपक्व करने का प्रयोग अभ्यास। दोनों का परस्पर अन्योन्याश्रय संबंध है। दर्शन एक कल्पना है। उसका परिणाम तभी निकलता है.जब वह अभ्यास में उतरे। आस्तिकता में मात्र ईश्वर का अस्तित्व स्वीकार कर लेने जितना छोटा उद्देश्य सन्निहित नहीं है, बरन तथ्य यह है कि ईश्वर को उत्कृष्टता एवं आदर्शवादिता का समुच्चय मानना होता है और उसे चिंतन एवं चरित्र का अविच्छिन्न अंग बनाकर तादात्म्य स्थापित करना ही होता है।

भक्ति का अर्थ है–प्यार भरी सेवा। संक्षेप में इसे आत्मीयता एवं उदारता का समन्वय कह सकते हैं। ईश्वर भक्ति का अर्थ होता है–आदर्शों के प्रति असीम प्यार। असीम का तात्पर्य है इतना प्रबल कि उसे क्रियान्वित किए बिना रहा न जा सके। ईश्वर भक्ति को समर्पण योग भी कहते हैं। शरणागति, लय आदि कई से इस स्थिति का उल्लेख किया जाता है। इसका व्यावहारिक स्वरूप है अहंता को स्वार्थपरता को भूल जाना। वैयक्तिक महत्त्वाकांक्षाओं को विसर्जित करके आदर्शवादी, सामूहिक महत्वाकांक्षाओं में रस लेना। इसी तत्त्व दर्शन को आस्था क्षेत्र में ' गहराई तक प्रतिस्थापित करने के लिए उपासना परक अभ्यास किए जा सकते हैं। यह आत्मोत्कर्ष के भाव.विज्ञान के अनुरूप अत्यंत महत्त्वपूर्ण प्रयोग तो है हीए साथ ही पर्यावरण संरक्षण में भी इसका प्रभावशाली योगदान रहता है।

आत्मा की उत्कृष्टतम स्थिति को ही परमात्मा कहते हैं। पुरुष से पुरुषोत्तम–नर से नारायण बनने का अभ्यास ही उपासना है। इसमें ईश्वर को व्यक्ति बनाने का नहीं, व्यक्ति को ईश्वर, अति मानव बनाने और अति मानस को प्रखर करने का प्रयोग है। सच्ची उपासना लघु को विभु, क्षुद्र को महान् बनाती एवं कामना को भावना में

विकसित करती है। मनोकामना पूर्ति के लिए ईश्वर का मनुहार करना–बाल–कक्षा के विद्यार्थियों जैसा ही सीमित रहना है। आत्मिक प्रौढ़ता की स्थिति आते ही ईश्वर का स्वरूप उत्कृष्ट आस्थाओं और आदर्शवादी भाव–संवेदनाओं का समुच्चय बन जाता है। ईश्वर भक्ति और आदर्शों के लिए समर्पित व्यक्तित्व परस्पर पर्यायवाचक बन जाते हैं। इसी स्थिति को प्राप्त करने के लिए भावनात्मक अभ्यासों की चिरपरिचित प्रणाली को उपासना भावनात्मक भासते हैं। इसी अवलंबन का आश्रय लेकर प्राचीन उपासना साधकों को ऋषिकल्प, देव मानव एवं सिद्ध पुरुष बनने का अवसर मिला है। ऐसे व्यक्तित्वों में भगवान का स्वरूप प्रत्यक्ष झाँकता है। अतएव भक्त और भगवान की एकता का प्रतिपादन शास्त्रकार सदा से करते रहे हैं।

युग परिवर्तन का श्रीगणेश आस्था क्षेत्र में उत्कृष्टता की प्रतिष्ठापना के साथ होता है। आस्तिकता का ध्येय है–व्यक्तित्व के स्तर को ऊँचा उठाना–आस्था परिवर्तन। उसी स्तर के अनुरूप आकांक्षाएँ उभरती हैं। आकांक्षाएँ विचारणा को दिशा देती हैं, विचारणा के दबाव से शरीर की गतिविधियाँ चलती हैं। गतिविधियों के अनुरूप परिस्थितियाँ बनती हैं। परिस्थिति ही पारिस्थितिकी या पर्यावरण का निर्माण करती है। यह भली–बुरी परिस्थितियाँ ही स्वर्ग–नरक उत्थान–पतन, विकास–विनाश आदि नामों से निरूपित होती रहती हैं।

पतन को उत्थान में बदलना हो, नरक को स्वर्ग बनाना हो, तो तदनुरूप परिस्थितियाँ बननी चाहिए। परिस्थितियाँ गतिविधियों की परिणति हैं। गतिविधियाँ शरीर की कार्य पद्धति को कहते हैं। शरीर पर मन का परिपूर्ण नियंत्रण है। मनःक्षेत्र का सूत्र संचालन इच्छाएँ करती हैं। इच्छाएँ अंतराल के आस्थापरक स्तर के अनुरूप ही उठती हैं। यही तत्त्व.दर्शन का खुला रहस्य है। जो इसे जानते हैंए वे पत्ते धोने की अपेक्षा जड़ को सींचते हैं। नफुसियों पर दवा लगाने की अपेक्षा रक्त शोधन पर अधिक ध्यान देते हैंए मच्छर मारते फिरने का श्रम करने की अपेक्षा गंदी नाली साफ कर डालने की आवश्यकता अनुभव करते हैं।

सामयिक परिस्थितियों और पर्यावरण संतुलन का विवेचन और निराकरण आवश्यक है। सत्थान के साधन भी जुटाए जाने चाहिए किंतु स्थायी तथा दूरगामी समाधान के लिए जलाए जाने को परिष्कृत करना होगा। इस प्रयोजन के लिए आस्तिकता का दर्शन और उपासना का अभ्यास परस्पर मिलकर ऐसी प्रतिक्रिया उत्पन्न करते हैंए जिससे अंतराल में जमे कुसंस्कारों का निष्कासन और उत्कृष्टता का अभिवर्धन तो हो हीए साथ में साधना से क्षेत्र के वातावरण में तीर्थों जैसी दिव्यता आ सके। अस्तुए नवयुग का बीजारोपण उपासना की प्रक्रिया को जीवनक्रम में नित्य कर्म की तरह सम्मिलित करने की आवश्यकता पड़ेगी। प्राचीनकाल के देवयुग में भी इस अवलंबन को प्रमुखता प्राप्त थी और अब उस परंपरा को पुनर्जीवित करने के लिए–उपासना के लिए गंभीर लोक–रुचि उत्पन्न करनी पड़ेगी।

सामयिक परिस्थितियों पर दृष्टिपात करने से उनमें भरी हुई विकृतियों और विभीषिकाओं के अनेकानेक रूप दिखाई पड़ते हैंए वे एक.दूसरे से भिन्न भी दिखाई पड़ते हैंए उनके समाधान भी स्थिति के स्वरूप को देखते हुए भिन्न-भिन्न प्रकार के सोचे जाते हैं। प्रत्यक्षवाद के आधार पर समाधान इसी प्रकार संभव दिखाई पड़ता है। शारीरिक दुर्बलता का निवारण, पौष्टिक आहार और रुग्णता का निराकरण चिकित्सा–उपचार से ही संभव प्रतीत होता है, किंतु परोक्ष तक पहुँचने वालों को इस निष्कर्ष पर पहुँचना किया है कि यह सारा बखेडा असूयम की दुश्प्रवृत्ति न पहुँचना किया है। असंयम के रहते भी पुष्टाई और दवाई की खिलवाड़ तो चलती रह सकती हैए पर उनमें दुर्बलता एवं रुग्णता का स्थायी निवारण कदापि संभव न हो सकेगा। तात्कालिक उपचार से जादुई लाभ तो मिल भी सकता है, किंतु स्थिर स्वास्थ्य की अपेक्षा रखने वालों को संयम साधना की जीवन नीति बनाकर चलना होगा। अनैतिकवाद और अध्यात्मवाद के दृष्टिकोण का यह अंतर हर क्षेत्र में समझा जा सकता है। प्रत्यक्ष कितना ही प्रभावी क्यों न होए आत्यंतिक समाधान परोक्ष के आधार पर ही निकलता है।

मानसिक विक्षोगों से जन–जन को तनावग्रस्त, खिन्न–उद्विग्न, निराश एवं नीरस भारभूत जीवन जीते पाया जाता है। मनोविकारों की प्रबलता से अनुकूलताएँ प्रतिकूलताएँ बनती हैं। सामान्य परिस्थितियाँ भी विकृत चिंतन के कारण तिल जैसी होते हुए भी ताड़ जितनी भयानक प्रतीत होती हैं। लोग परिस्थितियाँ बदलना बाहते हैंए पर जिस अनुपयुक्त दृष्टिकोण के कारण वे उत्पन्न होती है, उसके बदलने की बात तक नहीं सोचते। झरना झरता रहे और बहाव को मेंड़ बाँधकर रोकने में श्रम किया जाता रहे, तो थकान और निराशा के अतिरिक्त और कुछ पल्ले पड़ने वाला नहीं है। स्वस्थता की तरह प्रसन्नता भी आवश्यक हैए पर उसे परिष्कृ त दृष्टिकोण के मूल्य पर ही खरीदा जा सकता है। शरीर सुखए संयम पर निर्भर है और सानसिक संतोष चिंतन के संतुलन पर। कुल मिलाकर पर्यावरण विक्षोभ के कारण मानव जीवन में वन में निरंतर बढ़ती विकृ ति का समाधान आस्तिकतापूर्ण आध्यात्मिक जीवन ही है। यह तथ्य भले ही आज न सही हजार वर्ष बाद समझा जाएए किंतु समाधान सही निष्कर्ष पर पहुँचने और सही उपाय अपनाने पर ही संभव हो सकेगा।

आज व्यक्ति और समाज के सामने अगणित समस्याएँ और विभीषिकाएँ मुँह बाँधे खड़ी हैं। उनका निराकरण बुद्धिमानों द्वारा प्रत्यक्ष उपचारों.सामयिक उपायों के आधार पर सोचा जाता हैए मस्तिष्क की दौड़ इतनी ही है। विग्रहों को सामए दामए दंडए भेद जैसे कूटनीतिक उपायों से हल करने का बरताव ही उसने देखा. समझा है। सो उन्हें क्रियान्वित करने में भी कोई कसर नहीं रखी जाती। आर्थिक सुधार के लिए गरीबी हटाओ अभियान के अंतर्गत गृह उद्योगों से लेकर विशालकाय कारखाने लगाने तक का प्रावधान पंचवर्षीय योजना में है। निजी क्षेत्र भी इस संदर्भ में कुछ उठा नहीं रख रहा हैए पर कठोर श्रम और मितव्ययिता की गरीब रेहहाआ अभियान तपश्चर्या का सिद्धांत जन–जीवन में उत्तर न पाने के कारण बढ़ा हुआ उपार्जन दुर्व्यसनों की बढ़ोत्तरी तक को पूरा नहीं कर पाता और दरिद्रता तो जहाँ की तहाँ ही बनी रहती है। पर्यावरण को मनुष्य और कुपित कर बैठता है। इस कुचक्र में से निकल सकना अथोपार्जन और व्यय व्यवस्था में आदर्शवादी सिद्धांतों का समावेश किए बिना अत्यंतिक समाधान संभव ही नहीं हो सकता। प्राचीन–काल में उपार्जन बहुत सीमित था और आज की तुलना में सुविधा–साधन कहीं कम थे फिर भी यह देश स्वर्ग–संपदाओं का स्वामी और विदेशियों की दृष्टि में सोने की चिड़िया बना हुआ था। गरीबी चाहे आज मिटे चाहे सौ साल बाद अर्थशास्त्र में आदर्शवादिता का समावेश किए बिना और कोई स्थायी हल नहीं। अमेरिका सबसे ज्यादा समृद्ध होते हुए भी आर्थिक उद्विग्नता का जितना शिकार है उतना आदिवासी क्षेत्र भी असंतुष्ट दिखाई न पड़ेगा।

परिवारों की स्थिति का यदि सही मूल्यांकन किया जाए तो घरों का वातावरण सराय से अधिक उपयुक्त न मिलेगा। भेड़ें बाड़ों में भी रहती हैं और कैदी जेलों में भी। सद्भाव और सहकार के अभाव में होटलों में की जाने वाली चटक मटक भी कितनी कृत्रिम कितनी नीरस और कितनी कुरूप कर्कश लगती हैए उसे सभी जानते हैं। आर्थिक अभाव रहते हुए भी परिवारों में स्नेह सौजन्य के सहारे स्वर्गीय आनंद का रसास्वादन किया जा सकता है, इसके लिए साधनों की जितनी आवश्यकता है, उससे कहीं अधिक सुसंस्कारिता की। यह उपलब्धि बाह्य व्यवस्थाओं के सहारे नहीं, आंतरिक सदाशयता के सहारे ही संभव हो सकती है।

समाज में अनेकानेक मूढ़ मान्यताओं, कुरीतियों, अवांछनीयताओं, अनैतिकताओं की भरमार है। अपराध और भौगोलिक पर्यावरण प्रदूषण दिन.दूने रात–चौगुने बढ़ रहे हैं। सुक्ष्म या वैचारिक पर्यावरण भी कम विकृत नहीं है। व्यक्ति की प्रामाणिकता दिन–दिन घट रही है। सज्जनता का प्रतिपादन तो है पर प्रचलन नहीं। सहकारिता का समर्थन जोरों से होता है और आर्थिक क्षेत्र में उसका लंगड़ा–लूला कलेवर भी बना है किंतु पारस्परिक व्यवहार में सहकारिता एवं उदारता को खोज निकालना अति कठिन है। आपाधापी की शतरंज का नशा बुरी तरह चढ़ा है। हर कोई एक–दूसरे को मात देने और अपनी गोटी लाल करने में सारी अक्लमंदी निचोड़े दे रहा है। ऐसी दशा में समाज सच्चे अर्थों में समाज कैसे बने और किसी जनसंकुल क्षेत्र को सच्चा राष्ट्र कैसे कहा जाए?

पूरे पर्यावरण में कलह और विग्रहों के असंख्य क्षेत्र हैं सबके अपने–अपने कारण हैं। भाषाए प्रांत, धर्म, वर्ग, वर्ण आदि के निहित स्वार्थों को लेकर परस्पर टकराव की इतनी अधिक घटनाएँ होती हैं कि, उनका निराकरण कानून और पुलिस के द्वारा अत्यंत स्वल्प मात्रा में ही निकल पाता है। अंतर्राष्ट्रीय स्तर पर चलने वाले दांव–पेचों और कुटिल कुचक्रों से शीतयुद्धों की भरमार बढ़ती जा रही है और गरम युद्ध की अणु.अणुओं से लड़े जाने वाले तृतीय एवं अंतिम युद्ध की संभावनाएँ तेजी से समीप आ रही हैं। घटनाचक्र पर दृष्टिपात करने से महाप्रलय का दिन दूर दिखाई नहीं पड़ता। इस विग्रह से निपटने में तो कानून और पुलिस जैसे अनुबंध भी कुछ काम करते नहीं दीखते।

धर्म और अध्यात्म का उपयोगी कलेवर तो प्राचीन काल से भी अधिक विस्तृत और आकर्षक बन गया है, पर उसमें प्राण का दर्शन भर दुर्लभ हो रहा है। कर्मकांडों के घटाटोप छाए हुए हैं, पर आस्थाओं में उत्कृष्टता भरने वाली प्रक्रिया तो एक प्रकार से विकृत ही होती चली जाती है। धर्म ने मूढता और कट्टरता के कवच कुंडल पहन लिए हैं और अध्यात्म के कल्पना लोक में बिना पंखों की उड़ाने उड़ने जैसे उपक्रम चल रहे हैं। इन क्षेत्रों में धूर्तों और मूर्खों के बीच ऐसी पटरी बैठी है कि विज्ञजनों को इस कुछ का कुछ हो जाने को देखकर किंकर्तव्यविमूढ़ बना देने वाले असमंजस का अनुभव हो रहा है।

समस्याओं की यह भोटी झाँकी है, इस स्तर के अगणित कारण है, जो व्यक्ति और समाज को सुखी समुन्नत बनाने वाले सभी प्रयत्नों को व्यर्थ करते चले जा रहे हैं। इन विग्रहों के रहते आर्थिक, वैज्ञानिक, बौद्धिक उपलब्धियाँ कोई समाधानकारक हल खोजने में अपनी असमर्थता प्रकट कर रही हैए इन परिस्थितियों को पीछे मुड़कर देखना होगा और वस्तुस्थिति समझने की गहराई में उतरना होगा। परिस्थितियों का उत्तरदायित्व मन स्थिति पर लदा हुआ है। मनःस्थिति का भी अपना स्वतंत्र अस्तित्व नहीं। वे आस्थाओं एवं आकांक्षाओं पर निर्धारित है। अंत करण ही वह क्षेत्र है, जो व्यक्तित्व के स्तर को उठाता-गिरता है। मनुष्य ने स्वयं ही अपना इतिहास सृजा हैए वर्तमान की परिस्थितियों के लिए भी वही पूरी तरह उत्तरदायी है। भविष्य को उज्ज्वल या अंधकारमय बना लेना पूरी तरह उसी के हाथ में है। इस तथ्य को स्वीकार करने में असमंजस उन्हीं को हो सकता हैए जो व्यक्तित्व के उद्‌गम स्रोत अंतकरण की सामर्थ्य से अपरिचित है। मनुष्य को सर्वसमर्थ माना गया है। यह तथ्य पूर्णतः उसके आस्था क्षेत्र के आधार पर, सर्वथा सत्य पाया जा सकता है।

नवयुग मे मनुष्य आस्था प्रधान होंगे। वे उत्कृष्टताए आदर्शवादिता और उदात्त भाव संवेदनाओं से भरे पूरे होंगे। प्रश्न एक ही है किए वर्तमान अनास्था को उदात्त भाव श्रद्धा में परिणत कैसे किया जाए घ् इस संदर्भ में उत्तर तो कई दिये जा सकते हैंए पर सबसे प्रामाणिक प्रतिपादन आस्तिकता की भाव श्रद्धा का उन्नयन ही है। यह कार्य उपासना के आधार पर संभव हो सकता है। व्यक्ति.निर्माण का आधारभूत क्षेत्र यही है। यह प्रक्रिया ऐसी हैए जिसे उपेक्षित नहीं किया जा सकता। उसे प्रमुखता ही देना होगा। जन.जन को आस्तिक और उपासना प्रिय बनाने के प्रयत्नों में नवयुग की उज्ज्वल संभावनाएँ पूर्णतः समाविष्ट हैं। अस्तुए युग–शिल्पियों को अपने समस्त क्रियाकलापों में इस केंद्र बिंदु को प्रधान मानकर चलना होगा। महाकाल वैसी ही प्रेरणा देने और व्यवस्था बनाने में संलग्न भी है।

पर्यावरण के सूक्ष्म जगत को साधक बदलेंगे

संसार के सभी महत्त्वपूर्ण कार्यों के लिए एक विशेष योग्यता और शक्ति की आवश्यकता होती है। अनेक व्यक्ति कुछ महत्वपूर्ण कार्य करने की आकांक्षा तो करते हैं पर उनको करने के लिए जिस क्षमता एवं शक्ति की आवश्यकता है, उसे संपादित नहीं करते, फलस्वरूप उन्हें सफलता से वंधित ही रहना पड़ता है। जिनने भी कोई बड़ा पुरुषार्थ किया हैए बड़ी विजय प्राप्त की हैण् उनने तात्कालिक परिस्थितियों से ही सब कुछ नहीं कर लिया होता, वरन उनकी पूर्व तैयारी ही उस सफलता का मूल कारण रही होती है।

जनमानस को प्रभावित करने वाले पर्यावरण के सूडम तत्त्वों में परिवर्तन करनाए वातावरण में व्याप्त दुष्प्रवृत्तियों को हटाकर उनके स्थान पर सप्रवृत्तियों की स्थापना करना अत्यंत ही उच्चकोटि काए अत्यंत ही महत्त्वपूर्ण कार्य है। उसकी तुलना में और सभी सत्कार्य तुच्छ बैठते हैं। विवेकशील उच्च आत्माएँ समय-समय पर इस आवश्यकता को अनुभव करती है और वे लोकमानस में सत्प्रवृत्तियाँ बढ़ाने के लिए प्राणपण से प्रयत्न करती रहती हैं। यह कार्य जितना ही महान हैए उतनी महान ही क्षमता और शक्ति भी इसके लिए अपेक्षित होती है। यदि उसका अभाव रहा तो इस प्रकार की कामना और भावना रहते हुए भी कुछ विशेष सफलता नहीं मिलती।

आज का वातावरण बहुत हद तक दूषित हो चला है। उसने आसुरी तत्व एक बड़ी मात्रा में उत्पन्न हो रहे हैं। अनीतिए अन्यायए अधर्म और अकर्म का चारों ओर बोल.बाला है। स्वार्थए पाप वासनाए तृष्णाए ममता और अहंकार की तूती बोल रही है। एक दूसरे का शोषण करकेए सनाकर अपना स्वार्थ सिद्ध करने में कटिबद्ध हो रहे हैं। प्रेम की, उदारता, सहृदयता, सेवा और सज्जनता की मात्रा दिन–दिन घटती जा रही है, फलस्वरूप ऐसी घटनाओं की बाढ़ आ रही है, जिनमें चीत्कार एवं हाहाकार की भरमार रहती है। लगता है कि यह प्रवृत्तियाँ बढ़ती रहीं, तो मानव सभ्यता ही खतरे में पड़ जाएगी। विज्ञान ने मनुष्य के हाथ में विनाश की एक बड़ी शक्ति दे दी है। एटम शक्ति के आधार पर किसी सिरफिरे का एक छोटा–सा पागलपन कुछ ही क्षणों में सारे संसार के लिए तबाही उत्पन्न कर सकता है। ऐसे जमाने में इस बात की अत्यधिक आवश्यकता है किए लोग सज्जनता और मानवता के आवश्यक गुणों से संपन्न हों अन्यथा विज्ञान से प्राप्त हुई शक्ति के सहारे दुर्गुणों से ग्रसित मानव शोक.संताप के गहन गर्त में आसानी से बात की बात में डूब मरने की परिस्थिति पैदा कर लेगा।

इस ओर विवेकशील लोगों का ध्यान गया है। वे लोग सुधार के लिए अपने–अपने ढंग से काम भी कर रहे हैं। प्रवचन और लेखन द्वारा यह कार्य सरल हो सकता है। उस विचार से अनेकों उपदेशक, प्रवचनकर्ता, लेखक, पत्रकार बहुत प्रयत्न कर रहे हैं। अनेक सभा–सोसाइटियाँ इसी उद्देश्य के लिए विविध मनोरंजक आयोजनों की व्यवस्था करती रहती हैं। सरकारें भी इसके लिए सचेष्ट हैं। राजनीतिक कर्णधार जनता को सज्जनता अपनाने की अपीलें करते रहते हैं। उनके प्रचार साधन, रेडियो, चलचित्र, बुलेटिन, विज्ञानी पत्रिकाएँ आदि कार्य भी इसी उद्देश्य के लिए विविध–विध मनोरंजक आयोजनों की व्यवस्था करते रहते हैं, किंतु जब विचारपूर्वक इन सब कार्यों के परिणामों को देखा जाता है, तो भारी निराशा होती है। लगता है कि प्रयत्नों की तुलना में परिणाम की मात्रा नगण्य है। बुराइयाँ जितनी तेजी से बढ़ रही हैं और सुधार के प्रयत्न जिस प्रकार निष्फल से सिद्ध हो रहे हैं, उसे देखते हुए हर विचारशील व्यक्ति के मन में व्यथा होना स्वाभाविक है।

यह प्रश्न बहुत ही महत्त्वपूर्ण है कि, वातावरण में से दुष्प्रवृत्तियों को हटाकर उनके स्थान पर सत्प्रवृत्तियों को स्थापित करने का वास्तविक उपाय क्या है? जिससे मनुष्य अन्य प्राणियों तथा प्रकृति के साथ परस्पर पूरकता में रहकर सहयोग सद्भाव तथा शांति का जीवन जी सकेघ् इसका उत्तर ढूँढ़ने के लिए हमें इतिहास के पृष्ठ उलटने पड़ेंगे और यह देखना पड़ेगा कि जिन महापुरुषों ने इस प्रकार के विषम वातावरण में अपने समय में जनमानस को सुधारा था, उनमें क्या विशेषता थी, जिसके कारण वे स्वल्प साधनों से ही चमत्कार उत्पन्न कर सकेए जबकि हमारे आज के सुधारक विविध–विधि साधनों से संपन्न होने पर भी कुछ कर नहीं पा रहे हैं।

पूर्व काल में लाखों–करोड़ों वर्षों तक सतयुग की सुख–शांति भरी परिस्थितियाँ इस संसार में बनी रही हैं। इसका कारण एक ही रहा है कि उस समय के लोकनायक और मार्गदर्शक आत्म शक्ति से संपन्न रहे केवल वाणी से नहीं अपनी आंतरिक महानता की किरणें फेंककर समस्त वातावरण को प्रभावित करते रहे। मस्तिष्क की वाणी मस्तिष्क तक पहुँचती है, पर आत्मा की वाणी सर्वत्र फैलती हैए क्योंकि आत्मा व्यापक है। कोई सुशिक्षित व्यक्ति अपनी ज्ञान-शक्ति का लाभ सुनने वालों को जानकारी बढ़ाने के लिए दे सकता है, पर अंतःकरण में जमी हुई आस्था में हेरफेर करने का कार्य ज्ञान से नहीं, आत्म शक्ति से ही संपन्न होना संभव

हो सकता है। प्राचीन काल के लोकनायकए ऋषि-मुनि इस तथ्य को भलीभाँति जानते थे, इसलिए वे दूसरों को उपदेश देने में, उनकी बाह्य सेवा करने में जितना समय खर्च करते थे, उससे कहीं अधिक प्रयत्न वे अपना आत्मबल बढ़ाने के लिए तप करने में लगाते थे। तप से ही वह आत्म शक्ति प्राप्त होती है, जिसकी सहायता से वातावरण को प्रभावित कर लोगों के मन पर जमे हुए बुराइयों के आकर्षक कुसंस्कारों को हटाकर अच्छाइयों के मार्ग पर चलने की प्रेरणा दी जा सके।

प्राचीन काल के इतिहास–पुराणों में यह तथ्य बिल्कुल स्पष्ट है। पिछले दो हजार वर्षों में भी इसी आधार पर जन मानस का सुधार एवं परिवर्तन करना संभव होता रहा है। भगवान् बुद्ध के मन में अपने तथा संसार के दुःखों का निवारण करने की आकांक्षा जगी। इसके लिए वे 25 वर्ष की आयु में घर से निकल पड़े और 20 साल तक निरंतर विभिन्न स्थानों पर आत्म निर्माण एवं तप साधना में संलग्न रहे। 41 वर्ष की आयु में उन्होंने अपने अंदर परिपक्वता अनुभव की, तब वातावरण में परिवर्तन और दूसरों को शिक्षा देने के कार्य में हाथ लगाया। भगवान् महावीर ने अपनी आयु का तीन चौथाई भाग तप में और एक चौथाई भाग धर्मोपदेश में लगाया। इन दोनों महापुरुषों ने उपदेश उतने दिए जितने आज के मामूली उपदेशक दे देते हैं। तब भी उनका प्रभाव पड़ा और आज भी संसार की एक चौथाई जनता उनकी शिक्षाओं पर आस्था रखती है।

जगद्गुरु शंकराचार्य ने उत्तराखंड में जोशीमठ स्थान पर उग्र तप किया था। बत्तीस वर्ष की आयु लेकर आए थे। विद्या पढ़ने के बाद लगभग 12 वर्ष उनके जीवन में काम करने के लिए शेष थे। इनमें से भी आधा समय उनने तप में लगाया और शेष 67 वर्षों में ही अपनी आत्म शक्ति के बल पर वैदिक–धर्म के स्थापन दिव्य वातावरण के निर्माण के लिए अत्यंत प्रभावशाली कार्य कर डाला। गुरू नानक की तपश्चर्या प्रसिद्ध है। गुरू गोविंद सिंह ने हिमालय में लोकपत स्थान पर जहाँ घोर तप किया थाए वह स्थान आज भी सिख धर्मानुयायियों का तीर्थ बना हुआ है। यदि इन गुरूओं के पास तप की पूँजी न रही होतीए तो वे दुर्धर्ष यवन काल में पूरे वातावरण के आसुरी संस्कृति से विषाक्त होने–पर भी हिंदू धर्म रक्षा के लिए इतना अद्भुत कार्य कर सकने में कदापि, समर्थ न हो सके होते।

समर्थ गुरू रामदास ने छत्रपति शिवाजी सरीखे कितने ही महापुरूष तैयार किये थे। इतिहास के पृष्ठों पर उनमें से अकेले शिवाजी ही भले चमके हों, पर उन्होंने वातावरण में ऐसा प्रयोग किया था, जिसके फलस्वरूप शिवाजी की तरह के सैकड़ों धर्म सनिक बनकर तैयार हो गए थे। इस निर्माण में उनकी आत्मा का प्रभाव भी प्रधान रूप से काम करता था। स्वामी दयानंद 16 वर्ष की आयु में घर से निकले और 42 वर्ष की आयु में अपने आप को धर्म प्रसार के योग्य बना सके। संवत् 1624के कुंभ में हरिद्वार में उनने पाखंड खंडिनी पताका फहराई और धर्मोपदेश दिएए पर उनका कुछ विशेष प्रभाव न पड़ा। इसका कारण उनने अपने आत्म बल की न्यूनता समझी और तीन वर्ष के लिए पुनः तप करने उत्तराखंड के अज्ञात स्थानों को चले गए। गंगोत्री के पास कराली की गुफाओं में रहकर उनने तपस्या की और जब अंदर आत्म प्रकाश देखाए तो कार्य क्षेत्र में उतरे। उस समय उनकी वाणी में दैवी तेज था। उसी बल पर वे अकेले ही इतना कार्य कर गएए जितना अनेकों संगठित सभाएँ मिलकर भी आज नहीं कर पा रही हैं।

स्वामी रामकृष्ण परमहंस 46 वर्ष की आयु में स्वर्गवासी हुए। 40 वर्ष की आयु तक वे विशुद्ध रूप से साधनारत रहे। एक दिन उन्हें लगा कि उनके शिष्य आने वाले हैं। एक वर्ष तक वे शिष्यों की प्रतीक्षा करते रहे, फिर ब्रह्मानंद, शिवानंद, विवेकानंद जैसे थोडे से प्रतिभासंपन्न शिष्य घर बैठे प्राप्त हुए और उन्हीं के सहारे उनकी आत्मा ने संसार को हिंदू संस्कृति का महान् संदेश दिया। स्वामी विवेकानंद का धर्मप्रचार कार्य प्रसिद्ध है, पर उससे पहले उनने भी रामकृष्ण परमहंस के बताए अनुसार कई वर्ष तपश्चर्या करके आत्मा को तपाया था।

योगी अरविंद घोष, महर्षि रमण, स्वामी रामतीर्थ की तपश्चर्या प्रसिद्ध है। वैष्णव आचार्यों में से रामानुजाचार्य, निंबार्काचार्य, माधवाचार्य प्रभृति आचार्यों ने जितना ज्ञान संचय किया था उतनी ही तपसाधना भी की थी।

संसार के अन्य वे महापुरुष जिनने लोगों को उच्च भूमिका की ओर बढ़ाया निश्चित रूप से तपस्वी थे। महात्मा ईसा के जीवन में 27वर्ष तपश्चर्या में लगे। मुहम्मद साहब ने 25 वर्ष की आयु में साधना की ओर कदम बढ़ाया। 40 साल तक वे उसी में संलग्न रहे। 65 वर्ष की आयु में उनने धर्मोपदेश और इस्लाम की स्थापना का कार्य आरंभ किया। यहूदी धर्म के संस्थापक यहोवा और पारसी धर्म के देवदूत जरतुश्त की दीर्घकालीन कठोर तपश्चर्याएँ प्रसिद्ध है।

इसी प्रकार संसार में आदि काल से लेकर अब तक एक ही तथ्य समय-समय पर स्पष्ट होता रहा है किए तपश्चर्या द्वारा आत्म बल संपादित करने वाली आत्माएँ ही संसार का सच्चा मार्गदर्शन करने और जनमानस को शुद्ध करने में समर्थ हो सकती है। आज लोकमानस निम्न में से निम्नस्तर की ओर तेजी से गिरता जा रहा है। उसे सँभालने और सुधारने की नितांत आवश्यकता है, पर यह कार्य आत्म बल से रहित तपश्चर्या से विहीन व्यक्तियों द्वारा सपन्न नहीं हो सकताए भले ही वे सभा सोसाइटियों के द्वारा भाषणोंए लेखों, योजनाओं, प्रदर्शनों के द्वारा इसके लिए सिर तोड प्रयत्न करते रहें। यह महान् कार्य महान् आत्माओं के अनेक गुणों में प्रमुख एक तपश्चर्या भी है, जिसकी उपेक्षा नहीं की जा सकती। अतीत इतिहास के पृष्ठ हमें इसी ओर निर्देश करते हैं। लोकमानस की शुद्धि का महान् भार वाचालों के नहीं तपस्वियों के कंधे पर रहेगा। युग की आवश्यकता आज ऐसे ही तपस्वियों की प्रतीक्षा कर रही है। लोकनायकों को चाहिए कि वे जनता को अपने उच्चस्तरीय कार्योंए आदशों व करनी द्वारा प्रेरणा दें। श्रेष्ठ वातावरण बनाने के लिए सृजेता स्तर के तपस्वी ही सच्चा योगदान दे पाएँगे।

कठिन समस्याओं के सरल समाधान

भूमि में उर्वरता की समुचित मात्रा हो, तो उस पर खेत–उद्यान आदि की अनेकानेक सुषमा हरीतिमा उगाई जा सकती है। यदि वह ऊसर होए नमक उबलता होए तो फिर घास का एक तिनका तक जमने वाला नहीं है। बालूए इंट और खारी जमीन पर मकानए कारखाने तक खड़े नहीं किए जा सकते हैं। भूमि से संबंधित कोई भी संपदा उपार्जित करने के लिए भूमि का सही–समतल होना आवश्यक है। रेगिस्तान में, पहाड़ी चट्टानों में् समुद्र के तटवर्ती नमक वाले क्षेत्र में सुविधाएँ मिलना तो दूरण् उसके खाई–खंदक सामान्य क्रियाकलाप में भी बाधा उत्पन्न करते है।

सुविधा संवर्धन की योजनाएँ बनाने के पूर्व सर्वप्रथम उपयुक्त भूमि का चयन करना पड़ता है। संसार में अगणित प्रकार की सुविधा-संपदाओं का अभिवर्धन आवश्यक होता हैए पर उसके लिए उस मानवीय चेतना का स्वस्थ, संतुलित, समुन्नत होना आवश्यक है, जो वैभव उत्पादन के लिए अनिवार्य रूप से आवश्यक है। यदि भूमि पर, साधनों पर आधिपत्य जमाकर बैठे हुए अथवा योजनाएँ बनाने वाले लोग विकृत मस्तिष्क के होंगेए तो वे कुछ धन सकना तो दूर पर्यावरण में विग्रह और ध्वंस के बीज ही बोएँगे, उलझी हुई समस्याओं का समाधान तो उनसे बन ही कैसे पड़ेगा?

इन दिनो पतन–पराभव का संकट–विग्रहों का वातावरण बनाकर खड़े हुए अराजकता स्तर के असमंजसों की चर्चा बहुधा की जाती है। इनका निवारण–निराकरण इन्हीं दिनों किया जाना आवश्यक है। देर करने का समय है नहींए अन्यथा अवसर चूकने पर पछताने के अतिरिक्त और कुछ हाथ लगेगा नहीं। बात इतने पर ही समाप्त नहीं होती। क्षयजन्य रुग्णता को दूर करने को प्राथमिकता तो दी जाती है पर अगला कदम यही होता है कि,

रुग्णता से क्षीण.जर्जर काया को सही स्थिति में लाया जाए और जीवनी.शक्ति को इतना बढ़ाया जाए, जिससे दुर्बलता दूर हो सके और स्वस्थ–समर्थ मनुष्य की तरह जीवनयापन कर सकना संभव हो सके।

मस्तिष्क विकृत, हृदय निष्ठुर, रक्त दूषित, पाचन अस्त–व्यस्त हो, शरीर के अंग–प्रत्यंगों में विषाणुओं की भरमार हो और वस्त्राभूषणों की भरमार भी होए तो भी अगरए चंदन का लेपन और इत्र–फुलेल का मर्दन बेकार है। शस्त्र–सज्जा जुटी देने और तकिए के नीचे स्वर्ण मुद्राओं की पोटली रख देने से कुछ काम न चलेगा। पंच, ग्राम प्रधान, विधायक या प्रतिनिधि चुनाव में विजयी घोषित कर देने से भी प्रसन्नताए प्रफुल्लता का मानस कहाँ बन पाता है ? जबकि स्वस्थ, सुडौल होने के कारण सुंदर दीखने वाला शरीर गरीबी में भी हँसती-हँसाती जिंदगी जी लेता हैए आए दिन सामने आती रहने वाली समस्याओं से भी निपट लेता हैए प्रतिकूलताओं को अनुकूलताओं में बदल लेता है और किसी न किसी प्रकारए कहीं न कहीं प्रगति के साधन जुटा लेता है। वस्तुतः महत्त्व साधनों या परिस्थितियों का नहींए व्यक्तिगत स्वतंत्रताए प्रतिभा और दूरदर्शिता का है। वह सब उपलब्ध रहेए तो फिर न अभावों की शिकायत करनी पड़ेगी और न जिस–तिस प्रकार के व्यवधान सामने आते रहने पर भी अभ्युदय में कोई बाधा पड़ेगी। यही बात इन सब विपन्नताओं के संबंध में हैए जो आज हर दिशा में सुरसा जैसा मुँह फाड़े महाविनाश का तुमुलनाद करती है। वे समस्याएँ जो अतिविकट दीखती हैंए यदि दृष्टिकोण सुधरेए तो किसी के भी समाधान में कहीं कोई अड्चन न रहे।

औसत नागरिक स्तर का जीवन स्वीकार कर लेने पर सुविस्तृत खेतोंए देहातों में रहा जा सकता है और वायुमंडलए वातावरण को प्रफुल्लता प्रदान करते रहनेए संतुष्ट रखने में सहायक हो सकता है। प्राचीनकाल की सुसंस्कृत पीढ़ी इसी प्रकार रहती थी और मात्र हाथों के सहारे बन पड़ने वाले श्रम से जीवन–यापन के सभी आवश्यक साधन अति सरलतापूर्वक जुटा लेते थे। न प्रदूषण फैलने का कोई प्रश्न था और न शहरों की ओर देहाती प्रतिभा पलायन का कोई संकट। न देहात दरिद्रए सुनसानए पिछड़े रहते थे और न शहर गंदगी, चिंचपिच, असामाजिकता के केंद्र बनते थे। आज भी उस पुरातन रीति–नीति को अपनाया जा सकेए तो जिन समस्याओं के कारण सर्वत्र त्राहि–त्राहि मची हुई है, उनके उभरने का कोई कारण शेष न रहे। स्थानीय साधनों से बने मकान न केवल सस्ते होते हैं, वरन् हर दृष्टि से सुविधाजनक भी सिद्ध होते हैं। अमीरी बटोरने की हविश ही औद्योगीकरण के लिए उत्तेजित करती है। बड़े कारखाने लगते ही विष उगलते, पानी में जहर मिलाते, अत्यधिक ईधन खपाते और देहाती उद्योगों का सफाया करके बेकारी, बेरोजगारी का माहौल बनाते हैं। पुरातन देहात प्रधान कुटीर उद्योगों पर निर्भर रीति–नीति को आमूलचूल बदल डालने में मनुष्य का विकृ त चिंतन ही एकमात्र कारण है। यदि वह भविष्य में भी इसी प्रकार बना रहाए तो उपरोक्त समस्याओं में से किसी का भी महाविनाश से पूर्व समाधान होने की संभावना नहीं है।

''सादा जीवन उच्च विचार्'' का सिद्धांत अपनाते ही प्रस्तुत असंख्य समस्याओं में से एक के भी पैर न टिक सकेंगे। अपराधों की भरमार भी तब क्यों हो, जब हर व्यक्ति ईमानदारी, समझदारी, जिम्मेदारी और बहादुरी की नीति अपनाकर श्रमशीलता, सभ्यता और सुसंस्कारिता को व्यावहारिक जीवन में स्थान देने लगेगा। गुजारे के लायक इतने साधन इस संसार में मौजूद हैं किए हर पेट को रोटी, हर तन को कपड़ा, हर सिर को छाया और हर हाथ को काम मिल सके, तब गरीबी अमीरी की विषमता भी क्यों रहेगी ? जाति–लिंग के नाम पर पनपने वाली विषमता का अनीतिमूलक और दुःखदायी प्रचलन भी क्यों रहेगा ?

मनुष्य स्नेह और सहयोगपूर्वक रहने के लिए पैदा हुआ है। लड़ने, मरने और त्रास देने के लिए नहीं। यदि आपा–धापी न मचे, तो फिर एकता और समता में बाधा उत्पन्न करने वाली असंख्य कठिनाइयों में से एक का भी कहीं अस्तित्व दृष्टिगोचर न हो। शुद्ध व्यवसाय की बलिवेदी पर जो प्रचुर साधनए प्रबंधए श्रम.कौशल का हनन करना पड़ता हैए उसकी फिर क्या आवश्यकता है ? वातावरण में असंख्यों विकृतियों और व्यक्ति के सामने असंख्य समस्याओं के अंबार खड़े हैं। उनमें से प्रत्येक को अलग–अलग समस्या मानकर, उनके पृथक्

पृथक् समाधान खोजने में, यद्यपि विश्व की मूर्द्धन्य प्रतिभाएँ अपने–अपने ढंग से समाधान खोजने और उपचार खड़े करने के लिए भारी माथा–पच्ची कर रही हैं, पर उनसे कुछ बन नहीं पा रहा है। न अस्पतालों, चिकित्सकों द्वारा भारी धनराशि खर्च कर रोग काबू में आ रहे हैं और न पुलिस, कानून, कचहरी आदि–अपराधों को काबू में कर सकने में समर्थ हो रही हैं। आत्मघाती दुर्व्यसनों के रहते बैंकों से भारी कर्ज व अनुदान बँटने पर भी गरीबी मिट सकेगी नहीं। इसके लिए समस्याओं के मूल में जाना होगा एवं यह सोचना होगा कि यदि जीवन क्रम अब भी न बदला गया तो सामूहिक आत्मघात सुनिश्चित है। अध्यात्म ही समस्त समस्याओं का एक मात्र समाधान सुझा सकता है। उसके पास ही सारे तालों की वह कुंजी है, जो द्वार खोलकर प्रगति का पथ प्रशस्त कर सके।

वातावरण जिसमें हम रहते हैं, चेतनात्मक है । मनोविज्ञानी, पाश्चात्य मनीषी भी स्वीकारने लगे हैं कि– पर्यावरण का प्रभाव न केवल स्वास्थ्य पर, बल्कि मानव के मन– विचारों तक को प्रभावित करता है। भारतीय ऋषियों का तो कहना है कि परिस्थिति ही मनः स्थिति को प्रभावित नहीं करती बल्कि मनः स्थिति भी परिस्थिति को प्रभावित करती है। तात्पर्य यह है कि ,लोकचिंतन व विचार प्रवाह न केवल अदृश्य वातावरण को प्रभावित करता है बल्कि स्थूल पर्यावरण पर भी उसका कम प्रभाव नहीं होता। अध्यात्म प्रयोगों द्वारा अदृश्य का अनुकूलन संभव है । सूक्ष्मदर्शियों का कहना है कि ,स्वतंत्रता संग्राम में न केवल नरम –गरम दल के नेता और शहीदों का योगदान रहा है, बल्कि महर्षि रमण, अरविंद घोष , स्वामी विवेकानंद आदि के आध्यात्मिक प्रयास भी उतने ही महत्वपूर्ण रहे थे। वास्तव में देखा जाए तो आज तक की गई भौतिक प्रगति, सुख –सुविधाओं, साधनों से भरे पूरे संसार के लिए केवल और केवल मानव समुदाय द्वारा इस क्षेत्र में किया गया कठोर श्रम ही जिम्मेदार है। मनुष्य ही है –वह संसार का सिरमौर प्राणी, जिसने जब भी– जिस किसी क्षेत्र में अपने सोचने– समझने और काम करने की क्षमता का उपयोग किया, तो उसे सफलता मिलकर रही । उसकी संकल्प भारी साहसिकता के सामने ना कभी कोई अवरोध टिक सका और ना कभी टिक सकेगा।

परंतु आज वर्तमान में पर्यावरण पर नजर डालें तो पता चलेगा कि हमारे अपने ही अग्रजों ने ज्यादा पाने –बटोरने की हवस में मुर्गी का पेट ही फाड़ दिया । अपनी मां जैसी प्रकृति के चिथड़े कर दिए। उन्हें मालूम है कि, हम अपने बच्चों को कूड़े–कचरे और गंदगी से भरी पृथ्वी मां की गोद देने वाले हैं, फिर भी क्या करें? लाचार हैं – अपनी वहसियत से, हैवानियत से, स्वार्थ से, ज्यादा बटोरने की आदत से, आरामतलबी से । उन्हें मालूम है कि– हुए तो श पी श के मरेंगे ही, साथ ही अपनों को–– अपने बच्चों, पत्नी, मां, पिता, परिवार के सभी को श बिना पिये श्मरने पर आलीशान घर छोड़ जाएंगे–– पर करें क्या ? अपने हाथों ही अपने परिजनों की मौत की नींद सुला देने के लिए जिम्मेदार " हम मनुष्य " संभले तो कैसे ? चेतें तो कैसे ? ––उपाय है !!! ऋग्वेद में प्रार्थना की गई है कि श्हे भगवान !हमें देवताओं के पापों से बचा श –जिसे हम सभी जानते तो है , पर आज तक बृहद उपयोग में , अभ्यास में लाए नहीं है –जिसकी आज महती आवश्यकता है। हर परिस्थिति और मनः स्थिति के लिए जिम्मेदार यदि हम ही हैं – यदि मनुष्य ही हैं, तो क्यों ना इस मूल कारण का वास्तविक समाधान कर लिया जाए । कैसे ? मानवी व्यक्तित्व से संबंधित विज्ञान और अध्यात्म विज्ञान के प्रयोग –उपयोग द्वारा । अध्यात्म में जीवन की सभी समस्याओं का युगानुकुल समाधान है । युग की मांग है –––आत्मवत सर्वभूतेषु के लिए डीप इकोलॉजी के सिद्धांतों यानि अध्यात्म को ह्रदय अंगम करें और तदनुरूप व्यवहार स्वयं करें तथा दूसरों को प्रेरणा व मार्गदर्शन दें ताकि हंसती– खिलखिलाती जिंदगी की विरासत आने वाली पीढ़ी को दे सके।

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भारत में न्यायिक सक्रियता : पर्यावरण संरक्षण एवं पोषणीय विकास के विशेष संदर्भ में

माधवेन्द्र तिवारी

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प्रस्तावना

पृथ्वी का पर्यावरण मानव के लिए एक धरोहर है जिसका उचित संरक्षण करते हुए उससे लाभ प्राप्त करने हेतु उसका जन्म इस पृथ्वी पर हुआ है। किन्तु आज का मनुष्य स्वार्थी प्रकृति का होने के कारण केवल अपने अधिकारों का डंका पीटता है और कर्तव्यों को भूल जाता है तथा अपने ही हाथों अपने विनाश को आमंत्रण देता है। आज भारत ही नहीं वरन् पूरे विश्व में बढ़ती उष्णताए ग्रीन हाऊस प्रभाव पिघलते ग्लेशियरए डूबते द्वीपों तथा अलनीनों के बारे में चर्चायें एवं सेमीनार आयोंजित किये जा रहे है। इन सबकी जड़ में अन्ततः मनुष्य का स्वार्थी एवं लोभी स्वभाव ही दिखाई पड़ता है।

पोषणीय विकास की अवधारणा एवं विकास

पोषणीय या सतत् विकास का सीधा संबंध हमारी आने वाली पीढ़ी और आज के विकास से जुड़ा है। आज आवश्यकता इस बात की महसूस की जा रही है कि हम प्राकृतिक संसाधनों का दोहन एवं प्रयोग इस प्रकार करे कि वे हमारी आने वाली पीढ़ी के लिए भी सुरक्षित रहे। पोषणीय विकास की धारणा का प्रारम्भ मानव पर्यावरण की संकल्पना के उदय के साथ ही प्रारम्भ हो गया था और 1970 के दशक से लेकर 1990 के दशक तक यह धारणा और भी पुष्पित एवं पल्लवित हुई।

पोषणीय विकास की धारणा के पूर्व यह भ्रांति विशेष रूप से विकासशील देशों में प्रचलित थी कि पर्यावरण संरक्षण एवं विकास परस्पर विरोधी है तथा पर्यावरण केवल धनी देशों हेतु ही समस्या है और विकासशील एवं अविकसित देशों में यह कोई समस्या नहीं है। किन्तु यह धारणा निर्मूल साबित हुई और यह तथ्य सामने आया कि प्रदूषित पर्यावरणए अपने उत्पति के स्थान को ही प्रभावित नहीं करता वरन् इसका वैश्विक परिणाम होता है और आवश्यकता इस बात कि है कि विकसित एवं विकासशील देश मिलकर प्रदूषण के विरूद्ध लड़े और अपनी पृथ्वी को प्रदूषण से बचाते हुए इस प्रकार विकास के पथ पर अग्रसर हो कि विकास के संसाधन भावी पीढी के लिए भी सुरक्षित रहे।

पोषणीय विकास से तात्पर्य हैए सतर्कतापूर्वक आयोजन तथा प्रबंधन द्वारा पृथ्वी के प्राकृतिक स्रोतोंए जिसमें हवाए पानी पेड़–पौधेए जीव–जन्तु विशेष रूप से परिस्थितिकी तंत्र को नुकसान पहुंचाए बिना विकास करना है। इस संकल्पना में दो बिन्दु समाहित है प्रथमए परिस्थतिकीय विकास जिसका उद्देश्य पोषणीय विकास है जो सामाजिक रूप से वांछनीय आर्थिक तौर पर जीवन योग्य पारिस्थितिकीय तंत्र को संरक्षित रखना और

द्वितीय बिन्दु प्राकृतिक संसाधनों का संयत उपभोग है जिससे की भावी पीढ़ियों हेतु वह समाप्त न हो जाये। ऐसा तभी संभव है जब पोषणीय विकास की प्रक्रिया को अपनाया जाय।

पर्यावरण संरक्षण एवं पोषणीय विकास हेतु अन्तर्राष्ट्रीय प्रयास

1974 में संयुक्त राष्ट्र विकास सम्मेलन और संयुक्त राष्ट्र व्यापार एवं विकास सम्मेलन के संयुक्त प्रयास से कोकोयोक मैक्सिकों में पेटर्न ऑफ रिसोर्स यूजए इनवायर्मेन्ट एण्ड डेवलपमेंट स्टैंटेजीज पर एक अन्तर्राष्ट्रीय गोष्ठी बुलाई गयी जिसकी घोषणा में निम्नलिखित मुख्य बातें कहीं गयी है।

1. धनी देशो की नकल को विकास का आधार बनाना उचित नहीं है।
2. विकास का मूल प्रयास राष्ट्रीय स्वाबलम्बन एवं अन्तर्राष्टीय सहयोग हो।
3. विकासए भावी पीढ़ियों के आवश्यकताओं से संगत हो।

कोकोयोत घोषणा का मूल यह था कि विकास का ध्येय वस्तुओं का विकास करना नहीं वरन् मानव का विकास करना हो।

इसके पश्चात् महत्वपूर्ण रूप से सन् 1983 में संयुक्त राष्ट्र महासभा ने नार्वे की प्रधानमंत्री जी.एच. ब्रटलैन्ड की अध्यक्षता में पर्यावरण एवं विकास पर एक विश्व आयोग गठित किया उसने अपनी रिपोर्ट में ऐसे भविष्य के निर्माण पर पर्यावरण पर बल दिया जो ज्यादा सम्पन्नए ज्यादा उचित और ज्यादा सुरक्षित हो। रिपोर्ट में पोषणीय विकास को परिभाषित करते हुए कहा गया कि पोषकीय विकास से तात्पर्य ऐसे विकास से है जो बिना भावी पीढ़ियों की आवश्यकताओं से समझौता किये वर्तमान आवश्यकताओं को पूरा करता हो।

कालांतर में पर्यावरण एवं विकास पर संयुक्त राष्ट्र सम्मेलन 1989 आयोजित किया गया जिसमें पोषणीय एवं पर्यावरणीय रूप से स्वस्थ विकास की बात स्वीकार की गयी। इसी क्रम में पर्यावरण एवं विकास पर संयुक्त राष्ट्र सम्मेलन 1992 रियोडीजेनेरियो पृथ्वी सम्मेलनद्ध आयोजित किया गया जिसमें 150 देशों ने भाग लिया जिसमें–विश्व को प्रदूषण से बचाने हेतु वितीय प्रबन्धए वनों का प्रबंधए संस्थागत प्रबंधए प्रोद्योगिकी का अन्तरणए जैविकीय विविधिता एवं पोषणीय विकास आदि मुद्दों पर विचार हुआ। सभी मुद्दो पर विचार करने के बाद जो रियो घोषणा जारी हुई उसमें यह कहा गया कि पोषणीय विकास के केन्द्र में मानव प्राणी है। वे प्रकृति के अनुरूप स्वस्थ और उत्पादक जीवन के हकदार है विकास के अधिकार को इस प्रकार प्राप्त किया जाना चाहिए कि वे वर्तमान एवं भावी पीढ़ियों की विकास संबंधी एवं पर्यावरणीय संरक्षण संबंधी विकास प्रक्रिया का अभिन्न अंग हो और उसे इससे पृथक नहीं माना जाय। पोषणीय विकास हेतु गरीबी का उन्मूलन आवश्यक है और गरीबी उन्मूलन में सभी सहयोग करें विशेष रूप से विकसित देश विकासशील देशों की मदद करें।

इसी सम्मेलन में एजेण्डा 21 स्वीकार किया गया जिसका उद्देश्य पोषणीय विकास हेतु वैश्विक भागीदारी को तय करना था। पोषणीय विकास के संबंध में ही एजेण्डा 21 में संयुक्त राष्ट्र आयोग की स्थापना की अपेक्षा की गई थीए इसकी स्थापना 1993 में की गई। यह संयुक्त राष्ट्र आर्थिक एवं सामाजिक परिषद् का क्रियाशील आयोग है। इसका उद्देश्य सम्मेलन की घोषणा को प्रभावी करके अन्तर्राष्ट्रीय सहयोग में अभिवृद्धि करना है। पर्यावरणीय विकास के क्रम में 1997 में क्योटो जापानद्ध में वैश्विक उष्णता सम्मेलन बुलाया गया जिसमें स्वीकृत प्रोटोकाल 2005 में प्रभावी हुआ।

भारत में पर्यावरण संरक्षण हेतु विधायन

भारत में प्रदूषण को नियंत्रित करने हेतु पर्यावरण संरक्षण अधिनियम 1986 पारित किया गयाए इसकी धारा 7 औद्योगिक इकाईयों के स्वामियों पर यह बाध्यता एवं कर्तव्य आधिरोपित करती है कि वे किसी भी प्रकार के प्रदूषक चाहे वह ठोसए द्रव या गैस किसी भी रूप में वातावरण में उत्सर्जित नहीं करेगी और निर्धारित मात्रा से अधिक प्रदूषकों का उत्सर्जन उन्हें दण्ड का भागी बनायेगी और प्रदूषकों के उत्सर्जन पर रोक लगाने हेतु पर्यावरण संरक्षण नियमावली 1986 भी बनायी गयी है। इसी प्रकार अधि. की धारा 8 परिसंकटमय पदार्थो के हैण्डलिंग के लिए भी नियम प्रस्तुत करती है। इसी प्रकार जल प्रदूषण निवारण एवं नियंत्रणद्ध अधि–1974 की धारा 47 एवं 48 उद्योग के कार्यकारी को उद्योग द्वारा वहि स्रावित प्रदूषकों के लिए जिम्मेदार बनाती है तथा वायु प्रदूषण निवारण एवं नियंत्रण अधि–1981 की धारा 40 प्रावधान करती है कि प्रदूषकों का निश्चित मात्रा से अधिक उत्सर्जन करते समय कम्पनी के व्यवसाय को प्रबंधित करने वाले किसी भी व्यक्ति को प्रदूषण हेतु सीधे उतरदायी बनाया जायेगा।

भारत में कारखाना अधि. की धारा 41 की उपधारा क से ज तक में कारखानों द्वारा उत्सर्जित प्रदूषण पर नियंत्रण हेतु विभिन्न प्रावधान बनाये गये है और इस संबंध में केन्द्र सरकार एवं राज्य सरकार को पर्याप्त शक्तियॉ प्रदान की गयी है। इसी प्रकार से लोकदायित्व बीमा अधि-1991 खतरनाक उद्योगों पर यह दायित्व अधिरोपित करती है कि उनके द्वारा छोड़े गये प्रदूषकों से हुए जीवन एवं सम्पति की भरपाई भी उनके द्वारा की जाये। इसी प्रकार का प्रावधन राष्ट्रीय पर्यावरणीय अपील अथारिटी का भी गठन 1997 में किया गया।

पर्यावरण संरक्षण में उच्चतम न्यायालय की भूमिका

उत्सर्जित प्रदूषकों एवं उनसे होने वाली हानियों को नियंत्रित करने वाली विभिन्न विधियों का निर्माण सरकार द्वारा किया गया फिर भी यह अपने उद्देश्य अर्थात् पर्यावरण संरक्षण में विफल रही हैं। अतः भारतीय उच्चतम न्यायालय द्वारा औद्योगीकरण से पर्यावरण को बचाने हेतु अपने निर्णयों में न्यायिक सक्रियता के द्वारा विभिन्न सिद्धांतों का प्रतिपादन किया जो बहुत प्रभाव पूर्ण साबित हुए है।

उच्चतम न्यायालय ने प्रदूषण के मामलों में विधि के कठोर दायित्व के सिद्धांत को परिवर्तित कर पूर्ण एवं अत्यांतिक रूप से दायित्वधीन ठहराया है चाहे प्रदूषण कारित होने में उनके द्वारा कोई उपेक्षा या गलती न रही हो। उच्चतम न्यायालय ने पर्यावरण प्रदूषण के नियंत्रण एवं पोषणीय विकास हेतु विभिन्न वादों में निम्नलिखित प्रमुख सिद्धांत प्रतिपादित किये है।

1.प्रदूषक भुगतान का सिद्धांत 2.लोकन्यास का सिद्धांत 3.पूर्व सावधानी का सिद्धांत 4.पूर्ण दायित्व का सिद्धांत

1.प्रदूषक भुगतान का सिद्धांत

इस सिद्धांत का प्रतिपादन एम.सी.मेहता बनाम भारत संघ ए. आई. आर. 1988 ए एस.सी.1037 के बाद में किया गया इस सिद्धांत के अनुसार यदि किसी उद्योग से निकलने वाले बहिस्त्राव से पर्यावरण पर बुरा प्रभाव पड़ता है तो वह उद्योग का स्वामी इस नुकसान हेतु भुगतान करेगा और इस भुगतान का उपयोग पर्यावरण के पुनः सुधारने में किया जायेगा।

2. लोकन्यास का सिद्धांत

यह सिद्धांत पोषणीय विकास के संबंध में न्यायालय के महत्वपूर्ण दृष्टिकोण का प्रतिपादन करता है जिसे उच्चतम न्यायालय ने एम.सी मेहता बनाम् कमलनाथ ए.आई.आर.1997,1 SCC- 388 में प्रतिपादित किया। इस सिद्धांत के अनुसार जंगलए नदियांए पहाड़ एवं अन्य प्राकृतिक संसाधनों पर संपूर्ण लोक का सामूहिक अधिकार है और राज्य उसे लोक के फायदे हेतु न्यास के रूप में धारण करती है। इन संसाधनों का प्रयोग कोई व्यक्तिगत हित में नहीं कर सकता। राज्य इसका प्रयोग इस प्रकार सुनिश्चित करेगा जिससे वर्तमान के साथ साथ आनेवाली पीढ़ियों हेतु भी वह सुरक्षित रहे।

3. पूर्व सावधानी का सिद्धांत

इस सिद्धांत का प्रतिपादन एम.सी. मेहता बनाम भारत संघ ।ण्ण्त्ण् 1997, 2 SCC 35 (ताज महल वाद) में उच्चतम न्यायालय द्वारा किया गया। इस केस में कहा गया कि यह बात अस्वीकार्य है कि विकास एवं पर्यावरण संरक्षण दोनों एक साथ नहीं हो सकते सरकार राष्ट्रीय धरोहर एवं पारिस्थितिकीय तंत्र को बचाने हेतु उपयुक्त कदम उठाये एवं उन्हें सुरक्षित रहे।

4. पूर्व दायित्व का सिद्धांत

इस सिद्धांत का प्रतिपादन एम.सी.मेहता बनाम भारत संघ ए.आई.आर 1987 एस.सी. 1086 में किया गया इस सिद्धांत के अनुसार यदि किसी उद्योग द्वारा स्रावित प्रदूषकों से किसी भी जीवन एवं सम्पतियों को नुकसान पहुंचाता है तो इस हेतु उद्योग के स्वामी का पूर्ण दोयित्व होगा भले उसका ऐसी क्षतिकारित होने में कोई उपेक्षा न कि गई हो।

निष्कर्ष एवं सुझाव

औद्योगिक विकास आर्थिक वृद्धि हेतु आवश्यक है किन्तु यह औद्योगिक विकास पर्यावरण को दोहरे रूप से प्रभावित करता है। प्रथमतः उद्योगों से जो जहरीली गैसे उत्सर्जित होती है उससे वायुमंडल में प्रदूषण फैलाने वाली गैसों की मात्रा में अत्याधिक वृद्धि होती है। उद्योगों द्वारा वाहिः स्रावित दूषित जल से नदियों एवं समुद्रो के पारिस्थतिकी तंत्र पर बुरा प्रभाव पड़ता हैए दूसरे तरफ उद्योगों को लगाने हेतु तथा कई तरह के उद्योगों में कच्चे माल के रूप में उपयोग हेतु भारी मात्रा में पेडों की कटाई की जाती है जिससे पर्यावरण के सबसे बडे संरक्षक वनों का विनाश सुनिश्चित होता है साथ ही साथ उद्योगों में इस्तेमाल होने वाले कोयले एवं अन्य खनिजों की खुदाई से भी पर्यावरण बुरे रूप से प्रभावित होता है। औद्योगीकरण और संसाधनों के तेजी से होते हुए दोहन ने पर्यावरण एवं पोषणीय विकास पर गंभीर कुठाराघात किया है और विशेष रूप से जंगलों में रहने वाले एवं वनों पर निर्भर जीवन को खतरा उत्पन्न कर दिया है।

अन्तर्राष्ट्रीय पोषणीय विकास के लिए पोषणीय औद्योगिकीकरण आवश्यक है अतः आवश्यक है कि

1. राष्ट्रीय सामाजिक आर्थिक विकास एवं पर्यावरण नीतियों में वरीयता निर्धारित कर सक्षम कार्यक्रम विकसित कर औद्योगिक प्रदूषण को कम किया जाये।
2. उद्योगों को प्रोत्साहित किया जाये कि वे अपनी प्रोद्योगिकी विकसित करने की क्षमता बढ़ाये और ऐसे साधन प्रयोग में लावे जो प्रदूषण उत्पन्न न करें।
3. विकासशील देशों में औद्योगिक प्रौद्योगिकी के विकास एवं अन्तरण को प्रोत्साहित किया जाये।

4. पोषणीय औद्योगिक विकास को बढ़ावा देने हेतु पर्यावरणीय प्रभाव मूल्यांकन को विकसितए परिष्कृत एवं लागू किया जाये।

5. कम अपशिष्ट पैदा करने वाले पदार्थो के प्रयोग को प्रोत्साहित किया जाये।

संदर्भ ग्रंथ सूची–

1. कपूरए एस.के.ए भअन्तर्राष्ट्रीय विधिभ इलाहाबाद लॉ एजेंसी इलाहाबादए 2020।

2. अग्रवालए एच. ओ.ए भअन्तर्राष्ट्रीय विधिभ सेन्ट्रल लॉ पब्लिकेशन इलाहाबाद 2021।

3. जसवाल एवं निष्ठा जसवाल परमजीत भपर्यावरण विधिभ इलाहाबाद लॉ एजेंसी इलाहाबाद 2001।

4. मोहम्मद हुसैन के. एस.ए भवर्ल्ड समिट आन सस्टनेवल डेवलपमेंट ऐन एप्रीसलए जर्नल ऑफ इण्डियन लॉ इन्स्टीट्यूटभ नई दिल्ली सितम्बर 2002।

5. खानए आई. ए.ए भइनवायरमेन्टल लॉए सेन्ट्रल लॉभ पब्लिकेशन इलाहबाद 2002।

अंतर्राष्ट्रीय मानवीय कानून एवं पर्यावरण सम्मेलन

टी. आर. पाटले

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ठाकुर शोभा सिंह, शासकीय महाविद्यालय पत्थलगांव, जिला – जशपुर (छ0ग0)

1.0 अर्न्तराष्ट्रीय मानवीय कानून और पर्यावरण समझौते

पर्यावरण संरक्षण की समस्या आज विश्व के समझ एक बड़ी चुनौती हैं। विश्व का लगभग हर देश इस समस्या के समाधान के लिए अलग–अलग तरीके से प्रयासरत हैं। पर्यावरणीय संबंधी कानून पर्यावरण के संरक्षण व प्राकृतिक संसाधनों के उपयोग को नियंत्रित करने में एक बहुत ही महत्वपूर्ण भूमिका निभाते हैं। पर्यावरण–संबंधी कानूनों की सफलता मुख्य रूप से इस बात पर निर्भर करती है कि उनको किस प्रकार लागू करते है। कानून एक स्वस्थ पर्यावरण को कायम रखने के लिए आम जनता को शिक्षित करने का भी एक अनमोल मंत्र है। अन्तर्राष्ट्रीय कानून व नियम समझौता, विज्ञप्ति व संधि के नामों से जाने जाते है।

देश के सारे कानूनों की उत्पत्ति पर्यावरण की समस्याओं से जुड़ी हैं। पर्यावरण के संरक्षण के लिए प्रभावशाली कानूनों व नियमों का होना आवश्यक है नहीं तो, बढ़ती जनसंख्या की अधिक साधनों की आवश्यकता पर्यावरण पर बहुत भार डाल देगी। इन नियमों को लागू करना दूसरा मुख्य पहलू हैं। पर्यावरण को और अधिक हानि होने एवं प्रदूषण से बचाने के लिए इन कानूनों–नियमों को बलपूर्वक तथा प्रभावशाली ढंग से लागू करना अति आवश्यक है।

पर्यावरण का क्षय एक अन्तर्राष्ट्रीय समस्या हैं जिसके अन्तर्गत जल प्रदूषण, ध्वनि प्रदूषण, रासायनिक प्रवाह, नगरीकरण, जनसंख्या विस्फोट ग्लोबल वार्मिंग, विज्ञान और तकनीक का अप्रत्याशित प्रसार आदि ऐसे प्रमुख कारण हैं जिनकी वजह से पर्यावरण का दिन प्रतिदिन पर्यावरण की समस्याएं उत्पन्न हो रही है। अन्तर्राष्ट्रीय कानून के अन्तर्गत प्रत्येक राज्य का यह कर्तव्य हैं। कि वह अपने राज्य क्षेत्र में ऐसा कोई कार्य न करें। कि उस क्षेत्र में बाहर पर्यावरण संबंधी नुकसान व हानि उत्पन्न हो।

संयुक्त राष्ट्र के प्रारम्भिक दशको मे पर्यावरणीय चिंताए कही–कही अन्तर्राष्ट्रीय एजेंडा सूची पर आती थी। सन् 1960 के दशक में समुद्री प्रदूषण, विशेषकर तेल के बहाव से संबंधित कुछ समझौते हुए थें। लेकिन वैश्विक स्तर पर पर्यावरण के क्षय के बढ़ते प्रमाण के कारण 1970 के दशक् से अन्तर्राष्ट्रीय समुदाय ने इसकी पारिस्थितिक तंत्र एवं समाज पर विकास के प्रभाव पर लगातार चिन्ता व्यक्त की। आर्थिक विकास एवं पर्यावरण क्षय के बीच संबंध को सर्वप्रथम 1972 में स्टॉक होम में मानव पर्यावरण पर संयुक्त राष्ट्र सम्मेलन के ऐजेंडा में शामिल किया गया था। इस सम्मेलन के बाद सरकार ने संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP) स्थापित किया जो एक मुख्य वैश्विक पर्यावरणीय ऐजेंसी के रूप में कार्य कर रहा है। सन् 1973 में संयुक्त राष्ट्र ने पश्चिमी अफ्रीका में मरूस्थलीकरण विस्तार को कम करने के प्रयासों को बढ़ाने के लिए सुडानों–सहेलियन कार्यालय की स्थापना की और राष्ट्रीय आर्थिक नियोजन एवं निर्णय प्रक्रिया में पर्यावरणीय चिंताओं को शामिल करने का काम भी चलता रहा है। 1980 का दशक् पर्यावरणीय विषयों पर सभी राज्यों के मध्य ओजाने परत को सुरक्षित रखने एवं विषैले गैंस के उत्सर्जन की गति को नियंत्रित करने वाले संधियों का समावेश था। सन् 1983 में संयुक्त राष्ट्र महासभा द्वारा स्थापित पर्यावरण एवं विकास पर विश्व आयोग ने एक नये प्रकार की

विकास की जरूरत एवं पर्यावरण संसाधनों को सुरक्षित रखने की पहल भी सम्मलित की गई। महासभा को प्रस्तुत आयोग की सन् 1987 की रिपोर्ट में सतत् विकास या टिकाऊ विकास की अवधारणा रखी गई।

पर्यावरण संरक्षण हेतु अंन्तर्राष्ट्रीय कानून की व्यवस्था की गई है। जिसके अन्तर्गत लेकसेक्स सम्मेलन (1949) इस बात पर बल दिया गया कि प्रकृति के उपकरण एक नैसर्गिक बपौती के रूप में हैं। जिन्हें शीघ्रता से नष्ट नहीं करना चाहिए। आजादी के पहले आजादी के पूर्व पहली बार वन अधिनियम 1927 द्वारा पर्यावरण संरक्षण की बात कही गई थी। स्वतंत्रता प्राप्ति के बाद भारतीय संविधान में पर्यावरण संरक्षण के विभिन्न उपबंधों को स्थान दिया गया। संविधान के अनुच्छेद 51। (G) के अनुसार प्रत्येक नागरिक का यह कर्तव्य हैं कि वह प्राकृतिक पर्यावरण की रक्षा, प्राकृतिक पर्यावरण का संवर्धन करें एवं वन्य जीवों के प्रति दयाभाव रखे।

पर्यावरण के संरक्षण के लिए अनुच्छेद 48 । स्पष्ट करता है– यह प्रत्येक राज्य का कर्तव्य हैं कि वह न केवल पर्यावरण का बचाव एवं सुधार करें। बल्कि देश के वनों और वन्य जीवन का भी संरक्षण करें।

हमारे देश में 200 से भी अधिक अधिनियम बने है। यहां हम निम्नांकित सात अधिनियमों का` अध्ययन करेंगेः

1. पर्यावरण (संरक्षण) अधिनियम, 1986
2. वायु (प्रदूषण निवारण तथा नियंत्रण) अधिनियम, 1981
3. जल (प्रदूषण निवारण तथा नियंत्रण) अधिनियम, 1974
4. वन्य जीवन (संरक्षण) अधिनियम, 1972
5. वन (संरक्षण) अधिनियम, 1980
6. ध्वनि प्रदूषण (विनियमन) एवं नियंत्रण नियम, 2000
7. पर्यावरण (संरक्षण) अधिनियम, 1986
8. जैव विविधता अधिनियम, 2000
9. राष्ट्रीय हरित प्राधिकरण कानून 2010

1.1 पर्यावरण कानून को लागू करने में बाधाए

केन्द्र व राज्य सरकारों द्वारा पर्यावरण सुरक्षा, प्राकृतिक संसाधनों के संरक्षण, जल तथा वायु प्रदूषण नियंत्रण, वन्य जीव संरक्षण आदि से सम्बन्धित अनेक अधिनियम पारित किये गये है। लेकिन इन अधिनियमों को लागू करने में अनेक बाधाएं आती है। इनमें से कुछ निम्नलिखित है–

1. **बढ़ती हुई जनसंख्या** : अधिक जनसंख्या दबाव के कारण पर्यावरणीय कानूनों को लागू करने के लिए बहुत अधिक धन, समय तथा जनशक्ति की आवश्यकता होती है। इस प्रकार अधिक जनसंख्या अपने आप मे ंपर्यावरणीय कानूनों के लागू करने में सबसे बड़ी बाधक है।
2. **अशिक्षारू** पर्यावरण कानूनों को लागू करने में शिक्षा की बड़ी अहम भूमिका होती है। विकासशील देशों में जहां शिक्षा का स्तर बहुत कम है। वहां पर्यावरण कानूनों को लागू करने में अधिक बाधाएं आती है, क्योकि अशिक्षित व्यक्ति इन कानूनों के महत्व को नहीं समझता ।

3. **ज्ञान एवं जागरूकता का अभावः** अनेक शिक्षित लोग भी पर्यावरणीय कानूनों से अनभिज्ञ है। अतः पर्यावरणीय कानूनों का ज्ञान कराना आवश्यक है। इसके लिए इन कानूनों के अर्थ व महत्व का व्यापक प्रचार–प्रसार आवश्यक है।

4. **पर्याप्त कानून का अभावरू** वैसे तो पर्यावरण सुरक्षा व संरक्षण हेतु अनेक कानून बनाये गये है, फिर भी वन व वन्य जीवों के उपयोग व व्यवसाए, जलाशयों को गन्दा करने से रोकने, खनन आदि से सम्बन्धित मामलों मे पर्याप्त कानूनों का अभाव है। कुछ मामलों में कानूनों में खामियां भी है, लोग जिसका अनुचित फायदा उठाते है।

5. **आर्थिक कारण :** अधिक लाभार्जन के लालच में गलत तरीके से संसाधनों का दोहन होता है। हमारे देश में थोड़े से पैसा की रिश्वत देकर किसी अधिकारी से गलत तरीके से अनुमति प्राप्त कर लेना एक आम बात हो गयी है। छोटे उद्योगों में आर्थिक तंगी के कारण अपशिष्टो का पुनर्चक्रण नहीं किया जा सकता। बड़े–बड़े उद्योगपति तथा तस्कर धन के लालच में कानूनी खामियां का फायदा उठाते है।

6. **धार्मिक रीती–रिवाजः** विभिन्न धार्मिक आयोजनों के तहत् मूर्तियों, ताजियाँ , पूजा, सामाग्री आदि को जलाशयों में प्रवाहित कर दिया जाता है। इस प्रकार के मुद्दे चूंकि जनभावना से जुड़े होते है, इसलिए इनमें पर्यावरणीय कानूनों का सख्ती से पालन नहीं किया जा सकता।

1.2 पर्यावरण संरक्षण के अन्तर्राष्ट्रीय कानून

वर्तमान में किसी भी अन्तर्राष्ट्रीय आयोग को यह अधिकार नहीं हैं कि वह राष्ट्रीय आयोंगो द्वारा पारित नियमों की तरह नियम बना सके और न ही वैश्विक स्तर पर साधनों के नियंत्रण का अधिकार किसी अंतर्राष्ट्रीय एजेंसी को प्राप्त हो। सके परिणामस्वरूप, अंतर्राष्ट्रीय कानून–प्रणाली को सब समूहों की सहमति पर निर्भर होना पड़ता है। बहुद्देशीय स्तर के कुछ मद्दों का संबोधन उन नीतियों, समझौतों व संधियों का मिला–जुला कार्य है। जिन्हें हम आम तौर से अंतर्राष्ट्रीय पर्यावरण संबंधी कानून के नाम से जानते हैं। अधिकतर अन्तर्राष्ट्रीय पैमाने के कानून और नियम वे अन्तर्राष्ट्रीय पर्यावरण संबंधी कानून के नाम से जानते है।

अधिकांश अन्तर्राष्ट्रीय कानून और नियम वे अन्तर्राष्ट्रीय समझौते हैं जिनका सभी स्वेच्छा से पालन करते हैं। यह सहमति प्रायः अन्तर्राष्ट्रीय समझौते अथवा संधियों के माध्यम से पारित हुई हैं। जिन देशों ने इन समझौतों को मानने की सहमति दे दी है, उन्हें पार्टी के नाम से बुलाया जाता है। यह समझौता एक ढांचे को प्रदान करता है जिसका आदर न केवल हर एक पार्टी को करना पड़ेगा, बल्कि हर पार्टी का यह कर्तव्य है कि वह खुद की राष्ट्रीय कानून– प्रणाली का निर्माण करके इस समझौते को अपने राष्ट्रीय स्तर पर लागू करें। इन समझौतों का सहयोग देने के लिए, कुछ समय के प्रोटोकोल भी निर्मित करने पड़ते है।

'प्रोटोकोल' (Protocol) का आशय **एक ऐसी अन्तर्राष्ट्रीय सहमति है जो स्वयं अपने बल पर तो खड़ी होती है, परन्तु इसका मौजूदा समझौते के साथ गहरा संबंध भी है।** इसका अर्थ यह हुआ कि जलवायु का गई जानकारी पर नई आगे की नई–नई बातों को विकसित करता है।

द्वितीय विश्व युद्ध के पश्चात् जलवायु परिवर्तन को लेकर वैश्विक स्तर पर चर्चाएँ प्रारंभ हुई। 1972 में स्वीडन की राजधानी स्टॉकहोम में पहला सम्मेलन आयोजित किया गया। इन सम्मेलनों में तय हुआ कि प्रत्येक देश जलवायु परिवर्तन से निपटने के लिए घरेलु नियम बनाएगा। इस आशय की पुष्टि हेतु 1972 में ही संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP) का गठन किया गया तथा नैरोबी को इसका मुख्यालय बनाया गया।

जलवायु परिवर्तन पर हुए सम्मेलनों को ही पर्यावरण सम्मेलन कहते है, जो पर्यावरण संरक्षण लिए संयुक्त राष्ट्र द्वारा अन्तर्राष्ट्रीय स्तर पर आयोजित किये गए।

रामसर समझौता (आर्द्रभूमि समझौता)

यह अन्तर्राष्ट्रीय समझौता 2 फरवरी 1971 में ईरान के कैप्सियन सागर के तट पर स्थित शहर रामसर में हस्ताक्षार किए गए थे। इसलिये इसे रामसर समझौता कहा जाता है। कुछ लोग इस समझौते को आर्द्रभूमि समझौता (Wetland Convention) भी कहते है। यह 1975 में लागू हुई। जो आर्द्र भूमि के संरक्षण का सदुपयोग के लिए अन्तर्राष्ट्रीय सहयोग का ढांचा प्रदान करता है। संयुक्त राष्ट्र की शैक्षिक, वैज्ञानिक और सांस्कृतिक संगठन (UNESCO) ने इसमें सूत्रधार की भूमिका निर्वहन किया है। भारत ने इस समझौते पर 1981 में हस्ताक्षार किए। इसका मुख्य कार्यालय रामसर ब्यूरो ग्लाण्ड, स्विटजरलैण्ड में स्थित है। भारत में आर्द्रभूमि के संरक्षण के मामलों के लिए केन्द्रीय पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय नोडल मंत्रालय घोषित है। भारत में सम्पूर्ण भूमि के 4.7 प्रतिशत पर आर्द्रभूमि फैली हुई है। भारत में रामसर संधि द्वारा सुरक्षित स्थलों में 2019 में 11 एवं 2020 में 5 नए आर्द्रभूमियों को जोड़ दिया हैं। वर्तमान में रामसर समझौते के अन्तर्गत भारत में मान्यता प्राप्त स्थलों की संख्या 42 हो गई है। भारत का 42 वाँ रामसर क्षेत्र त्सोकर (लद्दाख) को 2020 में शामिल किया गया है। विश्व भर में रामसर स्थलों की कुल संख्या 23,88 हैं। विश्व आर्द्रभूमि 2020 की थीम– ''**आर्द्रभूमि और जैव विविधता**'' हैं। भारत में आर्द्रभूमियों के अन्तर्गत सार्वधिक क्षेत्र वाला राज्य गुजरात तथा दूसरे पर आंध्रप्रदेश आता है।

उद्देदश्य– इस समझौते के उद्देदश्य में मुख्य से जलीय भूमि की हानि को रोकना, पेड़–पौधों और पशुओं और उनसे संबंधित पर्यावरणीय प्रक्रियाओं का संरक्षण करना है। इस समझौते के मुख्य बिन्दु निम्नानुसार है–

1. एक या अधिक आर्द्र भूमि वाले स्थानों को अन्तराष्ट्रीय आर्द्र भूमि स्थलों की सूची में सम्मिलित करना।
2. आर्द्र भूमि क्षेत्रों के संरक्षण को प्रोत्साहित करना।
3. मेनग्रोव पादप स्थलों के बुद्धिमतापूर्ण प्रयोग को प्रोत्साहित करना।
4. समझौता लागू करने हेतु अन्य प्रांतो से सलाह कर, दो या अधिक देशों के मध्य पड़ने वाली आर्द्र भूमि, आपस मे
5. वितरित होने वाले नदी, जलाशय आदि जल व्यवस्थाएं एवं प्रजातियों के भाग के संबंध में निर्णय करना।
6. आर्द्र भूमि क्षेत्रों की योजनाओं के विकास के संबंध में चर्चा करना।
7. आर्द्र क्षेत्रों के संबंध में अनुसंधान एवं संचालन प्रशिक्षण को प्रोत्साहन देना।
8. वाटर फाउल के लाभ के लिए जलीय क्षेत्रों के संचालन समझौते में सूचना निर्धारित करना।
9. आर्द्र भूमि रिजर्व स्थलों की स्थापना करना।

स्टॉकहोम सम्मेलन – 1972

पर्यावरण संरक्षण के संबधिंत संभावित खतरों से विश्व में जागरूकता उत्पन्न करने के उद्देश्य से पहली बार संयुक्त राष्ट्र के तत्वावधान में 3–16 जून, 1972 में स्वीडन के स्टॉकहोम एक सम्मेलन आयोजित किया गया था। इसे स्टॉकहोम पर्यावरण एवं विकास सम्मेलन 1972 के नाम से जाना जाता है।

स्टॉकहोम सम्मेलन में सभी के लिए एक ही पृथ्वी सिद्धांत का प्रतिपादन किया गया था, जिसके अंतर्गत कहा गया कि कोई भी राष्ट्र विशेष अपने क्षेत्र में ऐसी कोई भी गतिविधि नहीं करेगा जिसका प्रभाव पर्यावरण पर पड़ता हो। सम्मेलन के दौरान संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP) का जन्म हुआ जिसका वर्तमान मुख्यालय केन्या देश के नैरोबी शहर में स्थित है। स्टॉकहोम सम्मेलन में दुनिया के 119 देशों ने भाग लिया था। भारत के तत्कालीन प्रधान मंत्री श्रीमती इन्दिरा गांधी ने स्टॉकहोम सम्मेलन में भाग लिया था। और भारत के लिए एक विशेष पर्यावरण नीति की घोषणा की थी।

इस सम्मेलन में मानवीय पर्यावरण घोषणाओं को स्वीकृत किया गया। इसके प्रमुख दो भाग थे। जिसके प्रथम भाग में मनुष्य और उसके पर्यावरण के संबंध में ज्ञात सत्यों की घोषणा हैं। और दूसरे भाग में 26 सिद्धान्तों का प्रतिपादन किया गया है। कुछ महत्वपूर्ण सिद्धांत निम्न है।

- पृथ्वी के सभी संसाधनों जिसमें जल, वायु, स्थल, जीव जन्तु, तथा प्राकृतिक पारिस्थितिकी तंत्र के विभिन्न प्रकार शामिल है, उनका संरक्षण, उचित प्रबन्धन एवं विचारपूर्ण योजनाओं के माध्यम में वर्तमान व भावी पीढ़ी के हित में किया जाना चाहिए।

- मनुष्य को स्वच्छ व उपयुक्त पर्यावरण में स्वतंत्रता, समानता एवं जीवन की पर्याप्त स्थितियों का मूल अधिकार है। यह अधिकार उसे गरिमापूर्ण व स्वस्थ जीवनयापन की अनुमति प्रदान करता है। उसे वर्तमान एवं भावी पीढ़ियों के लिए पर्यावरण की रक्षा व सुधार करने का दायित्व भी प्रदान करता है।

- सभी प्रांत मानव स्वास्थ्य प्रति खतरा उत्पन्न करने, जीवित संसाधनों, समुद्री जीवन को हानि पहुँचाने, समुद्री प्रदूषण को रोकने के लिए सभी सम्भव कदम उठायेंगे।

- सभी प्रांतो को उनकी पर्यावरणीय नीतियों के अनुरूप संसाधनों के दोहन का पूर्ण अधिकार है। लेकिन उनका यह सुनिश्चित करने का दायित्व भी है कि उनके अधिकार या नियंत्रण में लेने वाले क्रियाकलापों से उन राज्यों से या उनकी सीमा के बाहर के क्षेत्रों के पर्यावरण को हानि नहीं पहुँचायेगें।

- प्रांत अपने अधिकारों तथा नियंत्रण के अन्तर्गत किये गये कार्यो द्वारा उत्पन्न प्रदूषण तथा अन्य पर्यावरण क्षति से पीड़ितो के लिए दायित्व के संबंध में अन्तर्राष्ट्रीय कानून को आगे विकास करने के सहयोग करेंगे।

1. हेलसिंकी सम्मेलन – 1974

हेलसिंकी सम्मेलन का आयोजन फिनलैंड देश के हेलसिंकी शहर में 1974 ई. में किया गया था। इस सम्मेलन का मुख्य विषय 'समुद्री पर्यावरण' की रक्षा करना रखा गया था। इस सम्मेलन के विषय (समुद्री पर्यावरण की रक्षा करना) को स्पष्ट रूप से परिभाषित न किये जाने के कारण यह सम्मेलन असफल हो गया।

2. लंदन सम्मेलन – 1975

लंदन सम्मेलन का आयोजन ब्रिटेन के लन्दन शहर में 1975 ई. में किया गया था। इस सम्मेलन का मुख्य विषय 'समुद्री कचरे को बहार ही रोका जायेगा। और समुद्र में विद्यमान कचरे का प्रभावी निस्तारण किया जायेगा।

3. वियना सम्मेलन – 1985

वियना सम्मेलन का आयोजन आस्ट्रिया देश में स्थित वियना शहर में 1985 ई. किया गया था, इसीलिये इस सम्मेलन को वियना सम्मेलन कहते हैं। इस सम्मेलन का मुख्य विषय ओजोन परत का संरक्षण रखा गया था। इस सम्मेलन द्वारा सभी राष्ट्र एकमत होकर ऐसी गैसों के वैकल्पिक श्रोतों के चयन के लिए सहमत हुए जो ओजोन परत के लिए हानिकारक थीं।

ओजोन परत का संरक्षण

ओजोन परत ओजोन अणुओं की एक परत है, जो वायुमंडल में पाई जाती है। ओजोन परत पृथ्वी को सूर्य की हानिकारक अल्ट्रा वायलेट किरणों से बचाती है। 1995 से हर साल 16 सितंबर को ओजोन परत के संरक्षण के लिए विश्व ओजोन दिवस या ओजोन परत संरक्षण का आयोजन किया जाता है।

ओजोन परत का हानि सबसे अधिक दक्षिणी गोलार्द्ध में अंटार्कटिक क्षेत्र में हुआ है। ओजोन क्षरण पदार्थ प्रमुखता से एयर कंडीशनर, रेफ्रिजरेटर व प्लास्टिक आदि के इस्तेमाल में उत्सर्जित होते है। क्लोरोफ्लोरोकार्बन (CFC) आजोन परत में होने वाले विघटन के लिए उत्तरदायी हैं। इसके अलावा हैलोजोन, मिथाइल क्लोरोफार्म, कार्बन टेट्राक्लोराइड आदि रसायन पदार्थ भी ओजोन को नष्ट करने में सक्षम है। इन रासायनिक पदार्थों को ही ओजोन क्षरण पदार्थ कहते हैं।

1. मोट्रियल प्रोटोकॉल – 1987

इस सम्मेलन का आयोजन कनाड़ा देश के मॉन्ट्रियल शहर में 16 सितंबर 1987 ई. में किया गया था। मोट्रियल प्रोटोकॉल का भी मुद्दा या विषय वियना सम्मेलन से ही ओजोन परत का संरक्षण रखा गया था। यह संधि विभिन्न सदस्य देशों के बीच में 1 जनवरी 1989 को हेल्नासिंकी में प्रभावी हुई। तब से आज तक इस संधि में कई बार संशोधन हो चुके है। यह संशोधन क्रमशः लंदन 1990, नैरोबी 1999, कोपनहेगन 1992, वियना 1995, मॉन्ट्रियल 1997, ऑस्ट्रेलिया 1998, बीजिंग 1999, और मॉन्ट्रियल 2007।

इस सम्मेलन के माध्यम से सभी राष्ट्र एक मत होकर ऐसी गैसों में कटौती के लिए तैयार हुए जो ओजोन परत में होने वाले विघटन के लिए उत्तरदायी है। इस समझौते के फलस्वरूप ही अण्टार्कटिका में हुआ। ओजोन छिद्र धीरे–धीरे ठीक हो रहा हैं। जलवायु अनुमानों से संकेत मिलता हैं कि ओजोन परत का स्वरूप 2050–2070 के बीच 1980 के ओजोन स्तर पर पुनः आ जाएगा। अब तक दो ओजोन संधियाँ हो चुकी हैं। जिनकी सहमति 197 देशों के साथ की गई है। यह संधि संयुक्त राष्ट्र के इतिहास में सबसे सफल संधि के रूप में जानी जाती है।

2. टोरंटो सम्मेलन – 1988

इस सम्मेलन का आयोजन कनाड़ा के टोरंटो शहर में 1988 ई. में किया गया था। इस सम्मेलन का मुख्य विषय ग्रीन हाउस गैसों के अंतर्गत आनेवाली गैस कार्बन डाई ऑक्साइड (CO_2) रखा गया था। इस सम्मेलन में सभी राष्ट्र एक रूप से भागीदार नहीं हुए इसलिए यह सम्मेलन असफल हो गया।

3. पृथ्वी सम्मेलन (रियो सम्मेलन) – 1992

इस सम्मेलन का आयोजन ब्राजील की तात्कालिक राजधानी रियो–डी–जेनेरो में 3–14 जून 1992 ई. आयोजित किया गया था। इस सम्मेलन को रियो सम्मेलन के नाम से भी जाना जाता है। संयुक्त राष्ट्र की पर्यावरण एवं विकास अधिवेशन की महत्वपूर्ण संधि की पहल को जलवायु परिवर्तन पर संयुक्त राष्ट्र के अधिवेश्न के नाम से भी जाना जाता है। इसमें 178 देशों के प्रतिनिधियों, हजारों स्वयंसेवी संगठनों और अनेक बहुराष्ट्रीय निगमों ने भाग लिया। इस सम्मेलन में ही विश्व राजनीति मे पर्यावरण को एक ठोस स्वरूप मिला।

इस सम्मेलन मे पर्यावरण की दीर्घोउपयोगी विकास की अवधारणा को विकसित करने पर बल दिया गया था। इस समझौते पर 150 से अधिक देशों ने हस्ताक्षर किए थे। भारत ने 1994 में इस समझौते पर हस्ताक्षर किए। इस सम्मेलन के बिन्दु निम्न हैं।

1. मानव जाति दीर्घोपयोगी विकास के केन्द्र है तथा प्रकृति के साथ मानव स्वस्थ एवं उत्पादकता वाला जीवन जीने का हकदार है।
2. सभी प्रांत गरीबी दूर करने में एक दूसरे का सहयोग करें।
3. सभी प्रांत पर्यावरण संरक्षण संबंधी निर्देशों को जनमानस में पहुँचाए।
4. समस्त मानवों का अधिकार है कि वे स्वयं के विकास हेतु सामान्य संतोषप्रद पर्यावरण में निवास करें।
5. प्रांत पर्यावरण संरक्षण संबंधी कानूनों का सख्ती से पालना कराए।
6. सभी मनुष्य संसाधनों को न्यायोचित प्रयोग करे। भावी पीढ़ी की आवश्यकताओं को ध्यान में रखने हुए अपनी आवश्यकताओं की पूर्ति करें।
7. जन यातायात के साधनों के प्रयोग में सावधानी करके प्रदूषण के स्तर को कम किया जाए।
8. जीवाश्म ईधन के प्रयोग को कम कर ऊर्जा के वैकल्पिक स्त्रोतों का उपयोग करें। इससे प्रदूषण कम होने के साथ–साथ ऊर्जा संरक्षण भी होगा।
9. पर्यावरणीय प्रदूषण के स्त्रोतों का पता लगाकर उनके नियंत्रण द्वारा प्रदूषण को कम या सीमित करें।
10. मनुष्य का अधिकार है कि वह अच्छी गुणवत्ता वाले पर्यावरण में वास करे जहाँ उसका जीवन स्तर उच्च किस्म का हो।

इस सम्मेलन का मुख्य विषय 21वीं सदी के लिए पर्यावरण के महत्वपूर्ण नियमों का एक दस्तावेजों तैयार करना था

जिसे एजेंडा–21 के नाम से जाना जाता है।

एजेंडो–21 (Agenda - 21)

एजेंडा–21 संयुक्त राष्ट्र, सरकारों, और प्रमुख समूहों द्वारा प्रत्येक क्षेत्र में वैश्विक, राष्ट्रीय और स्थानीय स्तर पर 21 वीं शताब्दी के लिए एक व्यापक योजना है, जो पर्यावरण पर मानव के प्रभाव पर आधारित है। इसके माध्यम से सभी राष्ट्रों से निवेदन किया गया कि वह प्राकृतिक संतुलन को बनाए रखें, पर्यावरण के प्रदूषण को रोके तथा सतत् विकास का रास्ता अपनाएं। एजेंडा 21 के प्रमुख बिंदु निम्न थे–

- ऊर्जा का अधिक कुशल तरीके से प्रयोग किया जाए।
- किसान को पर्यावरण संबंधी जानकारी दी जाए।
- प्रदूषण फैलाने वालों पर भारी अर्थदंड लगाया जाए।
- पर्यावरण एवं विकास के मध्य संबंध के मुद्दो को समझा जाए।

सतत् विकास आयोग (CSD) को स्थानीय, राष्ट्रीय, क्षेत्रीय और अंतराष्ट्रीय स्तर पर समझौतों के कार्यान्वयन पर निगरानी और रिपोर्ट करने के लिए UNCED (United Nation Conference on Environment and Development) के प्रभावी अनुवर्ती सुनिश्चित करने के लिए दिसंबर 1992 में बनाया गया था। इस बात पर सहमति बनी कि 1997 में संयुक्त राष्ट्र महासभा की विशेष बैठक में पृथ्वी शिखर सम्मेलन की प्रगति की पांच साल की समीक्षा की जाएगी।

पेरिस जलवायु समझौता

यह जलवायु परिवर्तन पर संयुक्त राष्ट्र फ्रेमवर्क कन्वेशन (UNFCCC) के तहत एक समझौता है। इस समझौते पर 22 अप्रैल 2016 में हस्ताक्षर किए गए थे और यह जलवायु परिवर्तन शमन, अनुकूलन और वित से संबंधित है। इस समझौते पर 196 देशों के प्रतिनिधियों न चर्चा की थी।

फ्रांस में 21 वीं Conference of the Parties सम्मेलन में इस पर हस्ताक्षर किए गए थे। वर्तमान में, समझौते के तहत यूएनएफसीसीसी के 190 सदस्य दल है। तुर्की, ईरान और इराक जैसे देश इसके पक्षकार नहीं है।

4. न्यूयार्क सम्मेलन – 1997

इस सम्मेलन का आयोजन अमेरिका के वाशिंगटन राज्य के न्यूयार्क शहर में 1997 में किया गया था। इस सम्मेलन का मुख्य विषय एजेंडा–21 को प्रभावी बनाना रखा गया था।

5. नैरोबी घोषणा पत्र– 1997

इस सम्मेलन का आयोजन केन्या देश के नैरोबी शहर में 1997 में किया गया था। नैरोबी घोषणा पत्र अभी तक हुए सभी अंतर्राष्ट्रीय संधियों को प्रभावी बनाने के लिए किया गया था

4. क्योटो प्रोटोकॉल – 1997 (Kyoto Protocol – 1997)

क्योटा प्रोटोकॉल एक ऐसी अर्न्तराष्ट्रीय संधि है। जो कि जलवायु परिवर्तन एवं संयुक्त राष्ट्र संघ के मापदण्डों के अनुरूप विभिन्न देशों को ग्रीन हाउस गैस उत्सर्जन में कमी लाने के लक्ष्यों को बाध्य करती है। इस सम्मेलन का आयोजन जापान के क्योटो शहर में 11 दिसंबर 1997 ई. में किया गया था। एवं प्रभावी रूप से 16 फरवरी 2005 को लागू किया गया। इसके अन्तर्गत 37 देशों के साथ ही यूरोपीय संघ ने तय किया। कि वे ग्रीन हाउस गैसों के उत्सर्जन में 18 प्रतिशत तक कमी लायगें। और सन् 2020 तक इस गैंस के उत्सर्जन कों सन् 1990 के गैस उत्सर्जन स्तर तक लाने में सक्षम होगें। इस संधि को कुछ नयें आयामों के साथ दोहा समझौता किया गया। साथ ही कुछ गैसों के नामो में संसोधन किया गया। यह समझौता 8 दिसंबर 2012 को हुआ क्योटो प्राटोकॉल का मुख्य विषय ग्रीन हॉउस गैसो के अंतर्गत कार्बन डाई ऑक्साइड (CO_2) रखा गया था। इस सम्मेलन में सभी राष्ट्र एकमत होकर कार्बन डाई ऑक्साइड में कटौती के लिए सहमत हुए।

6. सिएटल सम्मेलन – 1999

इस सम्मेलन का आयोजन अमेरिका के वाशिंगटन राज्य के सिएटल शहर में 1999 में किया गया था। इस सम्मेलन का मुख्य विषय विश्व व्यापार की पर्यावरण के दायरे में लाना रखा गया था।

7. जोहान्सबर्ग सम्मेलन (रियो. 10) – 2002

इस सम्मेलन का आयोजन दक्षिण अफ्रीका के जोहान्सबर्ग शहर में वर्ष 2002 में किया था। इस सम्मेलन का मुख्य विषय सतत विकास **(Sustainable Development)** था।

सतत् विकास (Sustainable Development) – प्राकृतिक संसाधनों का ऐसा अनूकूलन प्रयोग जिससे उसकी उपयोगिता आनेवाली पीढ़ी के लिए बनी रहे, सतत् विकास कहलाता है।

जोहान्सबर्ग सम्मेलन के द्वारा वैश्विक गरीबी उन्मूलन के लिए ''विश्व एकजुटता कोष'' की स्थापना को मंजूरी प्रदान की गई।

8. रियो.20 –2012

इस सम्मेलन का आयोजन ब्राजील के रिओ–डी–जेनेरिओ शहर में 2012 ई. आयोजित किया गया था। इस सम्मेलन का मुख्य विषय सतत् विकास पर बल देना रखा गया था। इसमे ''फ्यूचर वी वांट (Future We Want) की संकल्पना दी गई थी।

कोप सम्मेलन

यह पृथ्वी सम्मेलन को सुचारू रूप से कार्यान्वित करने के लिए प्रतिवर्ष होने वाला UNFCCC के अंतर्गत सभी देशों का कांफ्रेस सम्मेलन है। प्रथम सम्मेलन 1 अप्रैल 1995 को बर्लिन, जर्मनी में हुआ था।

1. कोप 3, क्योटो, जापान 1997
2. रियो 10, रियो डि जेनेरियो, ब्राजील 2002
3. कोप 13, बाली, इण्डोनेशिया 2007
4. कोप 15, कोपनहेगन 2009

5. कोप 17, डरबन, दक्षिण अफ्रीका 2011

6. कोप 18, दोहा सम्मेलन 2012

7. कोप 19, वारसा सम्मेलन 2013

8. कोप, 20 लिमा 2014

9. कोप, 21 पेरिस, फ्रांस 2015

10. कोप, 22 बाबा इधली सम्मेलन मोरक्को 2016

11. कोप 23, बॉन सम्मेलन जर्मनी 2017

12. कोप 25, चिली (अध्यक्षता), मैड्रिड स्पेन 2019

13. कोप 26, ग्लासगो (अध्यक्षता) United Kingdom- 2021 में मेजबानी करेगा।

(ग्लासगो में नवंबर में आयोजित होने वाली संयुक्त राष्ट्र के कोप 26 जलवायु परिवर्तन सम्मेलन की कोविड–19 के कारण अगले साल के लिए स्थगित कर दिया गया है। यह निर्णय जलवायु परिवर्तन पर संयुक्त राष्ट्र फ्रेमवर्क कन्वेंशन (UNFCCC) के कोप ब्यूरो न यूके और इतालवी भागीदारी के साथ मिलकर किया है।)

सम्मेलन	सन्	विवरण
1. स्टाकहोम सम्मेलन	1972	• संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP) की स्थापना हुई • 5 जून को विश्व पर्यावरण मनाने का निर्णय लिया गया। • इस सम्मेलन को पर्यावरण का मैग्नाकार्टा कहा जाता है।
2. हेलसिंकी सम्मेलन	1974	• सामुद्रिक पर्यावरण की सुरक्षा करना इस सम्मेलन का उद्देश्य था।
3. लंदन सम्मेलन	1975	• समुद्र में कचरे के निस्तारण का प्रतिषेध।
4. वियना सम्मेलन	1985	• भोजन स्तर (परत) का संरक्षण व प्रोटोकोल 1 जनवरी 1989 से प्रभावी है।
5. मॉण्ट्रियल सम्मेलन	1987	• भोजन परत के संरक्षण के लिए पहला अंतर्राष्ट्रीय समझौता (मांट्रियल प्रोटोकाल) 16 सितम्बर 1987 को लागु हुआ था। • इसी सम्मेलन में 16 सितम्बर को भोजन दिवस मनाने का निर्णय लिया गया।
6. रियो सम्मेलन (पृथ्वी सम्मेलन)	1992	• पर्यावरण विकास के लिए अंतर्राष्ट्रीय सहयोग हेतु एजेण्डा – 21 स्वीकृत किया गया। • जलवायु परिवर्तन पर संयुक्त राष्ट्र फ्रेमवर्क कन्वेंशन (UMFCCC) की स्थापना की गई।
7. नैरोबी घोषणा पत्र	1997	• जलवायु परिवर्तन संबंधी अंतर्राष्ट्रीय संधियों का प्रभावी क्रियान्वयन।

8. क्योटो सम्मेलन/ क्योटो प्रोटोकॉल (पृथ्वी + 5 सम्मेलन)	1997	• ग्रीन हाऊन गैसों की पहचान तथा भूमण्डलीय ताप को कम करना। • वर्ष 2008 तक वर्ष 1990 के स्तर को 5.2 प्रतिशत उत्सर्जन कटौती का लक्ष्य रखा गया।
9. जोहान्सबर्ग रियो +10 सम्मेलन (पृथ्वी + 10) सम्मेलन	2002	• सतत् विकास पर विशेष बल दिया गया। • विश्व एकजुटता कोष की स्थापना पर सहमति ।
10. दुसरा मॉट्रियल सम्मेलन (UNFFCC)	2005	• विकसित देशों द्वारा वर्ष 2012 तक ग्रीन हाऊस के उत्सर्जन को कम कर वर्ष 1990 के स्तर तक लाना।
11. नुसा हुआ सम्मेलन (बाली रोड मैप)	2007	• ग्रीन हाऊस गैसों के उत्सर्जन के दर को वर्ष 2050 तक वर्ष 2500 तक के स्तर पर लाने का प्रयास।
12. कोपेन हेजन सम्मेलन (क्योटो प्रोटोकॉल के बाद)	2009	• विकसित और औद्योगिक राष्ट्रों द्वारा वर्ष 2020 तक ग्रीन हाऊस के गैसों के उत्सर्जन में भारी कटौती का प्रावधान। • कम कार्बन अर्थव्यवस्था (स्वू Carbon Economy) की परिकल्पना की गई।
13. कानकून सम्मेलन	2010	• हरित जलवायु कोष (Green Climate Fund) स्थापित करने का निर्णय लिया गया।
14. डरबन सम्मेलन (COP-17)	2011	• डरबन प्लेटफार्म के अंतर्गत ग्रीन क्लाइमेंट फंड की संकल्पना की गई।
15. दोहा सम्मेलन (COP-18)	2012	• कार्बन डेवलपमेंट मेकेनिज्म (CDM) के अंतर्गत प्रदूषण कम करने का प्रयास किया गया।
16. रियो +20 सम्मेलन (पृथ्वी सम्मेलन–20)	2012	• पृथ्वी सम्मेलन के दो दशक पूरे होने के उपलक्ष में संयुक्त राष्ट्र का सतत् विकास सम्मेलन जिसमें द फ्यूचर वी वांट मसौदा प्रयुक्त किया गया। • हरित व्यवसाय पर बल दिया गया।
17. वारसा सम्मेलन (COP - 19)	2013	• ग्रीन क्लाइमेट फंड बनाने पर सहमति बनी।
18. लीमा सम्मेलन (COP - 20)	2014	• वर्ष 2070 तक ग्रीन हाऊस गैसों के उत्सर्जन को समाप्त करने के लिए विश्व के देशों का प्रतिबद्धता की स्वीकृति बनी।
19. पेरिस सम्मेलन (COP - 21)	2015	• कार्बन उत्सर्जन लक्ष्यों हेतु कानूनी रूप में बाध्यकारी संधि।
20. बाबा इधली सम्मेलन मोरक्को (COP 22)	2016	• हमारी जलवायु और सतत् विकास के लिए मराकेश कार्यवाही की उद्घोषणा की गई।
21. बॉन सम्मेलन जर्मनी (COP - 23)	2017	• फीजी मोमेंटम फार इम्प्लीमेंटेशन प्रस्तुत किया गया।

22. चिली, मैड्रिड स्पेन (COP - 25)	2019	• अंतराष्ट्रीय समुदाय का ध्यान जलवायु आपदा की ओर आकर्षित करना और जलवायु परिवर्तन को रोकने के लिए तेज प्रयासों को बढ़ावा देना था।
23. ग्लासगो, यूके (COP - 26)	2021	• ग्लासगो में नवंबर में आयोजित होने वाली संयुक्त राष्ट्र के कोप 26 जलवायु परिवर्तन सम्मेलन की कोविड–19 के कारण अगले साल के लिए स्थगित कर दिया गया है।
24. शर्म अल शेख (मिस्र) (COP - 27)	2022	• 7 से 18 नवंबर 2022 (शर्म अल शेख, दक्षिण सिनाई, मिस्र) को 27वां कोप सम्मेलन मिस्र के शर्म अल शेख में होगा।

पर्यावरण संरक्षण अधिनियम – 1986

पर्यावरण संरक्षण अधिनियम भारत सरकार द्वारा 1986 ई. में पारित किया गया। इस अधिनियम को पारित करने का तात्कालिक कारण 2–3 दिसंबर 1984 को हुई भोपाल गैस दुर्घटना थी। जिसमें मिथाइल आइसो साइनाइट गैस का रिसाव हुआ था।

पर्यावरण संरक्षण अधिनियम को पारित करने का दूरगामी कारण भारत में स्टॉकहोम के पर्यावरण नियमों को लागू करना था। इस अधिनियम के अंतर्गत यह प्रावधान किया गया है कि भारत में 'उद्योग, कारखाने या किसी भी प्रकार का व्यापार करने के लिए भारत सरकार से अनुमति प्राप्त करनी होगी। इसके अलावा भारत सरकार प्रत्येक वर्ष पर्यावरण संरक्षण के लिए योजनाएं बनाएगी और उसका प्रभाव कार्यान्वयन करेगी।

सन्दर्भ – ग्रंथ

1. इराक भरूचा, पर्यावरण अध्ययन "ओरियंटब्लैक स्वान, प्राइवेट लिमिटेड,दूसरा संस्करण, नई दिल्ली (2005)।
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3. डॉ.रतन जोशी; "पर्यावरण अध्ययन" साहित्य भवन पब्लिकेशन, आगरा (2019)।
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पर्यावरण एवं सतत् विकास की चुनौतियां

डॉ. राजेश बरेठ [1], डॉ. अनुराधा तिर्की [2]

1. सहायक प्राध्यापक (राजनीति विज्ञान), स्व. प्यारे लाल कंवर शासकीय महाविद्यालय भैसमा, जिला– कोरबा (छ0ग0)

2. सहायक प्राध्यापक (अर्थशास्त्र), स्व. प्यारे लाल कंवर शासकीय महाविद्यालय भैसमा, जिला– कोरबा (छ0ग0)

सम्पोषित विकास/सतत् विकास

सतत् विकास की अवधारणा आर्थिक विकास तक ही सीमित नहीं है। विकास की अवधारणा के स्थान पर सतत विकास को प्राथमिकता थी जा रही है। यह प्राकृतिक तंत्रो (उत्पादक) एवं मानव जाति (उपभोक्ता) के मध्य सहजीवी संबंधी ओर अर्थव्यवस्था एवं पारिस्थितिक तंत्रों के साथ सामंजस्य पर आधारित है। दूसरे शब्दों में, सतत विकास एक ऐसी प्रक्रिया है जिसमें वर्तमान पीढ़ी की आवश्यकताओं के साथ–साथ भावी सन्तति की आकांक्षा और आवश्यकताओं की पूर्ति में काई कठिनाई न हो। इस उद्देश्य से वर्तमान पीढ़ी को पर्यावरणीय प्रक्रियाओं का ज्ञान आवश्यक है। इस संदर्भ में लोगों को पर्यावरणीय शिक्षा आवश्यक है।

सतत विकास

संपोषित विकास एक सतत् विकास है जो लम्बे समय तक जारी रह सके। पर्यावरण व विकास पर विश्व आयोग ने अपनी रिपोर्ट 1987 में सुस्थिर विकास का सामान्य सिद्धांत यह बताया था कि "वर्तमान पीढ़ी अपनी आवश्यकताओं की पूर्ति के लिए पर्यावरण की क्षमता पर विपरीत प्रभाव न हो।" अर्थात प्राकृतिक साधनों का दोहन,संरक्षण व विकास वर्तमान व भावी पीढ़ी दोनों के हितों को ध्यान में रखते हुए किया जावे।

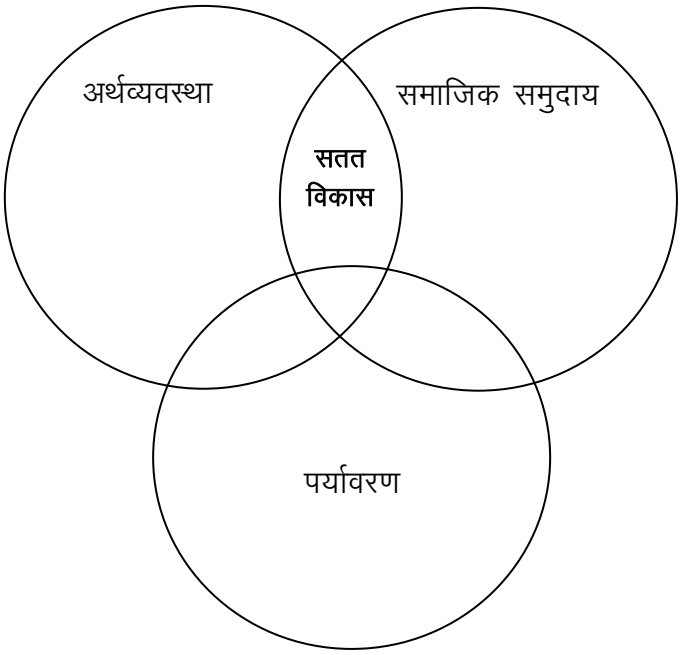
पर्यावरण की रक्षा व मानव का सतत् विकास की सहगामी अवधारणा को सतत् विकास, जीवन सहविकास, धारणीय विकास, सुस्थिर विकास,पोषणीय विकास,संपोषित विकास (Sustainable Development) इत्यादि नामों से जाने जाते है। इस शब्द का सर्वप्रथम प्रयोग 1980 में "विश्व संरक्षण रणनीति" में किया गया। संयुक्त राष्ट्र संघ द्वारा 1983 में पर्यावरण एवं विकास पर गठित ब्रंटलैण्ड आयोग नें संपोषित विकास को परिभाषित किया।

परिभाषा

ऐसे विकास जो वर्तमान पीढ़ी की आवश्यकताओं की पूर्ति इस प्रकार से करता है कि भावी पीढ़ी को अपनी आवश्यकताएँ पूरी करने के लिये किसी प्रकार का समझौता न करना पड़े, इसे सतत विकास या धारणीय विकास (Sustainable development) कहा जाता है। इस सतत विकास को हासिल करने के लिये वर्ष 2015 में संयुक्त राष्ट्र में महत्त्वाकांक्षी 'सतत विकास लक्ष्य' प्रस्तुत किये गए। इनमें 17 Goals एवं 169 targets निर्धारित किये गए हैं जो वर्ष 2016–2030 तक के लिये लक्षित है।

"मानव की भावी पीढ़ियों की आवश्यकताओं को पूरा करने की क्षमता में ह्रास किये बिना वर्तमान पीढ़ी की आवश्यकताओं की पूर्ति करना ही धारणीय विकास है"

अर्थात प्राकृतिक संसाधनों का दोहन वर्तमान व भावी पीढ़ी दोनों के हितो को ध्यान में रखते हुए किया जाना चाहिए। इस संकल्पना में प्राकृतिक पर्यावरण में मानवीय हस्तक्षेप को न्यूनत्तम स्तर तक स्वीकार किया गया है। प्रगति एवं विकास में परिस्थितिक दृष्टिकोण का समावेश करके प्राकृतिक पर्यावरण का उपयोग भी किया जा सकता है तथा पारिस्थितिक संकट को भी टाला जा सकता है। विकास को मात्र आर्थिक उत्पादन से न जोड़कर उसके सामाजिक आर्थिक व पारिस्थितिक पक्षों पर भी ध्यान देना चाहिए। पर्यावरण को न्यूनतम क्षति पहुचाने वाली प्रौद्योगिकी का विकास, जनसंख्या वृद्धि पर उपयोग, संरक्षण व पुनर्चक्रण तथा समान दृष्टिकोण पर ही धारणीय विकास निर्भर है।



चित्र–1: निर्वहनीय व सतत् विकास की अवधारणा

सतत विकास की अवधारणा

सतत विकास की दो प्रमुख अवधारणाएं हैं–

1. **आवश्यकता की अवधारणा** – जो विशाल रूप से विश्व की सर्वाधिक गरीब लोगों की अनिवार्य आवश्यकता से संबंधित हैं और जिसे सर्वोपरि प्राथमिकता प्रदान की जानी चाहिए

2. **विचारों की सीमाओं की अवधारणा** – प्रौद्योगिकी की स्थिति एवं पर्यावरण सामाजिक संगठनों कि योग्यताओं के द्वारा लागू किया जा सकता है जिससे वर्तमान एवं भविष्य दोनों की आवश्यकता को पूरा किया जा सके।

धारणीय विकास लक्ष्य को सर्वप्रथम वर्ष 2012 में रियो +20 सम्मेलन में प्रस्तावित किया गया था। धारणीय विकास (Sustainable Development) विकास की वह अवधारणा है, जिसके राहत वर्तमान की आवश्यकताओं के साथ–साथ भविष्य की आवश्यकताओं को भी ध्यान में रखा जाता है। इसी तत्वावधान में धारणीय विकास लक्ष्य बनाए गए हैं, जिन्हें वर्ष 2030 तक प्राप्त करने का लक्ष्य है।

सतत् विकास की विशेषताएँ

सतत् विकास से तात्पर्य एक ऐसे विकास से है जो वर्तमान पीढ़ी की आवश्यकताओं की पूर्ति, भावी पीढ़ियों की आवश्यकताओं को ध्यान में रखकर पूरा करें। अर्थात वर्तमान में प्राकृतिक संसाधनों का सर्वोत्तम अथवा अनुकूलतम उपयोग करें जिससे इन संसाधनों का संरक्षण हो सके तथा भावी पीढ़ियों को आवश्यकताओं की पूर्ति कर सके।

सतत् विकास की विशेषताएँ निम्नलिखित है :

1. संसाधनों का सर्वोत्तम उपयोग।
2. पर्यावरण संरक्षण।
3. पारिस्थितिक तन्त्र की सुरक्षा एवं संरक्षण।
4. दीर्घावार्ध विकास।
5. जातियों, वर्गों, लिंग तथा आयु, महाद्वीपों, देशों वर्गों के बीच न्याय संगतता।
6. सामाजिक एवं आर्थिक विकास।
7. लोगों के जीवन में सुधार के सिद्धांत पर आधारित है।
8. यह एक ऐसी प्रक्रिया है जिससे जीवन स्तर में सुधार होगा और पर्यावरण पर प्रभाव कम होगा।
9. सतत् विकास इस तथ्य पर जोर देता है कि पर्यावरण आवश्यकताएँ तथा मानवीय आवश्यकताएँ दोनों परस्पर एक दूसरे पर निर्भर है।

सतत् विकास लक्ष्य सूचकांक

- **सतत् विकास लक्ष्य सूचकांक 2017** में स्वीडन (स्कोर : 85.6) प्रथम स्थान पर है, जबकि भारत 116वें स्थान पर हैं।
- **सतत् विकास लक्ष्य सूचकांक 2018** में स्वीडन (स्कोर : 85.0) प्रथम स्थान पर जबकि भारत 112वें (स्कोर : 59.1) स्थान पर है।
- **सतत् विकास लक्ष्य सूचकांक 2019** में डेनमार्क (स्कोर : 85.2) प्रथम स्थान एवं स्वीडेन (स्कोर : 85. 0) द्वितीय स्थान पर जबकि भारत 115 वें (स्कोर : 61.1) स्थान पर है।
- **सतत् विकास लक्ष्य सूचकांक 2020 –** 30 जून 2020 को सतत् विकास समाधान नेटवर्क (SDSN) और बर्टल्समैन स्टिफटंग द्वारा जारी सतत् विकास लक्ष्य सूचकांक 2020 में स्वीडन (स्कोर : 84.7) प्रथम स्थान पर जबकि भारत 117वें (स्कोर : 61.9) स्थान पर है।
- **सतत् विकास लक्ष्य सूचकांक 2021 –** सतत् विकास लक्ष्य सूचकांक 2021 में भारत को 120वें स्थान पर रखा गया है। भारत का स्कोर 60.7 है।

- **सतत् विकास लक्ष्य सूचकांक 2022** – सतत् विकास लक्ष्य सूचकांक 2022 में भारत को 121वें स्थान पर रखा गया है। भारत का स्कोर 60.32 है।

- **सतत् विकास लक्ष्य सूचकांक 2023** – सतत् विकास लक्ष्य सूचकांक 2022 में भारत को 112वें स्थान पर रखा गया है। भारत का स्कोर 63.45 है।

- धारणीय विकास के कई आयामों में धारणीय कृषि भी एक पहलू है।

- वर्ष 2003 को UNO द्वारा सतत् विकास का वर्ष घोषित किया गया था।

सतत विकास ल़क्ष्य सूचकांक, 20223 में विभिन्न देशो का स्थान			
क्रमांक	स्थान	देश	स्कोर
1	1	फिनलैंड	86.76
2	2	स्वीडन	85.98
3	3	डेनमार्क	85.68
4	4	जर्मनी	83.36
5	5	ऑस्ट्रिया	82.28
6	6	फ्रांस	82.05
7	7	नार्वे	82.00
8	8	चेक गणराज्य	81.87
9	9	पोलैंड	81.80
10	10	स्टोनिया	81.68
11	63	चीन	72.01
12	89	श्रीलंका	69.43
13	101	बांग्लादेश	65.91
14	112	भारत	63.45
15	128	पाकिस्तान	58.97

स्त्रोत : UNO : SDG Index, 2023

- वर्ष 2020 के एस.डी.आर रिपोर्ट का विषय वैश्विक महामारी बन चुकी कोविड–19 से संबंध करते हुए – **''सतत विकास लक्ष्य और कोविड–19'' (Sustainable Development Goals and COVID – 19) रखा गया है।**

सतत् विकास के उद्देश्य

1. सहायता में वृद्धि करके उसे विकसित देश के राष्ट्रीय उत्पाद के एक प्रतिशत तक पहुंचाया जाए।
2. ऋण अनुतोष सहायता का वैद्य रूप होना चाहिए।
3. शिक्षा एवं शोध के ऊपर अधिक खर्च किए जाने चाहिए।
4. प्रक्रिया संबंधित बाधाओं को पहचान कर दूर किया जाना चाहिए।
5. तकनीकी सहायता के संस्थागत आधार को मजबूत किया जाना चाहिए।
6. विकासशील देशों की सहायता इस उद्देश्य से ही जानी चाहिए कि वे स्वतः पोषणीय विकास के मार्ग पर पहुंच सकें।
7. नीजी निवेशों की प्रोन्नति तथा निवेशकों के विशेष जोखिम की समाप्ति।
8. स्वतंत्र एवं सामान्यपूर्ण व्यापार का एक ढांचा उत्पन्न किया जाए जिससे विकसित देश तथा विकासशील देश ऐसे प्राथमिक माल पर आयात शुल्क एवं अत्यधिक कर समाप्त करें जिसका उत्पादवे स्वयं नहीं करते है।
9. विकास सहायता की बहुर्राष्ट्रीयकृत वृद्धि किया जाना चाहिए।
10. जनसंख्या की वृद्धि पर नियंत्रण किया जाना चाहिए।

सतत् विकास के सिद्धांत

सतत् विकास की मान्यता है कि उपयुक्त प्रविधि एवं सामाजिक व्यवस्था द्वारा पारिस्थितिकीय तन्त्र से पर्याप्त मात्रा में ऐसे संसाधनों की प्राप्ति हो सकती है जो मानव समाज की वर्तमान एवं भावी आवश्यकताओं को पूरा कर सकते हैं। यह विकास पर्यावरण संरक्षण से हटकर संसाधनों के दोहन पर अंकुश नहीं लगाकर उनकी अभिवृद्धि पर बल देता है। जिसके परिणामस्वरूप मानव एवं पर्यावरण के बीच एक ऐसी परिवर्तनशील व्यवस्था का उद्‌भव होता है,जो संसाधनों के विदोहन ,प्रौद्योगिकी विकास तथा संस्थागत परिवर्तनों के द्वारा मानव समाज की वर्तमान एवं भावी आवश्यकताओं के बीच सामंजस्य स्थापित करने में मदद देता है।

क्रिस पार्क ने "पर्यावरणिक सिद्धांत तथा प्रयोग" 1997 तें सतत् विकास को निम्नलिखित सिद्धान्तों पर आधारित माना है–

1. मानव जवन की गुणवत्ता में सुधार।
2. सामुदायिक जीवन की देखभाल एवं सम्मान।
3. पृथ्वी की निर्वाहन क्षमता को बनाए रखना।

4. पृथ्वी की सहन क्षमता एवं विविधता का संरक्षण करना।

5. अनव्यकरणीय संसाधनों की गुणवत्ता ह्रास को कम करना।

6. समंग्र विकास तथा संरक्षण के लिए एक राष्ट्रीय आधार तैयार करना।

7. सक्षम समुदायों द्वारा अपने पर्यावरण की देखभाल करना।

8. विश्वव्यापी गठबंधन का निर्माण करना।

सतत् विकास के प्रमुख मुद्दे

1. **संसाधनों के उपयोग के प्रतिरूपों की अन्तपींढ़ीय उलझन :** पर्यावरण धरोहर को संरक्षित करने के लिए प्राकृतिक संसाधनों के दोहन के बारे में ऐसी प्रभावी निर्णयन प्रक्रिया अपनायी जाये ताकि भावी पीढ़ियों को उसका लाभ मिल सके।

2. **निष्पक्षता संबंध :** संसाधनों पर किसकी पहुंच अधिक है? प्रतियोगी दावेदारों में उपलब्ध संसाधनों का आवंटन हो रहा है या नहीं? और वह किस सीमा तक हो रहा है? इत्यादि।

3. **समय संस्तर :** लघु अवधि लाभ या दीर्घकालिक पर्यावरण स्थिरता की दिशा में संसाधनों का आवंटन हो रहा है या नही? और वह किस सीमा तक हो रहा है?

इस प्रकार सतत् विकास पर्यावरण ह्रास को न्यूनतम हानि पहुँचाने वाली प्रौद्योगिकी के विकास, जनसंख्या नियंत्रण, संसाधन संरक्षण, भावी आवश्यकताओं के अनुसार वर्तमान संसाधन उपयोग की रणनीति इत्यादि पर निर्भर है। इसमें उपयुक्त प्रौद्योगिकी के विकास द्वारा संसाधनों की अभिवृद्धि कर आवश्यकताओं की पूर्ति पर बल दिया जाता है।

सहस्त्राब्दि विकास लक्ष्य रिपोर्ट 2015

संयुक्त राष्ट्र ने 6 जुलाई 2015 को सहस्त्राब्दि विकास लक्ष्य रिपोर्ट 2015 जारी किया इस रिपोर्ट में आर्थिक और सामाजिक मामलों के संयुक्त राष्ट्र विभाग द्वारा तैयार सहस्त्राब्दि विकास लक्ष्यों की दिशा में वैश्विक और क्षेत्रीय प्रगति की वार्षिक आंकलन हैं। सत्र 2000 से 2015 तक की अवधि के लिए सहस्त्राब्दि विकास लक्ष्य (Millennium Development Golas–MDG) की प्राप्ति की योजना बनाई गयी, संयुक्त राष्ट्र के उस समय के 189 सदस्यी राष्ट्रों एवं 22 अतंर्राष्ट्रीय संस्थाओं ने 2015 तक इन लक्ष्यों की प्राप्ति के लिए संकल्प लिया। इसके प्रमुख लक्ष्य निम्न हैं –

1. भूखमरी तथा गरीबी को खत्म करना।

2. सार्वभौमिक प्राथमिक शिक्षा हासिल करना।

3. लिंग समानता एवं महिला सशक्तिकरण का प्रचार प्रसार करना।

4. शिशु मृत्यु दर को कम करना।

5. मातृत्व स्वास्थ्य को अधिक से अधिक बढ़ावा देना।

6. एड्स/एचआईवी, मलेरिया तथा अन्य घातक बिमारियों से मुक्ति पाना।

7. पर्यावरण सत्त को बनाये रखना।

8. वैश्विक विकास के लिए संबंध को बनाये रखना।

सतत् विकास लक्ष्य - एजेंडा 2030

सतत् विकास की अवधारणा का प्रयोग 1987 में ब्रटलैंड रिर्पोट ''हमारा साझा भविष्य श्के तहत किया गया था। संयुक्त राष्ट्र संघ द्वारा वैश्विक स्तर पर सामाजिक न्याय, मानव गरिमा,शान्ति एवं सुरक्षा स्थापित करने के लिए वर्ष 2000 में 8 सह–स्राब्दी विकास लक्ष्यों के साथ संलग्न लक्ष्यों को 2015 तक प्राप्त करने का लक्ष्य रखा गया था। वर्ष 2015 में आठ सहस्राब्दी विकास लक्ष्यों को विस्तारित कर सत्रह सतत् विकास लक्ष्यों में पारित कर दिया जिसके अंदर 169 संलग्न लक्ष्य सन्निहित है। इन्हें 2030 तक प्राप्त करने का लक्ष्य रखा गया है, जिसका शीर्षक है, **''अपनी दूनिया में बदलाव : सतत् विकास के लिए एजेंडा 2030''।**

सतत् विकास एजेंडा 2030 के लिए वैश्विक एजेंडा का मूल मंत्र सार्वभौमिकता का सिद्धांत है– **''कोई पीछे न छूटे।''** भारत सरकार, सतत् विकास लक्ष्य सहित 2030 के एजेंडा के प्रति दृढ़ता से समर्पित हैं। भारत के राष्ट्रीय विकास लक्ष्य और समावेशी विकास के लिए **''सबका साथ सबका विकास''** नीतिगत पहल सतत् विकास के लक्ष्य के अनुरूप हैं। और भारत दुनिया भर में सतत् विकास लक्ष्यों को हासिल करने में सफलता निर्धारित करने में अग्रणी भूमिका निभाएगा। भारत के प्रधानमंत्री नरेंन्द्र मोदी ने सतत् विकास ऐजेंडा 2030 के संबंध में अपना उद्बोधन करते हुए कहा है–

''एजेंडा 2030 के पीछे की हमारी सोच जितनी ऊँची है हमारे लक्ष्य भी उतने ही समग्र हैं। इनमें उन समस्याओं को प्राथमिकता दी गई है, जो पिछले कई दशकों से अनसुलझी हैं और इन लक्ष्यों से हमारे जीवन को निर्धारित करने वाले सामाजिक, आर्थिक और पर्यावरणीय पहलुओं के बारें में हमारे विकसित होती समझ की झलक मिलती है। मानवता के 1/6 हिस्से के सतत् विकास का विश्व और हमारे सुंदर पृथ्वी के लिए बहुत गहरा असर होगा।'' –

नरेंन्द्र मोदी, भारत के प्रधानमंत्री

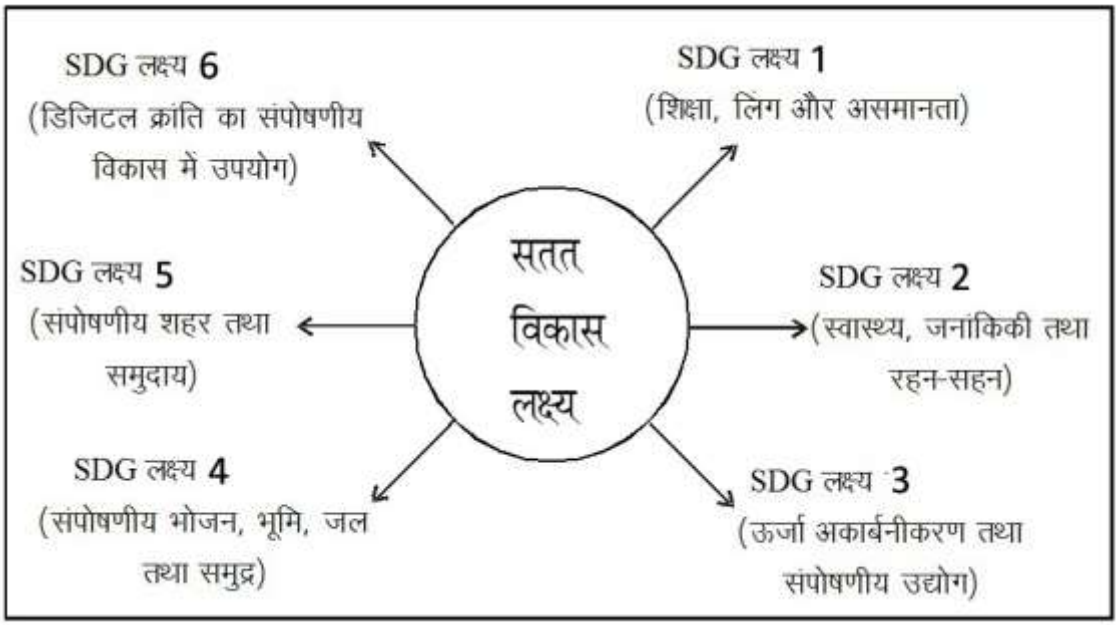
''2015 में अनुमोदित 2030 एजेंडा और उसके 17 सतत् विकास लक्ष्य इन चुनौतियों और इनके अंतरसंबंधों के समाधान के लिए संपूर्ण और सामंजस्यपूर्ण फ्रेमवर्क प्रदान करते हैं। इनके अंतर्गत सदस्य राष्ट्रों को सतत विकास के सामाजिक, आर्थिक और पर्यावरणीय पहलुओं का समाधान संतुलित ढंग से करना होगा। इन पर अमल करते हुए समावेशन और एकीकरण तथा किसी को पीछे छूटने न देने के सिद्धांतों का पालन अनिवार्य है।''–

एंटोनियो गुटेरेस, संयुक्त राष्ट्र महासचिव

संयुक्त राष्ट्र संघ द्वारा घोषित 17 सतत् विकास लक्ष्य निम्नलिखित हैं –

1. गरीबी के सभी रूपों का विश्व से संपूर्ण समाप्ति।
2. भुखमरी की समाप्ति, खाद्य सुरक्षा, बेहतर पोषण एवं टिकाऊ कृषि को बढ़ावा देना।
3. सभी वर्ग एवं आयु के लोगों की स्वास्थ्य सुनिश्चितता।
4. समावेशी एवं गुणवत्ता परक शिक्षा की सुनिश्चिता।
5. लैंगिक समानता एवं महिला सशक्ति करण।
6. स्वच्छ जल एवं स्वच्छता का सतत प्रबंधन।
7. समावेशी एवं सतत आर्थिक विकास, पूर्ण एवं उत्पादक रोजगार की व्यवस्था।
8. स्वच्छ, विश्वसनीय एवं टिकाऊ ऊर्जा सुनिश्चित करना।
9. बुनियादी ढ़ाँचा, नवाचार एवं सतत औद्योगिकीकरण को बढ़ावा देना।
10. देशों के मध्य एवं देश के भीतर असमानता कम करना।
11. संपोषणीय शहर एवं समुदाये की स्थापना।
12. संपोषणीय उपभोग एवं उत्पादन के तरीके सुनिश्चित करना।
13. जलवायु परिवर्तन के प्रभावों से मुकाबला हेतु त्वरित कार्यवाही।
14. समुद्रीय एवं महासागरीय जीवन, संसाधन का संरक्षण।
15. भूतल पर वन संरक्षण, प्रकिूल भू–अपक्षय को रोकना एवं जैवविविधता में वृद्धि।
16. शांति, न्याय हेतु सुदृढ़ संस्थानों का निर्माण।
17. सतत् लक्ष्य प्राप्ति हेतु सहयोग एवं सहभागिता बढ़ाना।

सतत् विकास लक्ष्य या एजेंडा 2030 मुख्यतः 5P (People, Planet, Peace, Prosperity and Partnership) पर जोर दिया गया है। भारत सरकार ने भी सतत् विकास लक्ष्यों की प्राप्ति हेतु भरतीय अर्थव्यवस्था को मजबूत एवं सतत् विकास लक्ष्यों की प्राप्ति हेतु भारतीय अर्थव्यवस्था को मजबूत एवं सतत् समावेशी बनाने का सार्थक प्रयास किया है। आज भारतीय अर्थव्यवस्था विश्व की छठी सर्वोच्च अर्थव्यवस्था है। आज भारत में रिकार्ड खाद्या उत्पादन (2016–17 में भारतीय आर्थिक वृद्धि दर 6.7 प्रतिशत था। वित्तीय वर्ष 2018–2019 में अन्तराष्ट्रीय मृदा कोष (आई0एम0एफ) ने भारत के विकास दी (7.3 प्रतिशत) अनुमानित रहने का घोषणा की है, जो विश्व में सर्वाधिक एवं गतिशील है। अमेरिकी क्रेडिट एजेन्सी मूडीज ने 13 वर्षो बाद 2017 में भारतीय अर्थव्यवस्था की रेटिंग को ठं3 से सुधार करके ठं2 श्रेणी में परिवर्तित कर दिया हैं।



चित्र–2 : सतत् विकास लक्ष्य

चित्र–3 : सतत् विकास लक्ष्य : एजेंडा 2030

सतत विकास संबंधी संकेतो की कार्य सूची

सतत विकास को मापने हेतु चुने वाले संकेतकों की प्रकृति के साथ–साथ उनकी संख्या विषयक किसी सर्वसम्मति पर पहुँचना मुश्किल था। संयुक्त राष्ट्रसंघ के तत्वावधान में एशिया व प्रशांत आर्थिक एवं सामाजिक आयोग ने सतत विकास के संकेतकों की एक कार्यसूची तैयार की। यह काम सतत विकास आयोग (सी.एस. डी) के सतत विकास संकेतो पर कार्यक्रम के तहत किया गया।

समाजिक		
विषय	**उप–विषय**	**स्केतक**
समदृष्टि	छरिद्रता	गरीबी–रेखा से नीचे रहने वाली जनसंख्या का प्रतिशत
		आय असमानता की गिनी इण्डैक्स
		बेरोजगारी दर
	लैंगिक समानता	औसत नारी वेतन के प्रति पुरूष वेतन का अनुपात
स्वास्थ्य	पोषण–संबंधी स्थिति	बच्चों की पोषण–संबंधी स्थिती
	नैतिक्ता	5 वर्ष की उम्र से कम की मृत्यु दर
		जन्म के समय जीवन–प्रत्याशा
	स्वच्छता	उचित मलव्ययन सुविधाओं वाली जनसंख्या का प्रतिशत
	पेयजल	सुरक्षित पेयजल प्राप्त जनसंख्या
	स्वास्थ्य–रक्षा प्रसव	प्राथमिक स्वास्थ्य रक्षा सुविधाएँ प्राप्त जनसंख्या का प्रतिशत
		रोगों के खिलाफ प्रतिरक्षा
		गर्भ निरोधक प्रचलन दर
शिक्षा	शिक्षा–स्तर	प्राथमिक स्वास्थ्य रक्षा सुविधाएँ प्राप्त जनसंख्या का प्रतिशत
		वयस्क अनुपूरक शिक्षा प्राप्ति स्तर
	साक्षरता	वयस्क साक्षरता दर
आवास	निर्वाह–योग्य दशाएँ	प्रति व्यक्ति फर्श क्षेत्रफल
सुरक्षा	अपराध	प्रति 100,000 जनसंख्या दर्ज अपराधों की संख्या
जनसंख्या	ज्नसंख्या परिवर्तन	जनसंख्या वृद्धि दर
		शहरी औपचारिक एवं अनौपचारिक रिहाइशों की जनसंख्या

पर्यावरण–संबंधी		
विषय	**उप–वस्तु**	**संकेतक**
वातावरण	जलवायु परिवर्तन	ग्रीन–हाउस गैसो का उत्सर्जनं
	ओजोन परत क्षय	ओजोन क्षयकारी पदार्थों की खपत
	वायु गुणवत्ता	शहरी क्षेत्रों में वायु–प्रदूषण का परिवेशी संकेन्द्रण
भूमि	कृषि	जोत्य व स्थायी फसल भूमि क्षेत्र
		उर्वरकों का प्रयोग
		कृषिय कीटनाशकों का प्रयोग
	वन	भूमि क्षेत्र के प्रतिशत रूप में वन क्षेत्र
		काष्ठ उपज प्रचण्डता
	मरूस्थलीकरण	मरूस्थलीकरण द्वारा प्रभावित भूमि
	शहरीकरण	शहरी औपचारिक एवं अनौपचारिक रिहाइशी क्षेत्र
	तटीय क्षेत्र	तटीय समुद्र में शैवाल संकेन्द्रण

महासागर,समुद्र एवं तट		तटीय क्षेत्रों में रहने वाली कुल जनसंख्या का प्रतिशत
	मत्स्य क्षेत्र	प्रमुख प्रजातियों के अनुसार वार्षिक पकड़
ताजा जल	जल मात्रा	कुल उपलब्ध जल प्रतिशत के रूप में भूमिगत व सतही जल का वार्षिक दोहन
	जल गुणवत्ता	जल निकायों में बी. ओ. डी. ताजे जल में फीकल कोलाइफॉर्म का संकेन्द्रण
जैव–भिन्नता	पारितंत्र	चुनींदा मुख्य पारितंत्रों का क्षेत्र
		कुल क्षेत्र प्रतिशत के रूप में संरक्षित क्षेत्र
	प्रजातियाँ	चुनींदा मुख्य प्रजातियों की प्रचुरता

आर्थिक		
विषय	**उप–विषय**	**संकेतक**
आर्थिक सुधार	आर्थिक निष्पादन	प्रति व्यक्ति जी. डी. पी.
		जी. डी. पी. में निवेश का हिस्सा
	व्यापार	माल व सेवाओं में व्यापार संतुलन
	वित्तीय स्थिति	जी.एन.पी. अनुपात के प्रति देनदारी
		जी. एन. पी. प्रतिशत रूप में प्रदत्त या प्राप्त कुल ओ. डी. ए.
उपभोग एवं उत्पादन प्रतिपादन	भौतिक खपत	भौतिक प्रयोग की प्रचण्डता
	ऊर्जा–प्रयोग	प्रति व्यक्ति वार्षिक ऊर्जा खपत
		पुनर्नव्य ऊर्जा संसाधनों के उपभोग का भाग
		ऊर्जा प्रयोग की प्रचण्डता
	कचरा उत्पादन एवं प्रबंधन	हानिकारक कचरे का उत्पादन
		रेडियोधर्मी कचरे का प्रबंधन
		कचरा पुनर्नवीकरण एवं पुंनर्प्रयोग
	परिवहन	परिवहन के साधन द्वारा प्रतिव्यक्ति तय की गई दूरी

संस्थागत		
विषय	**उप–विषय**	**संकेतक**
संस्थागत ढाँचा	एस.डी की रणनीतिक अभिपूर्ति	राष्ट्रीय सतत विध्य रणनीति
	अंतर्राष्ट्रीय सहयोग	पुष्टीकृत भूमण्डलीय समझौते का परिचालन
संस्थागत क्षमता	सूचक उपगम्य	प्रति 1000 निवासी इंटरनेट ग्राहकों की संख्या
	संचार ढाँचा	प्रति 1000 निवासी मुख्य दूरभाषा लाइने

	विज्ञान एवं प्रौद्योगिकी	जी.डी.पी. प्रतिशत के रूप में अनुसंधान एवं विकास पर व्यय
	आपदा तत्परता व प्रत्युत्तर	प्राकृतिक आपदाओं के कारण आर्थिक एवं मानवीय क्षति

स्रोत – संयुक्त राष्ट्र सांख्यिकी प्रभाग (UNSD) 2020

ऊपर दी गई संकेतक–सूची से यह स्पष्ट है कि सतत विकास केवल एक सम्पूर्ण बहु–फलक उपगम्य के माध्यम से ही संभव है। अनेक विद्वानों द्वारा सुझावित किसी भी उपगम्य में उस बात की कमी है जो जीवन की गुणवत्ता और पर्यावरण संपन्नता कायम रखने के लिए कम से कम जरूरी है।

सतत् विकास के उपाय

सतत् विकास के कुछ महत्वपूर्ण उपाय निम्नलिखित हैं –

1 सही तकनीकी का प्रयोग :

इसके अंतर्गत ऐसी तकनीकी के प्रयोग पर बल दिया जाता है जिनसे उत्पादन अधिक और अवशिष्ट कम पैदा हों। क्षेत्र–विशेष की स्थिति को ध्यान में रखते हुए ऐसी तकनीकी ही श्रेष्ठ है जो न्यूनतम ऊर्जा का उपयोग करके अधिकतम उत्पाद दें। इस अवधारणा को "प्रकृति के अनुरुप" भी की गया है।

2 पुनर्चक्रण

किसी भी संसाधन का बुध्दिमता से जरुरत के अनुसार उपयोग,उत्पादो का पुनप्रयोग एवं इन्हे कचरे मे फेकने की बजाय इसका पुर्नउत्पादन ही इस व्यवस्था का सिध्दांत है। इन मूल्यो को जीवन में अपनाकर संसाधनो पर बढ़ते दबाव को तो कम किया ही जा सकता है ।

3 पर्यावरण शिक्षा व जनजागरुकता :

पर्यावरण शिक्षा का शिक्षा–प्रणाली में अपनाया जाना लोगो मे जागरूकता लाने मे और निश्चित तौर पर पृथ्वी और पर्यावरण के लिए सौतेली विचारधारा में भी परिवर्तन लाने मे विशेष रूप से प्रभावकारी होगा। स्कूली छात्रो का पर्यावरण –ज्ञान निश्चित ही पृथ्वी के प्रति निकटता और प्रेम को बढ़ावा देगा सतत विकास के लिय इसके दूरगामी परिणाम होंगे।

4 संसाधनो का वहन क्षमता के अनुरूप प्रयोग :

किसी भी तंत्र की एक निश्चित सीमा तक जीवो को बनाए रखने की क्षमता कहलाती है। मनुष्य के विषय मे वाहन क्षमता एक जटिल प्रक्रिया है क्योकि मनुष्य भोजन के अलावा अन्य साधनों के अलावा अन्य साधनो के लिए भी प्रकृति पर निर्भर करता है।

किसी भी तंत्र की सततता इसकी "वहन क्षमता" पर आधारित है। अगर सामर्थ्य क्षमता की सीमा टूट जाए तो निश्चित ही प्राकृतिक संतुलन डगमगा जाएगा और इसे पुनः स्थापित करना आसान न होगा।

वहन क्षमता को हम दो आधरभूत घटकों में विभाजित करते हैं–

1. पोषण क्षमता (Supporting capacity) अर्थात पुनर्उत्पाद की क्षमता।

2. आत्मसात करने की क्षमता (Assimolative capacity) अर्थात अवशिष्टों को सहने की क्षमता।

सततता को प्राप्त करने हेतु उपर्युक्त दो घटको के अनुरूप संसाधनो का उपयोग महत्वपूर्ण है। यह आवश्यकता है कि संसाधनो का उपयोग इनके दोहन की दर से अधिक न हो और कोई भी तंत्र आत्मसात क्षमता को पार न करे।

भारत के समक्ष सतत विकास से जुड़ी चुनौतियाँ

1. **संकेतकों को परिभाषित करनाः** हमारी नीति निर्धारण प्रक्रिया की एक बड़ी कमी यह रही है कि सतत विकास से संबंधित परिणामों के आकलन के लिये प्रासंगिक संकेतकों को ठीक प्रकार से परिभाषित नहीं किया गया है।

2. **वित्त मुहैया करानाः** केंद्र सरकार द्वारा सामाजिक क्षेत्र में खर्च में कटौती किये जाने के बाद अब राज्यों पर इसे पूरा करने की जिम्मेदारी आ गई है और राज्यों के पास वित्त की अपर्याप्तता के कारण इन लक्ष्यों को पूरा करना एक चुनौतिपूर्ण कार्य होगा

3. **निगरानी और जिम्मेदारीः** इन लक्ष्यों को पूरा करने की दिशा में प्रगति की निगरानी का जिम्मा नीति आयोग पर है लेकिन इस संबंध में उचित संरचनात्मक तंत्र का अब तक विकास नहीं हो पाया है।

4. **प्रगति मापनः** आँकड़ों एवं सूचना की अपर्याप्त उपलब्धता, प्रशासनिक लचरता एवं राजनीतिक इच्छा शक्ति की कमी के कारण इन लक्ष्यों मं प्रगति का मापन उचित रूप से नहीं हो पा रहा है।

सतत विकास लक्ष्यों को हासिल करने की दिशा में किये जा रहे प्रयासः

1. भारत सरकार ने सतत विकास लक्ष्यों के कार्यान्वयन पर निगरानी रखने तथा इनके समन्वय की जिम्मेदारी नीति आयोग को सौंपी है जिसने सभी लक्ष्यों का अध्ययन कर उन्हें सबंधित मंत्रालयों में बाँट दिया और उनकी जवाबदेहिता सुनिश्चित कर दी।

2. सांख्यिकी और कार्यक्रम कार्यान्वयन मंत्रालय (MSPI) को संबंधित राष्ट्रीय संकेतक तैयार करने का कार्य सौंपा गया।

3. भारतीय संसद द्वारा 'अध्यक्षीय शोध पहल' (Speaker's Research Initiative) नामक एक मंच स्थापित किया गया है जो सतत विकास लक्ष्यों से संबंधित मुद्दों पर सांसदों द्वारा इस क्षेत्र के विशेषज्ञों के साथ परामर्श को सुविधाजनक बनाता है।

4. UNDP से संबंधित सभी कार्यक्रम सतत विकास लक्ष्यों को ध्यान में रखकर ही बनाए जाते हैं।

5. संघीय ढाँचे में सतत विकास लक्ष्यों की संपूर्ण सफलता के लिये राज्यों की भूमिका भी महत्त्वपूर्ण है अतः सभी राज्यों से कहा गया है कि वे सतत विकास लक्ष्यों पर अपने दृष्टि–पत्र तैयार करें।

यद्यपि सतत विकास लक्ष्यों को पाने की दिशा में भारत की रफ्तार काफी धीमी है किंतु इरादे मजबूत हैं और भारत इस दिशा में सकारात्मक प्रयास कर रहा है। फिर भी संपूर्ण विकास के हेतु लोगों की

आकांक्षाएँ पूरी करने के लिये पर्यावरण को संरक्षित रखते हुए राष्ट्रीय, राज्यीय और स्थानीय तीनों स्तरों पर प्रयास किये जाने की आवश्यकता है।

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अन्तर्राष्ट्रीय एवं राष्ट्रीय पर्यावरणीय संगठन/एजेंसी

प्रहलाद कुमार लहरे[1], के. एल. टंडन[2]

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2. सहायक प्राध्यापक (हिन्दी), स्व. प्यारे लाल कंवर शासकीय महाविद्यालय भैसमा, जिला– कोरबा (छ0ग0)

1. अन्तराष्ट्रीय पर्यावरणीय संगठनध्एजेंसियाँ की प्रकृति एवं उत्पत्ति

पर्यावरण प्रदूषण नियंत्रण, संरक्षण एवं सतत विकास को बढ़ावा देने के लिये पर्यावरण की प्रगति आदि के नियंत्रण के लिये हमारे देश की सरकार की भूमिका काफी आलोचनात्मक है। विभिन्न पर्यावरणीय मुद्दों पर कार्य करने के लिये संयुक्त राष्ट्र द्वारा राष्ट्रीय तथा अन्तरराष्ट्रीय स्तर पर, राष्ट्रीय सरकारों तथा सिविल सोसाइटी द्वारा कई पर्यावरण संबंधी संस्थाएँ एवं संगठन स्थापित किए गए हैं। कोई भी पर्यावरणीय संगठन एक ऐसा संगठन होता है जो पर्यावरण को किसी प्रकार के दुरुपयोग तथा अवक्रमण के खिलाफ सुरक्षित करता है साथ ही ये संगठन पर्यावरण की देखभाल तथा विश्लेषण भी करते हैं एवं इन लक्ष्यों को पाने के लिये प्रकोष्ठ भी बनाते हैं। पर्यावरणीय संगठन सरकारी संगठन हो सकते हैं, गैर सरकारी संगठन हो सकते हैं या एक चौरिटी अथवा ट्रस्ट भी हो सकते हैं। पर्यावरणीय संगठन वैश्विक, राष्ट्रीय या स्थानीय हो सकते हैं। यह पाठ अग्रणीय पर्यावरणीय संगठनों के बारे में सूचना प्रदान करता है। ये संगठन सरकारी हों या सरकार के बाहर के राष्ट्रीय तथा वैश्विक स्तर पर पर्यावरण के संरक्षण तथा विकास के लिये कार्य करते हैं।

यूनाइटेड नेशन्स पर्यावरण प्रोग्राम (UNEP), वर्ल्ड स्वास्थ्य संगठन (WHO) खाद्य एवं कृषि संगठन (FAO) आदि कुछ मुख्य अन्तर्राष्ट्रीय एजेंसियाँ हैं।

1.1 संयुक्त राष्ट्र पर्यावरण कार्यक्रम (UNEP)

UNEP का गठन यूनाइटेड नेशन्स जनरल असेंबली द्वारा यूनाइटेड नेशन्स की स्टॉकहोम, स्वीडन में, उसी वर्ष मानव पर्यावरण के ऊपर हुई कान्फ्रेंस के परिणामस्वरूप हुआ। 1992 में रियो–डी जेनेरियो में पर्यावरण एवं विकास पर हुई संयुक्त राष्ट्र कान्फ्रेंस तथा 2002 में जोहान्सबर्ग में सतत (दीर्घोपयोगी) विकास पर हुआ, विश्व शीर्ष सम्मेलन (इसे RIO 10 भी कहा जाता है) भी इसकी संरचना को बदल नहीं पाए। इसका मुख्यालय नैरोबी (केन्या) में है।

UNEP का मुख्य मत है वैश्विक पर्यावरण को ध्यान में रखते हुए पर्यावरण नीति के विकास का संचालन करना तथा अन्तरराष्ट्रीय समुदाय एवं सरकारों का ध्यान ज्वलंत मुद्दों की तरफ आकर्षित करना जिससे उन पर कार्य हो सके। इसकी गतिविधियाँ बहुत से मुद्दों को एकत्रित करती हैं, जिसमें वायुमंडल, समुद्री एवं स्थलीय या पारितंत्र शामिल हैं।

UNEP ने अन्तरराष्ट्रीय पर्यावरणीय परंपराओं को विकसित करने में एक अहम भूमिका निभाई है। इसके अलावा UNEP ने पर्यावरणीय गैर सरकारी संगठनों (NGO) के साथ कार्य करने में, राष्ट्रीय सरकार तथा क्षेत्रीय संस्थानों के साथ नीतियों को विकसित करने तथा उन्हें क्रियान्वित करने में एवं पर्यावरणीय विज्ञान तथा सूचना को बढ़ावा देने के साथ उन्हें यह भी बताया कि वे नीतियों के अनुसार किस प्रकार कार्य

करेंगे, आदि कार्यों में भी अहम भूमिका निभाई है। न्छम्ब् पर्यावरण के दीर्घोपयोगी विकास के लिये, उचित पर्यावरणीय प्रयासों द्वारा, पर्यावरण से संबंधित योजनाओं के विकास एवं क्रियान्वयन तथा आर्थिक सहायता उपलब्ध कराने में भी सक्रिय रहा है।

UNEP के कार्यों का क्रियान्वयन निम्न सात विभागों द्वारा किया जाता हैः

1. जल्द चेतावनी एवं उनका आकलन (Early Warning and Assessment)
2. पर्यावरणीय नीति क्रियान्वयन (Environmental Policy Implementation)
3. तकनीक, उद्योग एवं अर्थशास्त्र (Technical, Industry and Economics)
4. क्षेत्रीय सहयोग (Regional Co-operation)
5. पर्यावरणीय कानून एवं सम्मेलन (Environmental laws and Conference)
6. वैश्विक पर्यावरण सुविधा सहयोग (Environmental law and convention)
7. संचार एवं जन सूचना (Communication and public Information)

UNEP के कई अहम कार्यों में से ''विश्व को स्वच्छ रखो'' (Cleanup the world) अभियान के द्वारा विश्व में इस बात की जागरूकता फैलाने का प्रयास किया जाता है कि हमारी आधुनिक जीवनशैली के क्या दुष्प्रभाव हैं। अन्तरराष्ट्रीय मार्गों का प्रदूषण, सीमा पार का वायु प्रदूषण तथा हानिकारक रसायनों का अन्तरराष्ट्रीय व्यापार जैसे मुद्दों पर दिशा–निर्देश तथा संधियों के विकास में UNEP ने काफी मदद की है।

विश्व मौसम विज्ञान संबंधी संगठन (The World Metrological Organisation) एवं न्छम्ब् ने मिलकर 1988 में जलवायु परिवर्तन पर अन्तरराष्ट्रीय पैनल, इंटर गवर्नमेंटल पैनल ऑन क्लाइमेट चेंज (IPCC) का गठन किया था। वैश्विक पर्यावरणीय सुविधा (Global Environment facility GEF) का क्रियान्वयन एजेंसियों में से UNEP भी एक है।

आर्थिक सहायता (Funding)

UNEP को अपने कार्यक्रमों के लिये आवश्यक आर्थिक सहायता पर्यावरण कोष से प्राप्त होती है जिसका रख–रखाव सदस्य सरकारों के स्वैच्छिक सहयोग से, सत्तर से भी अधिक ट्रस्टी कोषों के सहयोग से तथा यूनाइटेड नेशन्स के नियमित बजट में से छोटे से सहयोग से किया जाता है।

1.2 विश्व स्वास्थ्य संगठन

संगठन एवं इतिहास

WHO के संविधान के अनुसार इसके उद्देश्य हैं ''सभी लोगों को स्वास्थ्य की प्रणाली उच्चतम संभावित स्तर पर उपलब्ध हो'' इसका मुख्य कार्य है रोगों से लड़ाई, विशेषकर संक्रामक रोगों से, एवं विश्व के लोगों में सामान्य स्वास्थ्य को बढ़ावा देना।

विश्व स्वास्थ्य संगठन WHO , संयुक्त राष्ट्र की प्रारंभिक एजेंसियों में से एक है। इसका सर्वप्रथम गठन प्रथम विश्व स्वास्थ्य दिवस (7 अप्रैल, 1948) को हुआ था। जब इसका समर्थन 26 सदस्य देशों द्वारा किया गया था। WHO में 193 सदस्य देश हैं।

- **WHO** को सदस्य देशों से एवं दानकर्ताओं से सहयोग एवं आर्थिक सहायता मिलती है।
- इसके क्षेत्रीय कार्यालय हैं: अफ्रीका का क्षेत्रीय कार्यालय (Regional Office for Africa, AFRO)
- यूरोप का क्षेत्रीय कार्यालय (Regional Office for Europe, EURO)
- दक्षिण पूर्व एशिया का क्षेत्रीय कार्यालय (Regional Office for South East Asia] SEARO)
- पूर्व भूमध्य सागर का क्षेत्रीय कार्यालय (Regional Office for Eastern Mediterranean)
- पश्चिमी पेसिफिक का क्षेत्रीय कार्यालय (Regional Office for Western Pacific, WPRO)
- अमरीका का क्षेत्रीय कार्यालय (Regional Office for the America, AMRO)

गतिविधियाँ

सार्स (SARS, Severe Acute Respiration Syndrome, सीवीयर ऐक्यूट रेस्पिरेटरी सिंड्रोम), मलेरिया, स्वाइन फ्लू एवं एड्स (AIDS) जैसी संक्रामक बीमारियों को फैलने से बचाने के वैश्विक प्रयासों के समन्वयन पर ध्यान रखना एवं इन रोगों के इलाज एवं रोकथाम के लिये कार्यक्रम प्रवर्तित करना WHO की गतिविधियों में शामिल है। सुरक्षित एवं प्रभावी टीके, फार्मास्यूटिकल डॉयग्नॉस्टिक्स एवं दवाओं के विकास एवं वितरण को WHO समर्थन करता है। चेचक के लिये करीब दो दशकों तक लड़ने के बाद 1980 में WHO ने घोषणा की कि यह बीमारी पूरी तरह से मिटा दी गई है। यह इतिहास में पहली ऐसी बीमारी थी जो मानव प्रयास द्वारा पूरी तरह से मिटा दी गई थी।

WHO का लक्ष्य है अगले कुछ वर्षों में पोलियो को भी जड़ से मिटा देना। कई बीमारियों को जड़ से मिटाने के इसके काम के साथ–साथ हाल ही के कुछ वर्षों में WHO ने स्वास्थ्य से जुड़े कई मुद्दों जैसे तंबाकू के सेवन को कम कराना तथा लोगों में फल तथा सब्जियों के सेवन को बढ़ाने के अभियान की तरफ अधिक ध्यान देना शुरू किया है।

पर्यावरण और स्वास्थ्य का आपस में घनिष्ट संबंध है। 1992 का पर्यावरण एवं विकास पर की गई रियो घोषणा का नियम कहता है कि ''सतत (दीर्घोपयोगी) विकास की चिंता के केंद्र में मानव जाति है। वे प्रकृति को संतुलन बनाए रखते हुए एक स्वस्थ्य तथा उत्पादकता पूर्ण जीवन के हकदार हैं।'' पर्यावरणीय खतरे, संपूर्ण विश्व में होने वाली बीमारियों के कुल योग का करीब 25: (अनुमानित) के लिये जिम्मेदार है।

1.3 हेली (HELI)

पर्यावरण संबंधित स्वास्थ्य खतरों से निपटने के लिया WHO ने हेल्थ एनवायरनमेंट लिंक इनीशिएटिव (Health Environmental Link Initatiave, HELI) का विकास किया है। HELI, WHO एवं UNEP के द्वारा किया गया एक वैश्विक प्रयास है जो विकासशील देशों के नीतिकारों द्वारा स्वास्थ्य पर होने वाले पर्यावरणीय खतरों पर किए जाने वाले कार्यों का समर्थन करता है।

HELI सभी देशों से इस बात को बढ़ावा देने की बात करता है कि आर्थिक विकास का संबंध स्वास्थ्य एवं पर्यावरण से होता है। आमतौर पर स्वस्थ्य जीवन एवं कार्य का वातावरण तथा वायु, जल, खाद्य एवं ऊर्जा के स्रोतों का पुनरुत्पादन अथवा प्रयोजन या जलवायु नियंत्रण जैसी सभी सेवाएँ जो मानव स्वास्थ्य तथा

तंदुरुस्ती के लिये हैं, का आकलन एवं समर्थन HELI द्वारा किया जाता है। HELI की गतिविधियों में राष्ट्रस्तरीय पायलट प्रोजेक्ट भी शामिल हैं।

1.4 संयुक्त राष्ट्र का खाद्य एवं कृषि संगठन (FAO)

यह यूनाइटेड नेशन्स की एक विशिष्ट एजेंसी है जो भुखमरी को मिटाने के अन्तरराष्ट्रीय प्रयासों की अगुआई करती है। विकसित एवं विकासशील दोनों तरह के देशों की सेवा करते हुए थे। वे (Food and Agriculture Organization) एक निष्पक्ष फोरम के रूप में कार्य करता है जहाँ सभी देश समान रूप से मिलकर बहस की नीति तथा सहमतियों पर विचार करते हैं। थे। वे ज्ञान एवं सूचना का एक स्रोत भी है एवं यह विकासशील देशों तथा परिवर्तनशील देशों को कृषि को आधुनिक बनाने एवं इसकी प्रगति, मत्स्य पालन तथा वनरोपण के कार्यों, सभी के लिये खाद्य सुरक्षा एवं सुपोषण सुनिश्चित करना आदि कार्यों में मदद करता है। इसका लैटिन भाषा में आदर्श वाक्य है 'Fiat Panis' जिसका अंग्रेजी में अर्थ है Let there be bread अर्थात हम हिंदी में कह सकते हैं कि ''सभी को रोटी मिले''।

FAO का मुख्यालय रोम में है एवं इसके 5 क्षेत्रीय कार्यालय हैं:

i. अफ्रीका के लिये क्षेत्रीय कार्यालय
(Regional office for Africa in Accra, Ghana)
ii. लैटिन अमेरिका एंड कैरीबियन देशों का क्षेत्रीय कार्यालय, सैंटियागो, चिली
(Regional office for Latin America and the Caribbean in Santiago] chili)
iii. एशिया एवं पेसेफिक के लिये क्षेत्रीय कार्यालय बैंकॉक, थाइलैंड
(Regional office for Asia and the Pacific in Bangkok, Thailand)
iv. रीजनल ऑफिस फॉर द नीयर ईस्ट इन काइरो, ईजिप्ट
(Regional office for the Near East in Cairo, Egypt)
v. यूरोप के लिये क्षेत्रीय कार्यालय बुडापेस्ट, हंगरी
(Regional office for Europe in Budapest] Hungary)

WHO के सदस्य राष्ट्र विश्व स्वास्थ्य सभा (World Health Assembly) के लिये प्रतिनिधि मंडल नियुक्त करते हैं। विश्व स्वास्थ्य सभा, WHO की सर्वश्रेष्ठ निर्णयकारी संस्था है। संयुक्त राष्ट्र के सभी सदस्य देश, WHO की सदस्यता के लिये उपयुक्त हैं एवं WHO की वेबसाइट के अनुसार, अन्य देश भी सदस्य के रूप में दाखिल हो सकते हैं जब उनका आवेदन विश्व स्वास्थ्य सभा के सामान्य बहुमत से स्वीकृत हो जाए।

1.5 यूनाइटेड नेशन्स फ्रेमवर्क कन्वेंशन ऑन क्लाइमेट चेंज (UNFCCC)

समझौता (सम्मेलन) एवं प्रोटोकॉल

एक दशक पहले हुए संयुक्त राष्ट्र के इस जलवायु परिवर्तन सम्मेलन UNFCCC में अधिकांश देश एक अन्तरराष्ट्रीय संधि में सम्मिलित हुए– एकमत होकर सोचना व कार्य करना प्रारंभ किया कि वैश्विक ऊष्मण को कम करने के लिये क्या–क्या किया जाना चाहिए एवं तापमान बढ़ने के अपरिहार्य कारणों से किस तरह तालमेल बैठाकर चलना चाहिए। हाल ही में कई देशों ने इस संधि में कुछ अतिरिक्त को भी मान्यता प्रदान की और उसका नाम 'क्योटो प्रोटोकॉल' हुआ जिसमें अधिक शक्तिशाली तरीके हैं जो कानूनी रूप से बाध्य होंगे।

इस विभाग में असंख्य संसाधन शामिल हैं– शुरूआती अथवा कुशल लोगों के लिये जैसे परिचयात्मक अथवा गहन प्रकाशन, आधिकारिक UNFCCC एवं क्योटो प्रोटोकॉल पाठ्य सामग्री एवं UNFCCC लाइब्रेरी के लिये एक सर्च इंजन।

समस्या का सामना एवं उसकी खोज करना

इस सम्मेलन की एक मुख्य उपलब्धि जो कि सामान्य एवं लचीली है वह यह है कि यह पहचान करता है कि समस्या क्या है। 1994 में यह कोई छोटी बात नहीं थी जब संधि प्रभावकारी हुई और इसके पास वैज्ञानिक सबूत कम मात्रा में उपलब्ध थे। (और अभी भी ऐसे कई लोग हैं जो यह मानने से मना करते हैं कि वैश्विक ऊष्मण (ग्लोबल वार्मिंग) वास्तव में हो रहा है और जलवायु परिवर्तन एक समस्या है)। विश्व के देशों को किसी एक बात पर सहमत कराना बहुत ही कठिन कार्य है। एक समस्या जो जटिल है उसके लिये हमें मिलकर प्रयास करना होगा, इसके परिणाम भी पूरी तरह स्पष्ट नहीं है एवं इसके भविष्य में कई दशकों या शताब्दियों तक बड़े भयंकर परिणाम हो सकते हैं।

यह सम्मेलन एक उद्देश्य तय करता है जिससे ग्रीन हाउस गैसों के सांद्रण को स्थिर किया जा सके ''एक ऐसे स्तर पर जो जलवायु प्रणाली के साथ किसी भी प्रकार के खतरनाक मानव हस्तक्षेप को रोकता है।'' इसके अनुसार ''इस प्रकार का स्तर एक निश्चित समय सीमा के भीतर प्राप्त किया जा सकता है जो पारितंत्रों को प्राकृतिक रूप से जलवायु परिवर्तन के साथ ढालने के लिये पर्याप्त हो। इससे खाद्य उत्पादन पर कोई खतरा न हो एवं इससे आर्थिक विकास के सतत एवं सुचारु रूप से चलने में मदद मिल सके।'' सम्मेलन को औद्योगिकीकरण वाले देशों से उत्सर्जित ग्रीन हाउस गैसों की नियमित एवं सही सूची मिलती रहनी चाहिए। किसी भी समस्या को सुलझाने का पहला चरण है इसके आयामों को जानना। कुछ अपवादों को छोड़कर, ग्रीन हाउस गैस उत्सर्जन तालिकाबद्ध करने का ''आधार वर्ष'' 1990 को ही माना जाता है। विकासशील देशों को भी सूची बनाने के लिये प्रोत्साहित किया जा रहा है।

सम्मेलन इस बात की पहचान करता है कि यह एक ''ढाँचागत'' दस्तावेज है– जो समय–समय पर संशोधित किया अथवा बढ़ाया जा सकता है जिससे वैश्विक ऊष्मण और जलवायु परिवर्तन से जुड़े कार्यों एवं प्रयासों को अधिक ध्यानाकर्षित एवं प्रभावशाली बनाया जाए। इस संधि में पहली वृद्धि ''क्योटो प्रोटोकॉल'' के रूप में 1997 में स्वीकृत की गई थी।

गैर सरकारी संगठन

कोई भी गैर सरकारी संगठन (NGO) एक ऐसा संगठन है जो सरकार का हिस्सा नहीं होता है। इसे ज्यादातर आर्थिक सहायता निजी सहयोग से मिलती है जो संस्थागत सरकार अथवा राजनैतिक संरचना के बाहर कार्य करती है। इसी कारण से NGO (Non Government Organisation), सरकार से पूर्णतः स्वतंत्र होते हैं। आम तौर पर NGO का अपना स्वयं का कार्यक्रम होता है। ऐसे कई NGO हैं जो वन्य जीव जन्तुओं के संरक्षण, पर्यावरण की सुरक्षा, संसाधनों का संरक्षण एवं सतत विकास के कार्य के लिये प्रतिबद्ध रूप से कार्यरत हैं। पर्यावरण के क्षेत्र में कार्य करने वाले महत्त्वपूर्ण राष्ट्रीय तथा अन्तर्राष्ट्रीय NGO की गतिविधियाँ एवं क्षेत्र नीचे बताए गए हैं।

1.6 इंटरनेशनल यूनियन फॉर कंजर्वेशन ऑफ नेचर

(International Union for Conservation of Nature- IUCN)

IUCN (International Union for Conservation of Nature) विश्व का सबसे पुराना एवं सबसे बड़ा वैश्विक पर्यावरण नेटवर्क है। यह एक गणतांत्रिक सदस्य सभा है जिसमें 1000 से अधिक सरकारी और गैर सरकारी सदस्य संगठन हैं, एवं करीब 11,000 स्वयंसेवी वैज्ञानिक हैं जो 160 से अधिक देशों में रहते हैं। IUCN का कार्य, विश्व में चारों तरफ फैले सैकड़ों पब्लिक, NGO एवं प्राइवेट क्षेत्रों के पार्टनरों तथा 60 ऑफिसों के करीब सौ से अधिक पेशेवर स्टाफ की मदद से चलता है। इसका मुख्यालय जेनेवा के निकट, ग्लैंड, स्विट्जरलैंड में स्थित है।

IUCN पर्यावरण तथा विकास से जुड़ी अधिकांश चुनौतियों के लिये व्यावहारिक समाधान विकसित करने के लिये कार्य करता है। यह वैज्ञानिक शोध का समर्थन करता है, पूरे विश्व में फील्ड प्रोजेक्टों का प्रबंधन करता है तथा सरकारी, गैर सरकारी, संयुक्त राष्ट्र, विभिन्न कंपनियों एवं स्थानीय समुदायों को एक जुट करता है जिससे नीतियों एवं कानूनों का क्रियान्वयन अच्छी तरह से हो सके।

IUCN का मिशन एवं दृष्टिकोण

1. पूरे विश्व में फैले विभिन्न समाजों को प्रभावित करना, बढ़ावा देना एवं उनकी मदद करना जिससे वे प्रकृति की विभिन्नता एवं अखंडता का संरक्षण कर सकें तथा यह सुनिश्चित करे कि किसी भी प्राकृतिक संसाधन का इस्तेमाल पूर्णतः न्याय संगत हो एवं पारिस्थितिकी के अनुसार चलने वाला भी हो।

2. प्रकृति हमें जीवन की सभी मूलभूत आवश्यकताएँ जैसे जल, खाद्य, स्वच्छ हवा, ऊर्जा एवं आवास प्रदान करती है। इसलिये हमें प्रकृति का बुद्धिमानी से इस्तेमाल करना चाहिए एवं इसकी सुरक्षा करनी चाहिए। लेकिन इसके साथ–साथ लोगों के जीवन को सुधारने एवं गरीबी घटाने के लिये सामाजिक एवं आर्थिक विकास भी लगातार होते रहना चाहिए।

3. हमारे जीवन को मिलाकर, पृथ्वी पर स्थित समस्त जीवन का आधार है जैव विविधता– जिसमें विभिन्न पशु–पक्षी, एवं उनके रहने के स्थान का जटिल नेटवर्क शामिल है। जैव विविधता का संरक्षण–पौधों एवं पशुओं की प्रजातियों को लुप्त होने से रोकना एवं प्राकृतिक क्षेत्रों को नष्ट होने से बचाना ही IUCN का मुख्य कार्य है।
4. जैव विविधता से संबंधित मानव जाति के सामने आज चार चुनौतियाँ हैंः जलवायु परिवर्तन, ऊर्जा, आजीविका एवं अर्थशास्त्र। प्न्ब्छ इसीलिये इन चारों क्षेत्रों पर कार्य करता है जबकि इसका मुख्य कार्य जैव विविधता पर ही है।

कार्य (Function)

1. **ज्ञानः** IUCN संरक्षण विज्ञान का समर्थन करता है खासकर प्रजातियों, पारिस्थितिकी तंत्रों, जैव विविधता एवं मानव आजीविका पर इनका प्रभाव किस प्रकार होगा इस पर विशेष ध्यान देता है।
2. **कार्यः** IUCN हजारों फील्ड प्रोजेक्ट पूरे विश्व में चलाता है जिससे प्राकृतिक पर्यावरण का प्रबंधन अच्छी तरह से हो सके।
3. **प्रभावः** IUCN सरकारों, छळव्ए अन्तरराष्ट्रीय सम्मेलनों, UN संगठनों, कंपनियों एवं समुदायों का समर्थन करता है जिससे वे नीतियाँ एवं कानून बनाकर उनका अच्छी तरह क्रियान्वयन कर सकें।

4. **सशक्तीकरणः** IUCN संगठनों को तैयार करके, उन्हें संसाधन उपलब्ध कराकर, लोगों को प्रशिक्षित करके तथा परिणामों की मॉनीटरिंग करके नियम, कानून तथा उनके क्रियान्वयन में मदद करता है।

1.7 वर्ल्ड वाइड फंड फॉर नेचर (WWF)

वर्ल्ड वाइड फंड फॉर नेचर (WWF) एक अन्तरराष्ट्रीय गैर सरकारी संगठन है जो पर्यावरण के संरक्षण, शोध एवं पुनःस्थापन के लिये कार्य करता है। पहले इसका नाम वर्ल्ड वाइड फंड था जो यूनाइटेड स्टेट्स एवं कनाडा में अभी भी इसका आधिकारिक नाम है। यह विश्व का सबसे बड़ा स्वतंत्र संरक्षण संगठन है जिसके संपूर्ण विश्व में करीब 5 मिलियन से अधिक समर्थक हैं जो 90 से अधिक देशों में काम कर रहे हैं, और पूरे विश्व में करीब 1300 संरक्षण एवं पर्यावरण से जुड़े प्रोजेक्टों पर काम कर रहे हैं। यह एक प्रकार का दान है जिसका 60ः हिस्सा निजी, व्यक्तिगत, स्वैच्छिक दान के रूप में आता है। इस फंड की 45 प्रतिशत आय यूनाइटेड स्टेट्स, यूनाइटेड किंगडम तथा नीदरलैंड से आती है।

WWF का लक्ष्य है ''हमारे पर्यावरण को नष्ट होने से रोकना एवं इसका प्रतिकार करना।'' वर्तमान में इसका अधिकांश कार्य तीन बायोम के संरक्षण पर केंद्रित है। इनमें विश्व की अधिकतम जैव विविधता छिपी हुई है जिसमें वन, अलवण जलीय पारिस्थितिकी तंत्र, महासागर एवं तट शामिल हैं। अन्य मुद्दों में यह विलुप्त प्राय प्रजातियों, प्रदूषण एवं जलवायु परिवर्तन पर भी ध्यान देता है।

यह संगठन 11 सिंतबर 1961 में स्विट्जरलैंड के मोर्जेस में एक धर्मार्थ ट्रस्ट के रूप में गठित हुआ था जिसका नाम वर्ल्ड वाइड फंड रखा गया था। यह जूलियन हक्सले एवं मैक्स निकोल्सन की कोशिश थी जिन्होंने 30 साल के अनुभव के साथ प्रगतिशील बौद्धिक लोगों को बड़े व्यापारिक रुचियों के साथ राजनैतिक तथा आर्थिक योजनाओं के द्वारा जोड़ने का प्रयास किया। कैने डियन फंड के लिये, कनाडा के टोरेंटो में भी इसका एक हेड ऑफिस है।

इसके स्थापना दस्तावेज में, संगठन ने अपना वास्तविक लक्ष्य इस तरह उल्लेखित किया हैः ''विश्व के जीव–जन्तु, पेड़–पौधे, वन, स्थल आकृतियाँ जल, मिट्टी एवं अन्य प्राकृतिक संसाधनों का संरक्षण भूमि के प्रबंधन, शोध एवं खोज, प्रचार, समन्वयन एवं प्रयास, अन्य इच्छुक पार्टियों के साथ सहयोग तथा अन्य उपयुक्त उपायों द्वारा किया जाएगा।''

पिछले कुछ वर्षों में, संगठन ने पूरे विश्व में ही कार्यालय खोल लिये हैं एवं कार्य प्रारंभ कर दिया है। इसकी गतिविधियों का प्रारंभिक केंद्र था विलुप्त प्रायः प्रजातियों की सुरक्षा करना। जैसे–जैसे अधिक संसाधन उपलब्ध होते गए, इसका कार्य अन्य क्षेत्रों जैसे जैव विविधता का संरक्षण, प्राकृतिक संसाधनों का सतत इस्तेमाल तथा प्रदूषण एवं बर्बादी से होने वाली खपत में कमी लाना, आदि की तरफ भी बढ़ता गया।

1986 में संगठन का नाम बदलकर वर्ल्ड फंड फॉर नेचर कर दिया लेकिन उसके आरम्भिक शब्द WWF ही रखे गये जो कि इसके क्रियाकलापों को अच्छे ढंग से बता सकें। जबकि यूनाइटेड स्टेट्स एवं कनाडा में यह अपने मूल नाम से कार्य करता है।

1.8 ग्रीन पीस

1986 में, कार्यकर्ताओं का एक छोटा दल जो ''हरित एवं शांतिप्रिय विश्व'' के अपने लक्ष्य द्वारा प्रेरित था, कनाडा, बैंकक्यूवर से पुरानी नाव में निकल पड़ा। इन कार्यकर्ताओं ने, जो ग्रीन पीस के संस्थापक थे, यह माना कि कुछ लोग मिलकर भी कुछ अलग कर सकते हैं।

उनका मिशन यूएस को एमचिटका, एक छोटा सा द्वीप जो अलास्का के पश्चिमी तट पर स्थित है, विश्व का सबसे अधिक भूकम्प संभावित क्षेत्र है, को नाभिकीय परीक्षणों से बचाने का बड़ा गवाह बनाना था। एमचिटका ने 3000 विलुप्तप्राय समुद्री ऑटरों एवं बेल्ड चीलों का घर, पेरीग्रीन फाल्कन एवं अन्य वन्य जीवों के कारण मना कर दिया था। फिर भी उनकी पुरानी नाव फिलिस कोरमॉक से यात्रा एमचिटका पहुँचने के पहले ही यह यात्रा लोगों के जिज्ञासा का कारण बन गयी थी। यूएस अभी तक बमबारी कर रहा था, लेकिन आवाज उठायी गयी थी, उसके कारणों को भी सुना गया था। एमचिटका पर उसी वर्ष नाभिकीय परीक्षण रोक दिये गये थे एवं इस द्वीप को बाद में पक्षी अभ्यारण्य घोषित कर दिया गया था।

ग्रीन पीस विश्व का सबसे बड़ा जमीनी स्तर का पर्यावरण नेटवर्क है। यह 77 राष्ट्रीय सदस्य समूहों एवं 5000 स्थानीय कार्यकर्ता समूहों को प्रत्येक महाद्वीप में एक जुट करता है। संपूर्ण विश्व में इसके 2 मिलियन से भी अधिक सदस्य हैं जिनके द्वारा ये आज के सबसे ज्वलंत पर्यावरणीय एवं सामाजिक मुद्दों पर अभियान चलाते हैं। नीदरलैंड के एम्सटर्डम में स्थित ग्रीन पीस के पास विश्व भर में करीब 2.8 मिलियन समर्थक हैं एवं 41 देशों में राष्ट्रीय तथा क्षेत्रीय कार्यालय हैं। आज ग्रीण पीस एक अन्तर्राष्ट्रीय संगठन है जो वैश्विक पर्यावरणीय अभियानों को प्राथमिकता प्रदान करता है।

ग्रीन पीस की नीतियाँ एवं मान्यताएँ इस प्रकार हैं:

i. शांति प्रिय एवं अहिंसात्मक तरीके से पर्यावरण को नष्ट होने से रोकना य
ii. राजनैतिक एवं व्यावसायिक रुचियों से आर्थिक स्वतंत्रता हासिल करना
iii. समाज के पर्यावरणीय पसंदों के बारे में खुली एवं स्वतंत्र बहस को बढ़ावा देना व उनके लिये समाधान खोजना य

दृष्टिकोण एवं मिशन

एक शांतिपूर्ण एवं अखंड विश्व जो ऐसे समाजों पर आधारित है जो प्रकृति के साथ संतुलन बनाए रखकर जीवन–यापन करते हैं। स्वतंत्र लोगों का एक समाज जो गर्व, संपूर्णता तथा संतोष के साथ रहते हैं जिसमें मानव समानता तथा लोगों के अधिकारों का अहसास होता है।

i. अखंड समाजों को सुरक्षित रखने के लिये मानव अधिकारों तथा लोगों के अधिकारों के प्रति सम्मान, मानव का आत्म सम्मान, पर्यावरणीय एवं सामाजिक न्याय आदि को सामूहिक तौर पर सुनिश्चित करना।
ii. पर्यावरणीय अवक्रमण तथा प्राकृतिक संसाधनों में कमी को रोकना या उसका विरोध करना, पृथ्वी की पारिस्थितिकी एवं सांस्कृतिक विविधता का पोषण करना तथा सतत आजीविका की सुरक्षा करना।
iii. स्वदेशी लोगों, स्थानीय समुदायों, महिलाओं समूहों एवं व्यक्तिगत लोगों के सशक्तीकरण को सुनिश्चित करना एवं निर्णय लेने में जनता की भागीदारी को सुनिश्चित करना।
iv. गुंजाय मान अभियानों में व्यस्त रहना, जागरूकता को बढ़ावा देना, लोगों को गतिशील बनाना एवं विविध प्रकार के अभियानों के साथ संबद्ध होना, जमीनी स्तर तक पहुँचना, राष्ट्रीय एवं वैश्विक संघर्ष में शामिल होना।

1.9 टाटा ऊर्जा शोध संस्थान

TERI एक जनरुचि शोध एवं समर्थक संगठन है जो पर्यावरण के लिये हितकर एवं न्यायसंगत विकासशील रणनीतियों को बढ़ावा देता है। इसकी औपचारिक स्थापना 1974 में हुई थी जिसका मुख्य उद्देश्य था गंभीर एवं कठिन समस्याओं से जूझना एवं उनका समाधान खोजना, जिनसे आने वाले वर्षों में मनुष्य का सामना होने वाला है। ये समस्याएँ पृथ्वी के सीमित ऊर्जा भंडारों में तेजी से आने वाली कमी के कारण उत्पन्न होंगी क्योंकि ये ऊर्जा भंडार अधिकांशतः अनवीकरणीय हैं। इनके इस्तेमाल के वर्तमान तरीकों में से अधिकांश प्रदूषण फैलाने वाले हैं, जो गंभीर समस्याएँ उत्पन्न करते हैं।

TERI सक्रिय रूप से ऊर्जा, पर्यावरण एवं विकास के आधुनिक तरीकों, जो अधिकांशतः दीर्घकालीन नहीं हैं, के क्षेत्र में आने वाली वैश्विक समस्याओं के लिये समाधान विकसित करने के कार्य में लगा है। यह संस्थान कई वर्षों में विकसित हुआ है, विशेषकर, जब इसने स्वयं की शोध गतिविधियाँ प्रारंभ की एवं नई दिल्ली में अपना आधार बना था जो इसका पंजीकृत मुख्यालय है। ज्म्त्प् के दर्शन का केंद्रीय तत्व है उद्यमिता के हुनर पर विश्वास करना जिससे समाज को लाभ मिल सके जिसमें ज्ञान रूपी संपत्ति का वितरण एवं विकास ही मुख्य जरिया हो। TERI की शाखाएँ उत्तरी अमरीका, यूरोप, जापान, मलेशिया एवं खाड़ी देशों में हैं।

ज्म्त्प् के पूरे विश्व के विभिन्न भागों में केवल कार्यालय ही नहीं बल्कि इसकी गतिविधियों की भी विस्तृत भौगोलिक प्रासांगिकता है। यह वार्षिक दिल्ली सतत विकास सम्मेलन का आयोजन करता है जो सतत विकास के ऊपर केंद्रित एक अहम घटना है जो मिलेनियम विकास गोल (MDG) एवं इन संवेदनशील क्षेत्रों में दुनिया भर की प्रगति के बारे में बताता है। इसके अलावा ज्म्त्प् ने एक विश्व सतत विकास फोरम (World Sustainable Development Forum WSDF) का भी गठन किया है, जो चुने विश्व नेताओं के समूह की छत्रछाया में संचालित होता है। WSDF प्रत्येक DSDS के अनुभव को विश्व के अन्य भागों तक पहुँचाता है तथा विश्वभर में इसके विकास पर नजर रखता है विशेषकर डक्ळ की बैठक में।

2 राष्ट्रीय पर्यावरणीय एजेंसियाँ

(National Environmental Agencies)

भारत में पर्यावरणीय संस्थाओं की ऐतिहासिक पृष्ठभूमि

भारतीय सभ्यता के आरम्भ से ही पर्यावरण को सुरक्षित रखने की जागरूकता लोगों में मौजूद थी। वैदिक एवं वैदिककाल के बाद का इतिहास इस बात का साक्षी है लेकिन आधुनिक काल में, विशेष रूप से स्वतंत्रता के बाद से, आर्थिक प्रगति को उच्च प्राथमिकता मिलने के कारण, पर्यावरण कुछ कम महत्त्वपूर्ण स्थान पर रह गया। केवल 1972 में पर्यावरणीय योजना एवं सहयोग के लिये राष्ट्रीय कमेटी (National Committee of Environment and Forest] NCEPC) के गठन के लिये कदम उठाए गए जो धीरे–धीरे पर्यावरण का अलग विभाग बना और 1985 में यह पूर्णरूप से पर्यावरण एवं वन मंत्रालय के रूप में परिवर्तित हुआ। शुरूआत में भारत के संविधान में पर्यावरण को बढ़ावा देने या उसके संरक्षण के लिये किसी प्रकार के प्रावधान नहीं थे। लेकिन 1977 में हुए 42वें संविधान संशोधन में कुछ महत्त्वपूर्ण धाराएँ जोड़ी गई जो सरकार पर एक स्वच्छ एवं सुरक्षित पर्यावरण प्रदान करने की जिम्मेदारी सौंपती है।

पर्यावरण एवं वन मंत्रालय, केन्द्रीय प्रदूषण नियंत्रण बोर्ड एवं वन्य जीवन के लिये भारतीय बोर्ड ही मुख्य राष्ट्रीय पर्यावरणीय एजेंसियाँ हैं।

2.1 दीर्घोपयोगी विकास आयोग ;ब्क्द्ध

इसकी स्थापना दिसंबर, 1992 में जनरल एसेंबली रिजॉल्यूशन A/Res/47/191 द्वारा की गई थी। इसे यूएन आर्थिक एवं सामाजिक काउंसिल के कार्यकारी आयोग (ECOSOC) के रूप में स्थापित किया गया था। इसने जून, 1992 में रियो डी जेनेरियो में हुए पृथ्वी सम्मेलन अथवा पर्यावरण तथा विकास पर यूएन की कॉन्फ्रेंस में एक ऐतिहासिक वैश्विक समझौता किया था जो एजेंडा 21 के चौप्टर 38 में दी एक संस्तुति को क्रियान्वित करता था।

मिशन

सतत विकास के लिये बना डिवीजन (Division for sustainable development] DSD) नेतृत्व प्रदान करता है एवं यह यूनाइटेड नेशन्स के सतत विकास पर बने सिस्टम के भीतर कुशलता का एक अधिकृत स्रोत है। यह दीर्घोपयोगी विकास के संयुक्त राष्ट्र आयोग (CSD) के लिये वास्तविक सचिवालय के तौर पर सतत विकास का प्रचार करता है एवं अन्तरराष्ट्रीय, क्षेत्रीय तथा राष्ट्रीय स्तर पर तकनीकी सहयोग तथा क्षमता निर्माण प्रदान करता है।

लक्ष्य

1. अन्तरराष्ट्रीय, क्षेत्रीय तथा राष्ट्रीय स्तर पर नीति निर्धारण में सतत विकास के लिये सामाजिक, आर्थिक तथा पर्यावरणीय आयामों का समाकलनय
2. सतत विकास के लिये एकीकृत एवं व्यापक रूप से भागीदारीपूर्ण प्रयास को बड़े पैमाने पर लागू करनाय
3. जोहान्सबर्ग की क्रियान्वयन योजना के लक्ष्य एवं लक्ष्य क्षेत्र के क्रियान्वयन में भारी प्रगति।

यह कहता है ''कॉन्फ्रेंस का प्रभावशाली अनुसरण करने को सुनिश्चित करने एवं अन्तरराष्ट्रीय सहयोग तथा युक्तिमूलक दृष्टिकोण में वृद्धि के लिये, पर्यावरण तथा विकास के मुद्दों को एकीकृत करने के लिये अंतः सरकारी निर्णय निर्धारण क्षमता तथा राष्ट्रीय, क्षेत्रीय एवं अन्तरराष्ट्रीय स्तरों पर एजेंडा 21 के क्रियान्वयन की प्रगति की जाँच करना, आदि कार्यों के लिये एक उच्च स्तरीय सतत विकास आयोग का गठन यूएन के चार्टर के अंतर्गत आर्टिकल 68 के अनुसार होना चाहिए।'' एजेंडा 21(1) 1992 के शरद काल में हुई जनरल एसेंबली की बैठक जो ब्बे की स्थापना पर बहस के लिये आयोजित हुई थी, के अनुसारः

1. आर्थिक एवं सामाजिक काउंसिल (The Economic and Social Council] ECOSOC) से अनुरोध किया गया है कि यह एक उच्च स्तरीय आयोग का गठन कार्यकारी काउंसिल संस्था के रूप में करे।
2. 53 देशों के प्रतिनिधियों को काउंसिल द्वारा तीन साल तक के कार्यकाल के लिये चुना जाएगा।
3. आयोग वर्ष में एक बार दो या तीन सप्ताह के लिये बैठक करेगा। यह कार्यकारी ECOSOC आयोग है जिसका पूर्णकालिक सचिवालय न्यूयॉर्क में स्थित है।

CSD का मत (रिजॉल्यूशन 1990/2007) हैः

1. एजेंडा 21 (पर्यावरण एवं विकास के मुद्दों पर काम करता है) के क्रियान्वयन एवं सरकार, NGO तथा अन्य यूएन संस्थाओं द्वारा निर्धारित पर्यावरण एवं विकास के लक्ष्यों के समाकलन से संबंधित गतिविधियों की प्रगति की निगरानी करना।

2. विकसित देशों द्वारा ओवरसीज विकास सहायता कोष (Overseas Development Aid) के लिये निर्धारित 0.7% GNP के लक्ष्य की प्रगति की निगरानी करना।

3. जैसा कि एजेंडा 21 में उल्लेखित है, तकनीकों का स्थानांतरण एवं उनकी आर्थिक मदद की पर्याप्तता का पुनरावलोकन करना।

4. एजेंडा 21 के क्रियान्वयन के संदर्भ में सुयोग्य NGOs द्वारा संबंधित सूचना को प्राप्त करके उसका विश्लेषण करना।

5. यूएन के ढाँचे के अंतर्गत आने वाले NGO, स्वतंत्र सेक्टरों एवं अन्य इकाइयों को जो यूएन प्रणाली के बाहर हैंय के साथ वार्तालाप बढ़ाना।

सामान्य सतत विकास के लिये संस्तुति प्रदान करने का अर्थ है वर्तमान पीढ़ी की आवश्यकताओं की पूर्ति इस प्रकार करना जिससे भविष्य की पीढ़ियों को अपनी आवश्यकताओं की पूर्ति करने की क्षमता में किसी तरह की रुकावट या गड़बड़ी न हो। इसे समाज द्वारा बड़े पैमाने पर लिया जाना चाहिए और प्रतिदिन प्रत्येक नागरिक के द्वारा किए जाने वाले विभिन्न पसंदीदा कार्यों के लिये यह एक दिशा–निर्देश देने वाला सिद्धान्त होना चाहिए। इसके अलावा बड़े राजनैतिक तथा आर्थिक निर्णयों में भी इसे शामिल किया जाना चाहिए। इसके लिये लोगों की सोच में, आर्थिक तथा सामाजिक संरचना में तथा उत्पादन एवं उपभोग के तरीके में व्यापक परिवर्तन किए जाने चाहिए।

2.2 पर्यावरण एवं वन मंत्रालय

(Ministry of Environment and Forest)

पर्यावरण एवं वन मंत्रालय (MoEF) देश में पर्यावरण एवं वन संबंधी कार्यक्रमों के क्रियान्वयन की योजना बनाने, उसका प्रचार करने, समन्वय करने के लिये केन्द्रीय सरकार के प्रशासनिक तंत्र में एक नोडल एजेंसी है। इस मंत्रालय द्वारा किए जाने वाले कार्यों की मुख्य गतिविधियाँ भारत के वनस्पति तथा जीव जन्तुओं को संरक्षण एवं सर्वेक्षण, वनों एवं बीहड़ क्षेत्रों का सर्वेक्षण एवं संरक्षण, प्रदूषण नियंत्रण तथा निवारण, वनरोपण को बढ़ावा तथा भूमि अवक्रमण को कम करना सम्मिलित है। यह भारत के राष्ट्रीय उद्यानों (National Park) के प्रशासन के लिये भी जिम्मेदार है। इसके इस्तेमाल होने वाले मुख्य साधन सर्वेक्षण, पर्यावरणीय प्रभावों का मूल्यांकन, प्रदूषण नियंत्रण, पुनरुत्पादन कार्यक्रम, संगठनों का समर्थन, समाधान खोजने के लिये शोध एवं आवश्यक मानवशक्ति को कार्य करने के लिये प्रशिक्षण, पर्यावरणीय सूचना का संग्रह एवं वितरण तथा देश की जनसंख्या के सभी भागों में पर्यावरणीय जागरूकता फैलाना है। यह मंत्रालय यूनाइटेड नेशन्स पर्यावरण कार्यक्रम (United Nations Environment Programme] UNEP) के लिये भी नोडल एजेंसी है

2.3 केंद्रीय प्रदूषण नियंत्रण बोर्ड

(Central Pollution Control Board - CPCB)

केंद्रीय प्रदूषण नियंत्रण बोर्ड (Central Pollution Control Board] CPCB) एक वैधानिक संगठन है जिसका गठन सितंबर 1974 में, जल कानून (प्रदूषण का नियंत्रण एवं निवारण) के तहत हुआ था। इसके अलावा CBCB को वायु कानून (प्रदूषण नियंत्रण एवं निवारण), 1981 के तहत क्षमताएँ एवं कार्य भी सौंपे गए थे। यह 1986 के अन्तर्गत पर्यावरण (संरक्षण) कानून के प्रयोजनों के लिये पर्यावरण एवं वन मंत्रालय को तकनीकी सेवाएँ प्रदान करता है एवं इसके लिये क्षेत्र निर्माण भी करता है।

CBCB के कार्य

CBCB के मुख्य कार्य, जैसा कि 1974 के जल कानून (प्रदूषण नियंत्रण एवं निवारण) तथा 1981 के वायु कानून (प्रदूषण नियंत्रण तथा निवारण) में बताया गया :

1. राज्यों के विभिन्न भागों में जल धाराओं तथा कुओं की सफाई को बढ़ावा देना जिसमें जल प्रदूषण का नियंत्रण,निवारण तथा कटौती शामिल हो,
2. देश में वायु प्रदूषण का नियंत्रण, निवारण तथा कटौती के साथ–साथ वायु की गुणवत्ता का विकास करना।

वायु गुणवत्ता का ध्यान रखना, वायु गुणवत्ता के प्रबंधन का एक महत्त्वपूर्ण भाग है। राष्ट्रीय परिवेश वायु गुणता मॉनीटरन प्रोग्राम (NAAQM) का गठन, वायु गुणवत्ता के वर्तमान स्तर का निर्धारण करने, कल कारखानों तथा अन्य स्रोतों में से वायु प्रदूषकों के उत्सर्जन का नियंत्रण एवं व्यवस्थापन करने तथा वायु गुणवत्ता को मानकों तक पहुँचाना जैसे उद्देश्यों के लिये हुआ था। यह उद्योगों को स्थापित करने तथा नगर योजनाओं के लिये आवश्यक वायु गुणवत्ता आंकड़ों के लिये पृष्ठभूमि भी प्रदान करता है।

अलवण (शुद्ध) जल एक सीमित संसाधन है जो कृषि, उद्योग, वन्य जीव–जन्तुओं एवं मात्स्यिकी के पालन तथा मानव जीवन के लिये अत्यंत आवश्यक है। भारत नदियों से परिपूर्ण देश है परन्तु यहाँ पर असंख्य झीलें, तालाब तथा कुएँ हैं, जो पेयजल के मुख्य स्रोत के रूप में इस्तेमाल होते हैं, यहाँ तक कि बिना पानी

का शोधन किए भी। अधिकांश नदियों में मानसून की वर्षा का पानी एकत्र होता है, जो साल के तीन महीनों तक ही सीमित है। अतः वर्ष के बाकी महीनों में ये सूख जाती हैं और अक्सर इनमें शहरों, कस्बों तथा उद्योगों से निष्कासित गंदा पानी ही बहता है जो हमारे कम हो रहे जलस्रोतों की गुणवत्ता पर और खतरा पैदा करता है। भारत की संसद ने अपनी बुद्धिमत्ता के अनुसार जल कानून (प्रदूषण का नियंत्रण एवं निवारण) 1974 इसलिये बनाया था ताकि हमारे जल भंडारों की स्वास्थ्यवर्धक क्षमता को सुरक्षित रखा जा सके। CBCB का एक मत ये है कि जल प्रदूषण से संबंधित तकनीकी तथा सांख्यिकी आंकड़ों को संग्रह करो, उन्हें मिलाओ और फिर उनका प्रसार करो। अतः जल गुणवत्ता मॉनीटरन (Water Quality Monitoring - WQM) एवं निगरानी दोनों काफी महत्त्वपूर्ण हैं।

भारतीय मानकों की गुणवत्ता की आवश्यकताओं के साथ–साथ कुछ पर्यावरण की शर्तों को पूरा करने के लिये बनाए गए घरेलू एवं उपभोक्ता उत्पादों के लिये ''पर्यावरण मित्र उत्पाद'' के लेबल की योजना काफी प्रभावी हो रही है। इस योजना को ''इकोमार्क स्कीम ऑफ इंडिया (Ecomark scheme of India) कहा जाता है।

राष्ट्रीय स्तर पर केंद्रीय बोर्ड के कार्य

1. केंद्रीय सरकार को जल एवं वायु प्रदूषण के नियंत्रण एवं निवारण से जुड़े किसी भी मुद्दे पर एवं वायु की गुणवत्ता को बढ़ाने के बारे में सलाह देना।
2. जल एवं वायु प्रदूषण के नियंत्रण, निवारण तथा कटौती के लिये राष्ट्रव्यापी कार्यक्रमों की योजना एवं संचालन करना।
3. राज्य बोर्डों की गतिविधियों का समन्वयन एवं उनके आपसी मतभेदों को दूर करना।
4. राज्य बोर्डों को तकनीकी सहायता एवं दिशा–निर्देश प्रदान करना, वायु एवं जल प्रदूषण से संबंधित समस्याएँ एवं उनके नियंत्रण, निवारण तथा कटौती के लिये शोध को कार्यान्वित करना एवं उनका समर्थन करना।
5. जल एवं वायु प्रदूषण के नियंत्रण, निवारण तथा कटौती से संबंधित कार्यक्रमों से जुड़े लोगों के प्रशिक्षण की योजना एवं व्यवस्था करना।
6. जल एवं वायु प्रदूषण के नियंत्रण, निवारण तथा कटौती के प्रोग्राम के बारे में एक व्यापक जन जागरूकता लाने के लिये एक जनसंचार की व्यवस्था प्रदान करना।

पर्यावरणीय शासन एवं राज्य प्रदूषण नियंत्रण बोर्ड

अंब्रेला एक्ट (Umbrella Act) EPA (पर्यावरणीय संरक्षण एजेंसी, Environmental Protection Agency Act-EPA) 1986 ने पहले के सभी प्रयोजनों को और मजबूती प्रदान की। देश में औद्योगिक, वाहन संबंधित तथा ध्वनि प्रदूषण नियंत्रण के लिये विशेष प्रावधान किए गए। भारत में, राज्यों की अपनी स्वयं कोई पर्यावरण नीति नहीं हैं बल्कि राष्ट्रीय स्तर पर बनाई गई नीतियों को ही अपनाते हैं बस इसमें उस राज्य की स्थानीय परिस्थितियों के अनुसार थोड़े बहुत परिवर्तन कर लिये जाते हैं। केन्द्र सरकार भी, राज्य सरकारों को विभिन्न पर्यावरणीय मुद्दों पर दिशा–निर्देश देती रहती है।

2.4 वन्य जीवों के लिये भारतीय बोर्ड

(Indian Board for Wildlife - IBWL)

देश में Indian Board for Wildlife - IBWL वन्य जीव संरक्षण के क्षेत्र में, एक अहम सलाहकार संस्था है एवं इसके अध्यक्ष भारत के माननीय प्रधानमंत्री होते हैं। IBWL का पुनर्गठन 7 दिसम्बर, 2001 से प्रभावकारी हुआ। IBWL की 21वीं बैठक 21 जनवरी, 2002 को नई दिल्ली में हुई जिसमें भारत के माननीय प्रधानमंत्री ने अध्यक्षता की थी।

राष्ट्रीय गैर सरकारी संगठन

(NGO)

2.5 विज्ञान एवं पर्यावरण केन्द्र

(Centre for Science and Environment - CSE)

विज्ञान एवं पर्यावरण केन्द्र (Centre for Science and Environment - CSE) एक जन जागरूकता संबंधी खोज एवं सलाहकार संगठन है जो कि दिल्ली में स्थित है। CSE लॉवियो के लिये अनुसंधान करता है एवं विकास की आवश्यकता की सूचना देता है कि दोनों दीर्घोपयोगी एवं समान हैं। पर्यावरणीय अवक्रमण की सबसे बड़ी चुनौती एक ओर तो प्राकृतिक संसाधनों का अत्यधिक दोहन है वहीं दूसरी ओर तेजी से बढ़ता हुआ औद्योगीकरण है, इन दोनों में संतुलन बनाये रखने का एक महत्त्वपूर्ण कार्य CSE ने ले रखा है। CSE इन समस्याओं के प्रति जागरूकता पैदा करती है एवं इसके दीर्घोपयोगी समाधान का भी सुझाव देती है।

सभी वर्गों के लोगों के बीच जिनमें विद्यार्थी भी शामिल हैं, पर्यावरणीय मुद्दों के प्रति बढ़ती हुयी रुचि के लिये काम करती है। CSE अनौपचारिक पर्यावरणीय शिक्षा का विकास कर रही है। उनके साधन जो लोगों के बीच जागरूकता पैदा करने के स्रोत प्रकाशित पत्रिकाएँ, फिल्म, प्रदर्शनियां एवं अन्य उत्पाद हैं।

उनके दो प्रमुख रोचक प्रकाशन 'डाउन टू अर्थ' (Down to Earth) एवं बच्चों की पत्रिका 'गोबर टाइम्स' (Gober Times) है।

2.6 कल्पवृक्ष (kalpvriksh)

इसकी स्थापना 1979 में हुई थी एवं यह पर्यावरणीय जागरूकता, अभियानों, मुकदमों, शोध एवं अन्य क्षेत्रों में कार्य करता है। इसने कई पर्यावरण विकास संबंधित मुद्दों पर अच्छी पकड़ बनाई है। अधिकांश समय में यह विरोध पत्रों अथवा सड़क प्रदर्शनों जैसे उपायों द्वारा राज्यों के साथ सीधा मुकाबला नहीं करता है। इसके अधिकतर सदस्य विविध एवं गहन रूप से सीखने की प्रक्रिया में लगे रहते हैं। चिपको आंदोलन के समय हिमालयी क्षेत्र का दौरा, दिल्ली के सबसे बड़े हरित क्षेत्र (रिज एरिया) के विनाश के खिलाफ स्थानीय विद्रोह को प्रारंभ करना, वन्य जीव संरक्षण तथा पशु अधिकारों के लिये प्रकोष्ठ गठन के साथ–साथ ये 'नेचर वॉक' भी करते रहते हैं। इनके अलावा ये भरतपुर पक्षी रिजर्व में हुई पुलिस फायरिंग की जाँच, नर्मदा प्रोजेक्ट के प्रभावों का पहला विस्तृत अध्ययन, आदि भी इन्हीं के कार्यों में शामिल है। इस प्रकार की पृष्ठभूमि के साथ, यह आश्चर्यजनक नहीं है कि NGO ने लगातार राज्यों और उसकी नीतियों को चुनौती देने वाले आंदोलनों में भाग लिया है जबकि यह राज्यों के उन तत्वों का समर्थन भी करता है जो पर्यावरण एवं विकास के क्षेत्र में प्रगतिशील तरीके से कार्य करते हुए आगे बढ़ रहे हैं।

कल्पवृक्ष (Kalpavriksh) का यह विश्वास है कि एक देश का सही मायने में विकास तभी हो सकता है जब पारिस्थितिकी की सुरक्षा एवं सामाजिक समानता सुनिश्चित हो एवं प्रकृति एवं प्राणियों के प्रति एकरूपता तथा आदर का भाव लाया जा सके। यह एक अपदानुक्रमीय (Non hierarchical) संगठन है एवं इस समूह में सभी निर्णय उचित बहस और चर्चा के बाद ही लिये जाते हैं।

2.7 डेवलपमेंट ऑल्टरनेटिव्स

(Development Alternatives)

यह एक अलाभकारी संगठन है जो सतत विकास के लिये शोध कार्य में व्यस्त रहता है। इसकी स्थापना 1983 में हुई थी एवं इसका पंजीकरण भारत सरकार के साथ सोसाइटी रजिस्ट्रेशन एक्ट के तहत हुआ था। डेवलपमेंट अल्टरनेटिव्स का यह मानना है कि 'विकास' चूँकि एक गतिशील प्रक्रिया है, यह मुख्यतः सामाजिक और पर्यावरणीय मुद्दों के बीच अंतःसंबंध स्थापित करने के बारे में है। जिसमें विशेषकर प्रकृति, मशीनों, संस्थानों एवं लोगों के बीच आपसी संबंध मुख्य हैं। डेवलपमेंट अल्टरनेटिव्स समूह की गतिविधियों में मुख्य तौर पर तीन प्रमुख क्षेत्र शामिल होते हैं जो किसी भी प्रकार की सतत विकास प्रक्रिया का आधार होते हैं। ये क्षेत्र हैंः उपयुक्त तकनीकों की डिजाइन एवं बड़े पैमाने पर उनका वितरण, पर्यावरण प्रबंधन तंत्र बड़े पैमाने पर उनका वितरण, पर्यावरण प्रबंधन तंत्र एवं प्रभावशाली जन–मूलक संस्थान तथा नीतियाँ। डेवलपमेंट अल्टरनेटिव्स एवं इसके सहयोग संगठन इस दर्शन पर काम करते हैं कि सतत विकास ना केवल आर्थिक क्षेत्र को लाभ पहुँचाता है बल्कि यह पर्यावरण एवं इससे भी ऊपर लोगों को भी लाभ पहुँचाता है। डेवलपमेंट अल्टरनेटिव्स ग्रुप, इसलिये, सामाजिक समानता, पर्यावरण की गुणवत्ता तथा आर्थिक निपुणता जो सतत विकास के लिये पहले से आवश्यक बातें हैं, में आपस में अच्छा संतुलन बनाए रखने में पूरी तरह से लगा रहता है।

लक्ष्य

डेवलपमेंट अल्टरनेटिव्स ग्रुप का लक्ष्य है सतत राष्ट्रीय विकास को बढ़ावा देना।

उद्देश्य

इसके कॉर्पोरेट उद्देश्य हैं बड़े पैमाने पर सतत आजीविका को चलाने के संसाधनों की खोज करके उन्हें लोगों तक पहुँचाना और इस प्रकार गरीबी दूर करने तथा पर्यावरण को पुनर्स्थापित करने के लिये विश्वव्यापी गतिविधियों को क्रियान्वित करना है।

डेवलपमेंट अल्टरनेटिव्स की गतिविधियाँ, विकास से जुड़े मुद्दों का एक बड़ा क्षेत्र को घेरे रहती है। ये मुद्दे बड़े जटिल होते हैं जिन्हें परिष्कृत एवं अनुशासनात्मक प्रतिक्रिया की आवश्यकता होती है। इस तरह की प्रतिक्रियाओं को सफलतापूर्वक प्रदान करने में सक्षम, इस समूह ने एक सशक्त क्षमता का निर्माण किया है जिससे देश के सामने मुकाबले को तैयार प्रमुख मुद्दों को पहचाना जा सके एवं उनका समाधान ढूंढने के प्रभावशाली तरीके खोजे जा सकें। इसी वजह से इसमें अनुभवी स्टाफ सदस्य, जो विभिन्न प्रकार की योग्यता एवं पृष्ठभूमि से आए हों। लेकिन मिलजुलकर सर्वश्रेष्ठ प्रदर्शन करने का उनका एक ठोस इरादा हो, को साथ लेकर चला जाता है।

2.8 सुलभ इंटरनेशनल

(Sulabh International)

सुलभ इंटरनेशनल (Sulabh International) एक समाज सेवी संगठन है जो मानव अधिकारों, पर्यावरण की स्वच्छता, ऊर्जा के गैर परंपरागत स्रोतों, अपशिष्ट प्रबंधन एवं शिक्षा द्वारा सामाजिक परिवर्तनों को बढ़ावा देने के लिये कार्य करता है। इसकी स्थापना डॉ. बिंदेश्वर पाठक ने 1970 में की थी। इसने भारत में लोगों का ध्यान स्वच्छता की ओर आकर्षित करने में अहम भूमिका अदा की है। इसने लोगों को खुले में मल–मूत्र त्याग की आदत को रोकने में अहम भूमिका निभाई है एवं साथ–साथ लोगों को टॉयलेट (शौचालयों) के इस्तेमाल के लिये उत्साहित किया है तथा स्वच्छता के प्रयास करने के लिये भी तैयार किया है। 1970 में सुलभ के आने से पहले सांस्कृतिक विषयों में टॉयलेट एक वर्जित विषय था।

एक स्वस्थ एवं स्वच्छ भारत जो खुले में मल मूत्र त्याग की आदत से मुक्त है एवं इनसे पर्यावरण को होने वाले प्रदूषण से भी मुक्त है। एक समाज जो छुआछूत एवं सामाजिक भेदभाव से मुक्त है। सुलभ ने मानव मलमूत्र को मानव द्वारा हाथ से साफ करने जैसे अमानवीय कार्य को रोका है।

मिशन

1. भविष्य में सुलभ की दृष्टि को प्राप्त करने के लिये लोगों को शिक्षित एवं प्रेरित करना, नीतिकारों एवं पदाधिकारियों को सुग्राही बनाना, सरकार एवं लोगों के कार्यक्रमों एवं गतिविधियों को बढ़ावा देना।
2. जो लोग सफाई कर्मी (उनको स्केवेन्जर कहा जाता है) जो मानव मलमूत्र की सफाई करते हैं, उनके प्रति सुलभ ने लोगों का नजरिया काफी बदल दिया है। शौचालयों के बारे में लेखों तथा चर्चाओं द्वारा आदरपूर्वक बातें होने लगी हैं। स्वतंत्रता से पहले, जो लोग अस्पृश्य होते थे और मलमूत्र की सफाई के काम में लगे रहते थे, को समाज ने स्वीकार कर लिया है और अब लोग उनसे मिलने जुलने में संकोच नहीं करते हैं।

सफाई कर्मियों को मानव सम्मान दिलाने में सुलभ के प्रयासों में पाँच अलग–अलग चरण होते हैं:

1. स्वतंत्रता
2. पुनर्स्थापना
3. व्यावसायिक प्रशिक्षण सामाजिक उत्थान
4. अगली पीढ़ी को उचित शिक्षा

सुलभ के नए आविष्कारों में सफाई मुक्त दो गड्ढों वाला पोर फ्लश शौचालय (सुलभ शौचालय) सुरक्षित एवं स्वच्छ मानव मल मूत्र निपटान तकनीक, जन सुविधाओं जहाँ पैसे देकर इस्तेमाल होता है, के निर्माण एवं रख–रखाव की नई अवधारणा, करीब 10 मिलियन लोगों द्वारा प्रतिदिन इस्तेमाल की जाने वाले सुलभ कॉम्प्लेक्स जिनमें नहाने, कपड़े धोने एवं पेशाब घरों की सुविधा होती है, मलमूत्र आधारित बायोगैस संयंत्रों से बायोगैस एवं बायो खाद का उत्पादन, संस्थानों एवं उद्योगों के लिये मध्यम क्षमता वाले गंदे पानी को संशोधित करने वाले कम खर्चीले संशोधन संयंत्र आदि शामिल हैं।

अन्य कार्यों में नई दिल्ली में अंग्रेजी माध्यम का पब्लिक स्कूल खोलना, गरीब परिवारों विशेषकर सफाई कर्मियों के लड़के, लड़कियों को विशेष केंद्रों द्वारा पूरे देश में प्रशिक्षण देना, जिससे वे रोजगार के खुले बाजार में खुद अपने लिये रोजगार खोज सकें। 2006 के लिये आई मानव विकास इंडेक्स रिपोर्ट के 124वें पेज पर सुलभ को स्थान मिला था। सुलभ, भारत में गरीबों में स्वच्छता लाने के लिये प्रतिबद्ध है। 2007

अक्टूबर में सुलभ ने एक ऐसे सस्ते शौचालय सिस्टम की डिजाइन तैयार की जो मानव अपशिष्ट को बायोगैस एवं खाद में पुनः चक्रित करता है।

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पर्यावरण संरक्षण अधिनियमः नीतियां तथा कानून

श्रीमती प्रभाराज

सहायक प्राध्यापक एवं विभागाध्यक्ष (रसायन शास्त्र)

शासकीय विवेकानन्द स्नातकोत्तर महाविद्यालय मनेन्द्रगढ़ जिला–मनेन्द्रगढ़ चिरमिरी भरतपुर (छ0ग0)

परिचय

पर्यावरण को सुरक्षा प्रदान करने के लिए यद्यपि ब्रिटिशकाल में भी कुछ कानून बने हुए थे, किन्तु स्वतंत्रता के पश्चात् पर्यावरण संरक्षण संबंधी 40वं संविधान संशोधन इस दिशा में महत्वपूर्ण कदम था। इसके अनुच्छेद 48। के अनुसार ''राज्य, देश के पर्यावरण संरक्षण और सुधार का तथा वन एवं वन्य जीवों की रक्षा करने के प्रया करेगा।'' 42वें संविधान संशोध के अनुच्छेद 51।(ह) के अनुसार भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि व'' प्राकृतिक पर्यावरण की जिसके अंतर्गत वन , झील, नदी और वन्य जीव हैं, रक्षा करें और उसका सुधार करें तथा प्राणी मात्र के प्रति दया भाव रखें।'' केन्द्र सरकार द्वारा 1980 में पर्यावरण मंत्रालय की स्थापना की गई।

विधि के शासन (Rule of Law) में किसीजन–समस्या का विधि द्वारा ही हल किया जाता है। स्वतंत्र भारत में यह अनुभव किया कि औद्येगिक विकास, कृषि भूमि विस्तार, परिवहन सुविधाओं के प्रसार , खनन गतिविधियों के विस्तार तथा जनसंख्या वृद्धि के कारण पर्यावरण को अत्यधिक क्षति हो रही है। पर्यावरण हास को रोकने के लिए तत्कालीन कानूनी प्रावधान अपर्याप्त लगे। अतः प्रदूषण की रोकथाम तथा पर्यावरण को संरक्षण प्रदान करने के लिए विभिन्न अधिनियम बनाए गए , जिनमें निम्न प्रमुख हैं :

1 पर्यावरण (संरक्षण) अधिनियम, 1986

(The Environment (Protection) Act , 1986)

(i) यह अधिनिय संसद द्वारा 23 मई , 1986 को पारित किया गया तथा 19 नवम्बर 1986 को लागू किया गया। इसमें 4 अध्याय तथा 26 धाराएं हैं। इसे पारित करने का मुख्य उद्देश्य संयुक्त राष्ट्र द्वारा पर्यावरण संरक्षण की दिशा में किए गए प्रयासों को भारत में विधि बनाकर लागू करना है। प्रथम अध्याय की धारा के (1) अनुसार इसका विस्तार सम्पूर्ण भारत में है।

(ii) प्रथम अध्याय की धारा (2) में पर्यावरण , पर्यावरणीय प्रदूषक, पर्यावरणीय प्रदूषण ,व्यवहार करने, परिसंकटमय पदार्थ, अधिभोगी तथा विहित शब्दों की विशेष परिभाषाएं दी गई हैं।

(iii) द्वितीय अध्याय में चार धाराएं हैं जिनमें धारा (3) में पर्यावरण के संरक्षण और उसमें सुधार के लिए उपाय करने की केन्द्र सरकार की शक्तियां , धारा (4) में अधिकारियों की नियुक्ति, उनकी शक्तियांतथा कृत्य, धारा (5) में निर्देश देने की शक्ति तथा धारा (6) में पर्यावरणीय प्रदूषण को विनियमित करने हेतु नियमों उल्लेख है।

(iv) अध्याय तीन में पर्यावरण प्रदूषण के निवारण नियंत्रण तथा उपशासन से संबंधित धारा (7) से (17) अर्थात् 11 धाराएं हैं। धारा (15) में उपबंधों का उल्लंघन करने पर दण्ड (शास्ति) से संबंधित विधिक प्रावधान दिए गए है।

(v) अध्याय चार में धारा (18) से (26) अर्थात् कुल 9 धाराओं में विविध वर्णन हैं। इनमें सद्भाव में की गई कार्यवाही को संरक्षण, अपराधों का संज्ञान, अधिकारिताका वजर्न, प्रत्यायोजन की शक्तियां, नियम बनाने की शक्तियां, नियमों को संसद के समक्ष रखा जाना, का उल्लेख है।

पर्यावरण (संरक्षण) अधिनियम, 1986 का विवरण

अध्याय क्र.	अध्याय का शीर्षक	धाराएं
1.	प्रारंभिक	1–2
2.	केन्द्र सरकार की सामान्य शक्तियां	3–6
3.	पर्यावरणीय प्रदूषण का निवारण, नियंत्रण और शमन	7–17
4.	विविध	18–26

EPA अधिनियम की अच्छाईयां (Merits)

(i) खतरनाक फैक्ट्रियों, परिसंकटमय पदार्थों था पर्यावरणय आपदाओं को स्पष्टः परिभाषित किया गया है।
(ii) प्रदूषण प्रावधानों को मात्र जल व वायु तक सीमित न कर इनका विस्तार किया गया है।
(iii) खतरनाक प्रदूषण को रोकने के लिए अधिनियम के उपबंधों का उल्लंघन करने वालों को सख्त दण्ड के प्रावधान किए गए हैं।
(iv) केन्द्र सरकार को प्रदूषणकारी उद्योगों को निर्देशित व बन्द करने की शक्तियां प्रदान की गई हैं।
(v) व्यक्तियों व कम्पनियों के साथ ही सरकारी विभागों को भी अधिनियम के क्षेत्र में लाया गया है।

EPA अधिनियम कमजोरियां (Demerits)

(i) समस्त शक्तियाकेन्द्र सरकार में निहित होने से राज्यों में पर्यावरण संरक्षण त्वरित नहीं हो पाएगा।
(ii) सामान्य न्यायालयों में पहलने ही लाखों मुकदमें अनिर्णीत पड़े हैं, ऐसे में पर्यावरण प्रदूषण संबंधी मुकदमों की सुनवाई के लिए विशेष न्यायालयों की व्यवस्था की जानी चाहिए थी। यह प्रावधान इस अधिनियम में नहीं है।
(iii) अधिनियम के अनुसार किसी भी भारतीय नागरिक को किसी उद्योग द्वारा किए जा रहे प्रदूषण के संबंध में जनहित याचिका दायर करने का अधिकार तो दिया है, किन्तु उसके साथ 60 दिन के नोटिस जैसे प्रतिबंधों से वह स्वयं को असहाय होता है।
(iv) प्रदूषण के अन्य प्रकारों, जिसमें ओजोन परत का क्षरण, अम्लीय वर्षा , ग्रीन हाउस प्रभाव, समुद्री प्रदूषण, नाभिकीय प्रदूषण आदि आते हैं का इस अधिनियम में कोई स्थान नहीं है।

2 वायु (प्रदूषण निवारण और नियंत्रण) अधिनियम, 1981

The air (Prevention and Control of Pollution) Act, 1981

1. संसद द्वारा 29 मार्च, 1981 को पारित 'वायु (प्रदूषण निवारण और नियंत्रण) अधिनियम' 16 मई , 1981 को सम्पूर्ण भारत में लागू किया गया। इसे 1987 में संशोधित किया गया। इसे पारित करने का मुख्य उद्देश्य जून 1972 में राष्ट्र संघ द्वारा स्टॉकहोम में अंतर्राष्ट्रीय सम्मेलन के प्रस्तावों के अनुरूप पर्यावरण में निरंतर हो रहे वायु प्रदूषण की रोकथाम के लिए कारगर कानून बना रहा है।

2. इस अधिनियम की कुल 54 धाराओं को सात अध्यायों में निम्नानुसार विभक्त किया गया है :

वायु प्रदूषण निवारण एवं नियंत्रण अधिनियम , 1981 का विवरण

अध्याय क्र.	अध्याय का शीर्षक	धाराएं
1.	प्रारंभिक	1–2
2.	वायु प्रदूषण निवारण और नियंत्रण के लिए केन्द्रीय व राज्य मण्डल	3–15
3.	(बोर्ड)	16–18
4.	बोर्डों की शक्तियां और कृत्य	19–31
5.	वायु प्रदूषण का निवारण और नियंत्रण	32–36
6.	विधियां, लेखे तथा लेखा परीक्षा	37–46
7.	सजाएं (शास्ति) तथा प्रक्रिया	47–5
	विविध	

3. अधिनियम की प्रमुख धाराओं में धारा (2) में वायु प्रदूषक , वायु प्रदूषक, अनुमोदित उपकरण, अनुमोदित ईंधन, मोटर गाड़ी, केन्द्रीय बोर्ड, चिमनी, नियंत्रक उपकरण, उत्सर्जन, औद्योगिक संयंत्र , सदस्य, राज्य बोर्ड आदि शब्दों को परिभाषित किया गया है।
4. धारा (20) में मोटरगाड़ियों से उत्सर्जन के लिए मानक सुनिश्चित करने हेतु अनुदेश देने की शक्ति वर्णित है।
5. धारा (21) के अनुसार कोई भी व्यक्ति राज्य बोर्ड की पूर्व सहमति क बिना किसी भी वायु प्रदूषण नियंत्रण क्षेत्र में किस भी औद्योगिक संयंत्र की न तो स्थापना करेगा और न चलाएगा।
6. धारा (24) राज्य बोर्ड द्वारा सशक्त व्यक्ति को किसी औद्योगिक इकाई में प्रवेश व निरीक्षण की शक्ति प्रदा करती है।

टिप्पणी – अनेक कमियों के कारण वायु (प्रदूषण निवारण और नियंत्रण) अधिनियम, 1981 बहुत कारगर एवं उपयोगी नहीं हो सका। इस अधिनियम के क्रम में एक नया स्वतंत्र वायु (प्रदूषण निवरण और नियंत्रण) संशोधन अधिनियम 1987 बनाया गया।

2 जल (प्रदूषण निवारण और नियंत्रण) अधिनियम 1974

1. जल प्रदूषण के नियंत्रण और रोकथाम तथा देश में पानी की उच्च गुणवत्ता बनाए रखने हेतु इसे वर्ष 1974 में अधिनियमित किया गया था। यह अधिनियम वर्ष 1988 में संशोधित किया गया था। जल (प्रदूषण निवारण और नियंत्रण) उपकर अधिनियम कुछ औद्योगिक गतिविधियों के व्यक्तियों द्वारा पानी की खपत पर उपकर लगाने के लिये 1977 में अधिनियमित किया गया था।
2. यह उपकर जल (प्रदूषण निवारण और नियंत्रण) अधिनियम, 1974 के तहत जल प्रदूषण के नियंत्रण और हस्तक्षेप के लिये गठित केंद्रीय बोर्ड के संसाधनों और राज्य सरकार के विकास की दृष्टि से इकट्ठा किया जाता है। इस अधिनियम में अंतिम बार वर्ष 2003 में संशोधन किया गया था।

जल (प्रदूषण निवारण और नियंत्रण) अधिनियम, 1974 का विवरण

अध्याय	अध्याय का शीर्षक	धाराएं
1.	प्रारंभिक	1–2
2.	वायु प्रदूषण निवारण और नियंत्रण के लिए केन्द्रीय व राज्य मण्डल (बोर्ड)	3–12
3.	संयुक्त बोर्ड	13–15
4.	बोर्डों की शक्तियां और कृत्य	16–18
5.	वायु प्रदूषण का निवारण और नियंत्रण	19–33
6.	विधियां, लेखे तथा लेखा परीक्षा	34–40
7.	सजाएं (शास्ति) तथा प्रक्रिया	41–50
8.	विविध	51–64

3. अधिनियम की प्रमुख धाराओं में धारा (2) में प्रदूषण मल बहिःस्राव, मलजल, सरिता, निकास, बोर्ड आदि शब्दों को परिभाषित किया गया है।
4. धारा (20) राज्य बोर्ड के सक्षम अधिकारियों को जल प्रदूषण व निवारण के संबंध में जानकारी अभिप्राप्त करने की शक्ति प्रदान करती है।
5. धारा (21) बोर्ड द्वारा बहिःस्राव के नमूने लेने की शक्ति और उसके संबंध में की जाने वाली प्रक्रिया से संबंधित है।
6. धारा 41 से 46 त अधिनियम के प्रावधानों का उल्लंघन कर जल प्रदूषण करने वालों के लिए सजाओं का प्रावधान है।

टिप्पणी – यद्यपि यह अधिनियम विधिवेत्ताओं द्वारा कड़ी मेहनत से तैयार किया गया था, किन्तु जल प्रदूषण के नियंत्रण में अधिक कारगर सिद्ध न हो सका। सिविल कोर्ट द्वारा उद्योगपतियों के आवेदन करने पर निषेधाज्ञा प्रदान करने की व्यवस्था के कारण अधिनियम के कड़े प्रावधान अशक्त हो गए। इस अधिनियम के प्रकाशन के बाद विभिन्न धाराओं के संदर्भ में इतने आक्षेप आए कि इसे उपयोग में लाने में कठिनाई हुई। बाद में एक पूरा संशोधित अधिनियम 'जल (प्रदूषण निवारण और एवं नियंत्रण) संशोधन अधिनियम 1978' ही पारित करना पड़ा।

3 वन्यजीव (संरक्षण) अधिनियम, 1972

The Wild life (Protection) Act, 1972

(1) वन्यजीव (संरक्षण) अधिनियम, संसद द्वारा 9 सितम्बर 1972 को पारित किया गया । इसके द्वारा वन्य जीवों के संरक्षण को राज्य सूची से हटाकर समवर्ती सूची में रखा गया। अधिनियम का उद्देश्य तेजी से लुप्त हो रहे वन्य जीवों के संरक्षण तथा प्रबंधन को सुनिश्चित करना था। इसमें वन्य जीवों के शिकार तथा उनसे निर्मित वस्तुओं के व्यापार को निषिद्ध करने के प्रावधान किए गए।

(2) इस अधिनियम की कुल 66 धाराओं और 7 अध्यायों में निम्नानुसार विभक्त किया गया है :

वन्य जीव (संरक्षण) अधिनियम, 1972 का विवरण

अध्याय क्र.	अध्याय का शीर्षक	धाराएं
1.	प्रारंभिक	1-2
2.	पदस्थापित किए जाने वाले अधिकारी	3-8
3.	वन्यजीवों का आखेटन	9-17
3 ।	विशिष्ट पादपों का संरक्षण	17A-17H
4	अभ्यारण्य , राष्ट्रीय पार्क तथा संवृत क्षेत्र	18-38
4 ।.	केन्द्रीय जंतु प्राधिकरण का गठन	38A-38J
5	वन्य जीवों का व्यापार या वाणिज्य	39-49
5 ।.	जंगली जानवरों से निर्मित वस्तुओं के व्यापार अथवा वाणिज्य को निषिद्ध करना	49A-49C
6.	अपराधों की पहचान तथा विधिक प्रक्रिया	50-58
7.	विविध	59-66

(3) अधिनियम की प्रमुख धाराओं में धारा (2) में जन्तु, जंतु से निर्मित वस्तु, संवृत्त क्षेत्र, आवास वन्य जीव, आखेटन, राष्ट्रीय पार्क, अभ्यारण्य आदि शब्दों को परिभाषित किया गया है।

(4) धारा (8) में वन्यजीव सलाहकार बोर्ड के कर्तव्य तथा धारा (9) में प्रतिबंधित आखेट को स्पष्ट किया गया है।

(5) धारा 50 से 58 में अधिनियम के उपबंधों का उल्लंघन करने वालों को सजा (शास्ति) दिए जाने संबंधी प्रावधान हैं।

(6) धारा (65) मे निकोबार द्वीप समूह की जनजातियों के आखेटन अधिकारों के अप्रभावित रहने का उल्लेख है।?

4 वन (संरक्षण) अधिनियम, 1980

The forest (Protection) Act, 1980

1. वन (संरक्षण) अधिनियम को 25 अक्टूबर, 1980 को लागू किया गया। इसे 1988 में संशोधित किया गया। अधिनियम का उद्देश्य वन विनाश र प्रभावी रोकथाम करते हुए इस महत्वपूर्ण प्राकृतिक संसाधन को बचाना है।
2. अधिनियम के अनुसार किसी भी आरक्षित वन या वन भूमि के गैर वानिकी उपयोग की घोषणा से पूर्व केन्द्र सरकार का अनुमोद राज्यों के लिए अनिवार्य कर दिया गया।
3. वन अधिनियम का उल्लंघन करने वालों के विरूद्ध दण्डात्मक प्रावधानों को और कड़ा करने के लिए 1988 में संशोधन किया गया। 'गैरवानिकी उद्देश्य' का विस्तार करने हुए चाय व कॉफी बागानों , रबर, औषधीय पौधों व गरम–मसालों की कृषिको सम्मिलित किया गया।
4. केन्द्रीय पर्यावरण , वन एवं वन्य जीव विभाग द्वारा वनों की सुरक्षा व संरक्षण पर निगरानी छः प्रादेशिक कार्यालय स्थापित करने का प्रावधान किया गया, जोकि बेंगलुरू, भोपाल, भुवनेश्वर,, शिलांग तथा चण्डीगढ़ में खोले गए।
5. केन्द्र सरकार के सुझाव पर विभिन्न राज्यों व संघ शासित प्रदेशों में पर्यावरण संरक्षण (Environment Protection Councils, E.P.C) स्थापित कने का प्रावधान रखा गया।

5 राष्ट्रीय हरित अधिकरण

National Green Tribunal (NGT)

यह ट्रिब्यूनल पर्यावरण संबंधी मामलों की देखरेख करने वाल एक शीर्ष निकाय है, जिसका गठन एक अधिनियम के अंतर्गत 18 अक्टूबर, 2010 को किया गया था। वन एवं पर्यावरा मंत्रालय के अधीन कार्य करने वाले इस अधिकरण की स्थापना वनों एवं अन्य प्राकृतिक संसाधनों के संरक्षण से संबंधित मामलों के त्वरित एवं प्रभावी निपटारे के लिए की गई है। इसके सदस्यों में न्यायिक एवं विशेषज्ञ सदस्य हो सकते हैं। राष्ट्रीय हरित अधिकरण ने पहली सुनवाई 25 मई 2011 को शुरू की थी। दिल्ल, भोपाल, कोलकाता, चेन्नई और पुणे में ट्रिब्यूनल की सुनवाई की व्यवस्था है

पर्यावरण से संबंधित किसी भी मामले की अपील एवं अरजियों की सुनवाई इस ट्रिब्यूनल में हो सकती है। इसके अंतर्गत वायु प्रदूषण, जल प्रदूषण, पर्यावरण संरक्षण और जैव विविधता सहित सात कानूनों के क्रियान्वयन से उठने वाले महत्वपूर्ण पर्यावरणीय मामले सुने जा सकते हैं। यह केवल अपीलीय निकाय नहीं है, बल्कि इसके मूल क्षेत्राधिकार में कुछ खास कोटि के मामलों पर निर्णय देने का अधिकार भी आता है। यह क्षतिपूर्ति का निर्णय दे सकता है और क्षतिग्रस्त परिस्थितिकीय और सम्पत्ति के फिर से बहाली का निर्णय भी दे सकता है। ट्रिब्यूनल को चुनौती देने के लिए निर्णय के तीस दिनों के भीतर ट्रिब्यूनल में अपील कर सकता है।

पर्यावरणीय कानूनों को लागू करने में सम्मिलित मुद्दे

पर्यावरण संरक्षण हेतु बनाए गए विभिन्न कानूनों के क्रियान्वयन में अनेक प्रकार की बाधाए हैं–

1. अशिक्षा व अनभिज्ञता के कारण जनसंख्या का बड़ा भाग नहीं जानता कि पर्यावरण के तत्वों (जल,वायु, भूमि आदि) की गुणवत्तामें हास करने पर कोई कानूनी उल्लंघन होता है।
2. छोटी औद्योगिक इकाईयों चलाने वाले तथा छोटी खदानों के मालिकों का आर्थिक पक्ष इतना सुदृढ़ नही होता कि अपशिष्टों का सुरक्षित निस्ताण कर सकें या शुद्धिकरण संयंत्र लगा सकें।
3. खनन, उद्योग, लकड़ी कटाई आदि व्यवसाय में बहुत बड़ी संख्या में लोग जीवनयापन करते हैं। देश में बढ़ती बेरोजगारी व गरीबी के कारण पर्यावरण के हित में इन्हें तुरन्त बन्द करना एवं वैकल्पिक व्यवस्था करना मुश्किल कार्य है।
4. वन्य जीवों व लकड़ी के तस्करों क अंतर्राज्यीय गिरोहों को पकड़ने के मार्ग में विभिन्न राज्यों की सीमाएं, अलग–अलग कानून, परस्पर तालमेल का अभाव , सीमित संसाधन आदि बाधाओं के कारण सफलता नही मिल पाती है।
5. विभिन्न कानूनी प्रावधानों व खामियों का लाभ उठाकर अनेक बार उद्योगपति पर्यावरण कानूनों का उल्लंघन करके भी बच निकलते हैं या कूनी कार्यवाही को लम्बित करने में सफल हो जाते हैं।
6. अनेक धार्मिक व सामाजिक रीति–रिवाज ऐसे होते हैं, जिनसे पर्यावरण को हानि होती है, किन्तु जनभावनाएं भड़कने के कारण इन पर सख्ती नहीं की जा सकती। इनमें जलाशयों में मूर्तियों का विसर्जन , ताजियों को ठण्डा करना, पूजा सामग्री को जलाशयों में फेंकना, धार्मिक स्थलों पर उच्च क्षमता के ध्वनि विस्तार यंत्र लगाना, होली के पश्चात् वन्य जीवों के शिकार की एड़ा प्रथा आदि कृत्य प्रमुख हैं।

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जैव–विविधता अधिनियम, 2002

सुनिल दास [1], आरती लकड़ा [2], सोनाली लकड़ा [3], देवानन्द सिंह [4], डॉ. रोहित कुमार बरगाह [5]

1,2,3,4 जनभागीदारी शिक्षक (रसायन शास्त्र), शासकीय श्यामा प्रसाद मुखर्जी महाविद्यालय सीतापुर, जिला–सरगुजा (छ0ग0)

5. सहायक प्राध्यापक (रसायन शास्त्र),शासकीय श्यामा प्रसाद मुखर्जी महाविद्यालय सीतापुर, जिला–सरगुजा (छ0ग0)

1 प्रस्तावना

जैव विविधता पृथ्वी पर सारे जीव वैविध्य को समावृत करती है। भारत वश्व के 12 मेगा विविधतापूर्ण देशों में से एक है। विश्व में 2.5 प्रतिशत भू–क्षेत्र वाला भारत, वैश्विक प्रजातियों में से 7.5 प्रतिशत का प्रतिनिधित्व करता है। भारत पारम्परिक एवं समसामयिक ज्ञान की सांकेतिक एवं अनौपचारिक दोनों पद्वतियो में धनी है।

भारत 5 जून, 1992 को रियो दि जेनेरो में हस्ताक्षर किये गये जैव विविधता से संबंधित संयुक्त राष्ट्र कन्वेंशन में एक पक्षकार है। उक्त कन्वेंशन 29 दिसम्बर, 1993 को प्रवृत्त हुआ। राज्यों का अपने जैव संसाधनों पर संप्रभु अधिकारों का संज्ञान करते हुए, कन्वेंशन यह चाहता है कि पक्षकार अपने राज्य के कानून तथा आपस में शर्तों का अनुपालन करते हुये अन्य पक्षकारों को आनुवंशिक संसाधनों की पहुंच के लिये अवसर प्रदान करें।1 जैव विविधता कन्वेंशन स्थानीय तथा देशीय समुदायों के योगदानों और पारम्परिक ज्ञान, उपयोजन तथा नवपरिवर्तनों द्वारा जैव संसाधनों के पोषणीय उपयोग का संज्ञान करता है और अपने ज्ञान, उपयोजन तथा नवपरिवर्तनों के उपयोग द्वारा उदीयमान लोगों के लिए हितों में साम्यापूर्ण हिस्सा बंटाने का प्रावधान भी करता है।

जैव विविधता अधिनियम ,2002 का निर्माण जैव विविधता पर संयुक्त राष्ट्र कन्वेंशन 1992 में निहित उद्देश्य को प्राप्त करने के लिए भारत के प्रयास के परिणाम स्वरूप अस्तित्व में आया। जो राज्यो को स्वयं के जैविक संसाधनों का उपयोग करने के लिए उनके सम्पूर्ण अधिकारो को मान्यता प्राप्त करता है। भारत की जैविक संसाधनों की प्रचुरता और उससे संबंधित स्थानीय ज्ञान की एक अच्छी जानकारी उपलब्ध है। अधिवेशन के समानांतर लाभ को वितरण के उद्देश्य की प्राप्ति के किसी सहायक यंत्र का संचालन, एक बड़ी चुनौती है। इस उद्देश्य की प्राप्ति के लिए एक विस्तृत विचार–विमर्श के पश्चात जैविक विविधता पर अधिनियम तैयार किया गया। इस कानून का उद्देश्य जैविक संसाधनों की उपलब्धि नियंत्रित कराना, जिससे उनके प्रयोग से उत्पन्न लाभ का समानान्तर वितरण हो सके। जैविक विविधता विधेयक, जो कि संसद में 15 मई, सन् 2000 को प्रस्तावित हुआ था उसे निरीक्षण, इत्यादि के लिए संसद की विज्ञान, तकनीकी, पर्यावरण व वनों की समिति को भेज दिया गया था। साक्षियों व सबूतों के परीक्षण के पश्चात् इसे स्थायी समिति (Standing Committee) ने इस विधेयक को कुछ संशोधनों के साथ पारित कर दिया था। इस आयोग द्वारा दिए गए सुझावों पर आधारित सरकारी प्रस्ताव को मंत्रालय (केबिनेट) ने स्वीकृति दी। जैविक विविधता विधेयक 2002 को लोकसभा ने सन् 2 दिसम्बर 2002 को और राज्यसभा ने 11 दिसम्बर सन् 2002 को पारित किया था।

जैव विविधता की परिभाषा– ''जैव विविधता का आशय अर्द्धस्थलीय, समुद्री और अन्य जलीय पारिस्थितिक तंत्रों एवं पारिस्थितिक परिसरों में विविधता तथा सजीवों के मध्य होने वाली परिवर्तनशीलता से है, इसमें प्रजातियों व पारिस्थितिक तंत्रो के मध्य विविधता भी शामिल होती है।''

2 जैव विविधता अधिनियम, 2002 के प्रमुख उद्देश्य (Main Objects of the Biological Diversity Act, 2002)

जैव विविधता अधिनियम, 2002 के प्रमुख उद्देश्य निम्नलिखित हैं–

1. देश के जैव संसाधनों की पहुंच (Access) को नियमित करना ताकि जैव संसाधनों के उपयोग से अभिप्राप्त लाभों का साम्यापूर्ण हिस्सा तथा जैव संसाधनों से सहबद्ध ज्ञान प्राप्त किया जा सके।
2. जैव विविधता का संरक्षण तथा पोषणीय उपभोग करना।
3. जैव विविधता से संबंधित स्थानीय समुदायों की जानकारी का आदर एवं संरक्षण करना।
4. स्थानीय लोगों को जैव संसाधनों के संरक्षक एवं तत्संबंधी ज्ञान तथा सूचना के संवर्धकों के रूप में स्वीकृत करते हुए उन्हें तत्संबंधी लाभों का साम्यापूर्ण हिस्सा प्राप्त करना।
5. विलुप्त हो रही प्रजातियों का संरक्षण एवं पुनर्वास।
6. जैव विविधता के संरक्षण एवं विकास की दृष्टि से महत्वपूर्ण क्षेत्रों को जैव विविधता विरासतीय स्थल (Heritage site) घोषित करना।
7. समितियों के गठन द्वारा जैव विविधता अधिनियम, 2002 के कार्यान्वयन में राज्य सरकारों एवं स्थानीय निकायों की भागीदारी सुनिश्चित करना।

3 अधिनियम की प्रमुख विशेषताएं

1. अधिनियम राष्ट्रीय जैव विविधता प्राधिकरण के पूर्व अनुमोदन के बिना निम्नलिखित गतिविधियों को प्रतिबिंब करता है:
    - किसी भी व्यक्ति अथवा संगठन (भारत में स्थित अथवा नहीं) द्वारा शोध या व्यावसायिक उपयोग हेतु भारत में उत्पादित किसी भी जैव संसाधन की प्राप्ति।
    - भारत में पाए जाने वाले या भारत से प्राप्त जैव संसाधन से संबंधित किसी भी प्रकार के शोध परिणामों का स्थानांतरण।
    - भारत से प्राप्त जैव संसाधनों पर किये गए शोध पर आधारित किसी भी आविष्कार पर बौद्धिक संपदा अधिकारों का दावा।
2. अधिनियम ने जैव संसाधनों तक पहुँचे को विनियमित करने के लिये एक त्रिस्तरीय संरचना की परिकल्पना की:
    - राष्ट्रीय जैव विविधता प्राधिकरण (NBA)
    - राज्य जैव विविधता बोर्ड (SBB)
    - जैव विविधता प्रबंधन समितियाँ (BMC)
3. अधिनियम इन प्राधिकरणों हेतु देश के जैव प्राकृतिक संसाधनों से संबंधित किसी भी अनुसंधान परियोजना को निष्पादित करने के लिये विशेष वित एवं एक पृथक बजट का प्रावधान करता है।
    - यह जैव संसाधनों के धारणीय उपयोग की निगरानी करेगा तथा वित्तीय निवेश व प्राप्तियों पर नियंत्रण रखेगा तथा पूंजी एवं बिक्री की उचित व्यवस्था करेगा।
4. इस अधिनियम के तहत NB। के परामर्श से केंन्द्र सरकार निम्नलिखित उपाय करेगी:

- संकटाग्रस्त प्रजातियों के बारे में सूचित करेगी और उनके संग्रहण को प्रतिबंधित या विनियमित करने के साथ ही पुनर्वास को संरक्षित करेगी।
- जैव संसाधनों की विभिन्न श्रेणियों के लिये कोष के रूप में संस्थानों को नामित करेगी।

5. अधिनियम के तहत सभी अपराधों को संज्ञेय एवं गैर– जमानती रूप में निर्धारित करना।
6. इस अधिनियम के तहत राष्ट्रीय जैव विविधता प्राधिकरण या राज्य जैव विविधता बोर्ड के आदेश अथवा लाभ के बँटवारे निर्धारण से संबंधित किसी भी शिकायत को राष्ट्रीय हरित अधिकरण के पास ले जाया जाएगा।

4 राष्ट्रीय जैव विविधता प्राधिकरण
(National Biodiversity Authority)

जैव विविधता अधिनियम, 2002 की धारा 8 के प्रावधानों के अनुसार अधिनियम के प्रयोजनों के लिये केन्द्रीय सरकार द्वारा राष्ट्रीय जैव विविधता प्राधिकरण के नाम से एक निकाय की स्थापना की गयी है। राष्ट्रीय जैव विविधता प्राधिकरण एक निगमित निकाय है जिसका शाश्वत उत्तराधिकार और सामान्य मुद्रा है तथा इसे जंगम और स्थावर दोनों ही प्रकार की सम्पत्ति अर्जित करने की या उसके व्ययन करने की और संविदा करने की शक्ति प्राप्त है तथा वह उस नाम से वाद ला सकता है या उसके विरूद्ध वाद लाया जा सकता है।

प्राधिकरण एक स्वशासी निकाय होता है जो जैव संसाधनों के संरक्षण, उसके पोषणीय उपयोग तथा फायदों में साम्यापूर्ण हिस्सा बंटाने से संबंधित विषयों के बारे में भारत सरकार के लिये सरल, विनियामक और सलाहकारी कृत्यों को निष्पादित करता है। राष्ट्रीय जैव विविधता प्राधिकरण का प्रधान कार्यालय चेन्नई में स्थित है। प्राधिकरण केन्द्रीय सरकार के पूर्व अनुमोदन से भारत में अन्य स्थानों पर भी कार्यालय स्थापित कर सकता है।

4.1 राष्ट्रीय जैव विविधता प्राधिकरण का गठन

(Comosition of National Bio-diversity Authority)

राष्ट्रीय जैव विविधता प्राधिकरण का गठन निम्नलिखित सदस्यों से मिलकर होता है –

(क) अध्यक्ष – राष्ट्रीय जैव विविधता प्राधिकरण के अध्यक्षकी नियुक्ति केन्द्रीय सरकार द्वारा की जाती है। अध्यक्ष ख्यातिप्राप्त व्यक्ति होता है जिसके पास जैव विविधता के संरक्षण और उसके पोषणीय उपयोग में तथा फायदों में साम्यापूर्ण हिस्सा बंटाने से सम्बन्धित विषयों में पर्याप्त ज्ञान और अनुभव होना अपेक्षित है।

4.2 अध्यक्ष की शक्तियां और कर्तव्य

(Powers and Duties of Chairperson)

जैव विविधता अधिनियम, 2004 के 13 के अनुसार राष्ट्रीय जैव विविधता प्राधिकरण के अध्यक्ष की शक्तियां और कर्तव्य निम्नलिखित हैं –

(1) अध्यक्ष का प्राधिकरण के दिन–प्रतिदिन के क्रियाकलापों पर सम्पूर्ण नियंत्रण होता है।

(2) प्राधिकरण के अध्यक्ष को प्राधिकरण के अधिकारी और कर्मचारिवृन्द के ऊपर साधारण अधीक्षण की शक्तियां होती हैं और वह प्राधिकरण के कार्यों के संचालन और प्रबंध के लिये आवश्यक निदेश जारी कर सकता है।

(3) अध्यक्ष प्राधिकरण के सभी गोपनीय कागजों और अभिलेखों का भारसाधक होता है और उनकी सुरक्षित अभिरक्षा के लिये उत्तरदाय होता है।

(4) प्राधिकरण द्वारा जारी किये जाने वाले सभी आदेश और अनुदेश अध्यक्ष या इस निमित्त उसके द्वारा प्राधिकृत किसी अधिकारी के हस्ताक्षर के अधीन होते हैं।

(5) अध्यक्ष या तो स्वयं इस प्रयोजन के लिये प्राधिकृत प्राधिकरण के किसी अधिकारी के माध्यम से अनुमोदित बजट के सभा सदस्यों की मंजूरी और वितरित कर सकता है।

(6) अध्यक्ष को सभी प्राक्कलनों (Estimates) को प्रशासनिक और तकनीकी मंजूरी अनुदत्त करने के लि पूर्ण शक्तियां होती हैं।

(7) अध्यक्ष प्राधिकरण के सभी अधिवेशनों को बुलाता है और उनको अधिसूचित करता है और यह सुनिश्चित करता है कि प्राधिकरण द्वारा किये गये सभी विनिश्चय समुचित रीति में कार्यान्वित किये गये हैं।

(8) अध्यक्ष ऐसी अन्य शक्तियों का प्रयोग और ऐसे अन्य कृत्यों का पालन करता है जो समय–समय पर प्राधिकरण को केन्द्रीय सरकार द्वारा उसे प्रत्यायोजित किये जायें।

अध्यक्ष राष्ट्रीय जैव विविधता प्राधिकरण का मुख्य कार्यपालक होता है और वह ऐसी शक्तियों का प्रयोग और ऐसे कर्तव्यों का पालन करता है जो उसे अधिनियम के प्रयोजनों के लिये केन्द्रीय सरकार द्वारा विहित की जाती है।

4.3 अध्यक्ष की पदावधि

(Term of office of the Chairperson)

(क) प्राधिकरण का अध्यक्ष तीन वर्ष की अवधि के लिये पद धारण करता है और पुनर्नियुक्ति के लिये पात्र होता है। कोई अध्यक्ष 65 वर्ष की आयु प्राप्त करने पर या उसकी अवधि की समाप्ति के पश्चात् , जो भी पूर्वतर हो, पद धारण नहीं करता है। अध्यक्ष केन्द्रीय सरकार को कम से कम एक मास की सूचना देकर अपने पद से त्याग पत्र दे सकता है।

(ख) केन्द्रीय सरकार द्वारा तीन पदेन सदस्यों की नियुक्ति की जाती है, जिनमें जनजाति कार्यों से संबंधित मंत्रालय का प्रतिनिधित्व करने के लिये और पर्यावरण एवं वन से संबंधित मंत्रालयों का प्रतिनिधित्व करने के लिये दो सदस्य जिसमें से एक वन अपर महानिदेशक या वन महानिदेशक होता है।

(ग) निम्नलिखित से सम्बन्धित केन्द्रीय सरकार के समबद्ध मंत्रालयों का प्रतिनिधित्व करने के लिये केन्द्रीय सरकार द्वारा सात पदेन सदस्य नियुक्त किये जाते हैं –

(i) कृषि अनुसंधान और शिक्षा

(ii) जैव प्रौद्योगिकी,

(iii) समुद्र प्रौद्योगिकी,

(iv) कृषि एवं सहकारिता,

(v) औषधि एवं होम्येपैथिक की भारतीय पद्धतियां,

(vi) विज्ञान एवं प्रौद्योगिकी,

(vii) वैज्ञानिक एवं औद्योगिक अनुसंधान।

(घ) ऐसे पांच गैर शासकीय सदस्य जो ऐसे विशेषज्ञों और वैज्ञानिकों में से नियुक्त किये जाते हैं जिनके पास जैव विविधता के संरक्षण, जैव संसाधनों के पोषणीय उपयोग और जैव संसाधनों के उपयोग से उद्‌भूत फायदों में साम्यापूर्ण हिस्सा बंटाने से संबंधित विषयों में विशेष ज्ञान और अनुभव हो और जो उद्योग के प्रतिनिधि, जैव संसाधनों के संरक्षक, सर्जक और जानकारी धारण करने वाले हों।

4.4 सदस्यों का हटाया जाना

(Removal of Members)

केन्द्रीय सरकार राष्ट्रीय जैव विविधता प्राधिकरण के किसी सदस्य को पद से हटा सकती है, यदि वह व्यक्ति –

(क) दिवालिया न्यायनिर्णीत किया गया हो, या

(ख) किसी ऐसे अपराध का सिद्धदोष ठहराया गया है जिसमें नैतिक अधमता अन्तर्वलित है, या

(ग) शारीरिक या मानसिक रूप से सदस्य के रूप में कार्य करने के अयोग्य हो गया हो, या

(घ) जिसने अपने पद का ऐसा दुरूपयोग किया है जिससे पद पर उसका बने रहना लोकहित के लिये अहितकर है, या

(ङ) जिसने ऐसा वित्तीय या अन्य हित अर्जित किया है जिससे सदस्य के रूप में उसके कृत्यों पर प्रतिकूल प्रभाव पड़ने की सम्भावना है

प्राधिकरण के किसी सदस्य को उपर्युक्त विनिर्दिष्ट किसी आधार पर किसी ऐसे अधिकारी द्वारा, जो केन्द्रीय सरकार द्वारा नियुक्त भारत सरकार के सचिव से नीचे के रैंक का न हो, सम्यक् और उचित जांच कराये बिना और ऐसे सदस्य को सुनवाई का युक्तियुक्त अवसर दिये बिना उसके पद से नहीं हटाया जा सकता है।

4.5 राष्ट्रीय जैव विविधता प्राधिकरण के कार्य और शक्तियां

(Powers and functions of the National Bio-diversity Authority)

जैव विविधता अधिनियम, 2002 की धारा 18 राष्ट्रीय जैव विविधता प्राधिकरण के कृत्य और शक्तियों के बारे में प्रावधान प्रस्तुत करती है। राष्ट्रीय जैव विविधता प्राधिकरण की धारा 3 (कतिपय व्यक्तियों द्वारा राष्ट्रीय जैव विविधता प्राधिकरण के अनुमोदन के बिना जैव विविधता से संबंधित क्रियाकलापों का न किया जाना), धारा 4 (अनुसंधान के परिणाम राष्ट्रीय जैव विविधता प्राधिकरण के अनुमोदन के बिना कतिपय व्यक्तियों को अन्तरित न किया जाना) और धारा 6 (बौद्धिक सम्पदा अधिकारों के लिये आवेदन राष्ट्रीय जैव विविधता प्राधिकरण के अनुमोदन के बिना न किया जाना) में विनिर्दिष्ट क्रियाकलापों को विनियमित करने और विनियमों द्वारा जैव संसाधनों तक पहुंच और फायदों में साम्यापूर्ण हिस्सा बंटाने तक के लिए मार्गदर्शन जारी करने का कर्तव्य है। राष्ट्रीय जैव विविधता प्राधिकरण अधिनियम की धारा 3, धारा 4 और धारा 6 में विनिर्दिष्ट क्रियाकलापों को करने के लिये अनुमोदन अनुदत्त कर सकता है।

राष्ट्रीय जैव विविधता प्राधिकरण केन्द्रीय सरकार को जैव विविधता के संरक्षण, इसके अवयवों के पोषणीय उपयोग और जैव विविधता संसाधनों के उपयोग में से उद्भूत फायदों के साम्यापूर्ण हिस्सा बंटाने के संबंध में सलाह दे सकता है।

राष्ट्रीय जैव विविधता प्राधिकरण राज्य सरकारों को जैव विविधता के महत्वे क्षेत्रों के चयन में जो विरासत स्थल के रूप में अधिसूचित किये जाने तथा ऐसे विरासत स्थलों के प्रबंध के उपाय के चयन के बारे में सलाह दे सकता है। प्राधिकरण ऐसे अन्य कृत्यों को कर सकता है जो जैव विविधता अधिनियम, 2002 के उपबंधों के कार्यान्वयन के लिये आवश्यक समझे जायें।

राष्ट्रीय जैव विविधता प्राधिकरण केन्द्रीय सरकार की ओर से भारत में अभिप्राप्त किसी जैव संसाधन या ऐसे जैव संसाधन से सहयोजित, जो भारत से व्युत्पन्न हुआ है, भारत के बाहर किसी देश में बौद्धिक सम्पदा अधिकारों को मंजूर करने का विरोध करने के लिये आवश्यक कम उठा सकता है।

4.6 प्राधिकरण के साधारण कार्य

(General Functions of the Authority)

अधिनियम के प्रयोजनों के लिये राष्ट्रीय जैव विविधता प्राधिकरण के साधारण कार्य निम्नलिखित हैं–

1. अधिनियम की धारा 3, धारा 4 और धारा 6 के अधीन उपबंधित क्रियकलापों को शासित करने के लिये प्रक्रिया और मार्गदर्शक सिद्धांत अधिकथित करना।

2. केन्द्रीय सरकार के जैव विविधता के संरक्षण और उसके संघटकों को पोषणीय उपयोग तथा जैविक स्त्रोतों और ज्ञान के उपयोग से उद्भूत फायदों के उचित और साम्यापूर्ण बांटने से संबंधित विषयों के संबंध में सलाह देना।

3. राज्य जैव विविधता बोर्डों के क्रियाकलापों को समन्वित करना।

4. राज्य जैव विविधता बोर्डों को तकनीकी सहायता और मार्गदर्शन उपलब्ध कराना।

5. अध्ययन आरम्भ करना और अन्वेषण तथा अनुसंधान प्रायोजित करना।

6. प्राधिकरण को उसके कृत्यों के प्रभावी निर्वहन में तकनीकी सहायता उपलब्ध कराने के लिये तीन वर्ष से अनधिक की विनिर्दिष्ट अवधि के लिये परामर्शदाताओं को लगाना। परन्तु यह कि यदि तीन वर्ष से अधिक की अवधि के लिये किसी परामर्शदाताओं को लगाना आवश्यक है तो इसके लिये प्राधिकरण द्वारा केन्द्रीय सरकार का पूर्वानुमोदन प्राप्त करना आवश्यक है।

7. जैव विविधता संरक्षण , उसके संघटकों के पोषणीय उपयोग और जैवीय संसाधनों और ज्ञान और उपयोग से उद्भूत फायदों के उचित और साम्प्यापूर्ण बंटवारें से संबंधित तकनीकी और सांख्यिकीय आंकड़ें और मैनुअल, संहितायें या गाइडें संग्रहीत, संकलित और प्रकाशित करना।

8. जैव विविधता संरक्षण और उसके संघटकों के पोषणीय उपयोग और जैवीय संसाधनों और ज्ञान और उपयोग से उद्भूत फायदों के उचित और साम्यापूर्ण बंटवारें से संबंधित जन प्रचार द्वारा वृहतः कार्यक्रम आयोजित करना।

9. जैव विविधता संरक्षण और उसके संघटकों के पोषणीय उपयोग के लिये कार्यक्रमों में लगे या लगाये गये या लगाये जाने वाले कार्मिकों के लिये योजना और प्रशिक्षण आयोजित करना।

10. प्राधिकरण का उसकी रसीदों और केन्द्रीय सरकार से उसके अवमूल्यन को भी समाविष्ट करते हुये वार्षिक बजट तैयार करना परन्तु यह कि केन्द्रीय सरकार द्वारा आवण्टन केन्द्रीय सरकार द्वारा अनुमोदित बजट उपबन्धों के अनुसार प्रचालित किया जायेगा।

11. प्राधिकरण के कृत्यों का प्रभावी रूप से निर्वहन करने के लिये केन्द्रीय सरकार को पदो ंके सृजन करने की सिफारिश करना परन्तु ऐसा पद चहे स्थायी/अस्थायी हो या किसी भी प्रकृति को हो, केन्द्रीयसरकार के पूर्वानुमोदन के बिना सृजित नहीं किया जायेगा।

12. प्राधिकरण के अधिकारियों और सेवकों की भर्ती की पद्धती का अनुमोदन करना।

13. प्रभावी प्रबंधन, संवर्धन और पोषणीय उपयोगों को सुनिश्चित करने के लिये जैव विविधता रजिस्टर और इलेक्ट्रॉनिक डाटा बेस के माध्यम से जैवीय संसाधनों और सहबद्ध पारम्परिक ज्ञान के लिये डाटा बेस बनाने और जानकारी तथा दस्तावेज पद्धति सृजित करने के लिये कदम उठाना।

14. राज्य जैव विविधता बोर्डों और जैव विविधता प्रबंध समितियों का अधिनियम के प्रभावी कार्यान्वयन के लिये लिखि में निदेश देना।

15. प्राधिकरण के कार्यकरण और अधिनियम के कार्यान्वयन के बारे में केन्द्रीय सरकार को रिपोर्ट देना।

16. समय–समय पर जैवीय संसाधनों की बावत स्वामिस्वों के प्रभारों के फायदे ंके बंटवारे की सिफारिश, उपान्तरित और संगृहीत करना।

17. विनिर्दिष्ट प्रयोजनों के लिये राज्य जैव विविधता बोर्डों और जैव विविधता प्रबंध समितियों के लिये अनुदान सहायता और अनुदान मंजूर करना।

18. अधिनियम के कार्यान्वयन के संबंध में किसी क्षेत्र का वास्तविक निरीक्षण करना।

19. भारत से बाहर किसी देश में किसी जैवीय संस्थान और सी अवैध रीति से भारत से अभिप्राप्त ज्ञान के संबंध में बौद्धिक संपदा अधिकार अनुदत्त किये जाने का विरोध करने के लिये विधि– विशेषज्ञों की नियुक्ति के लिये आवश्यक उपाय करना।

20. ऐसे अन्य कार्य करना जो समय–समय पर केन्द्रीय सरकार द्वारा सौंपे जायं या निदेशित किये जायें।

4.7 राष्ट्रीय जैव विविधता प्राधिकरण द्वारा अनुमोदन

(Approval by National Bio-diversity Authority)

जैव विविधता अधिनियम, 2002 की धारा 19 के अनुसार, कोई भी व्यक्ति जो भारत का नागरिक नहीं है या भारत का ऐसा नागरिक जो आयकर अधिनियम, 1961 की धारा 2 के खण्ड (30) में परिभाषित अनिवासी है या ऐसा निगमित निकाय, संगम या संगठन जो (i) भारत में निगमित या रजिस्ट्रीकृत नहीं है, या (ii) तत्समय प्रवृत्त किसी विधि के अधीन भारत में निगमित या रजिस्ट्रीकृत है जिसमें उसकी शेयर पूंजी या प्रबंध में कोई गैर भारतीय भागीदार है, राष्ट्रीय जैव विविधता प्राधिकरण के पूर्व अनुमोदन के बिना भारत में व्युत्पन्न कोई जैव संसाधन या अनुसंधान के लिये या वाणिज्यिक उपयोग के लिये उससे सहबद्ध जानकारी अभिप्राप्त नहीं कर सकता है। ऐसे किसी व्यक्ति द्वारा जो भारत में होने वाली किसी जैव संसाधन को या उससे सहयोजित ज्ञान को, अनुसंधान या वाणिज्यिक उपयोग या जैव सर्वेक्षण और जैव उपयोग के लिये अथवा भारत में होने वाले या भारत के बाहर से अभिप्राप्त जैव संसाधन से संबंधित किसी अनुसंधान के परिणामों के अन्तरण को प्राप्त करने के लिये आशयित हैं, विहित प्रारूप में विहित फीस का संदाय करते हुये अनुमोदन प्राप्त करने हेतु राष्ट्रीय जैव विविधता प्राधिकरण को आवेदन किया जाता है।

कोई भी व्यक्ति किसी बौद्धिक सम्दा अधिकार के लिये, चाहे उसका कोई भी नाम हो, भारत में या भारत से बाहर किसी अनुसंधान पर आधारित किसी अविष्कार के लिये या भारत से अभिप्राप्त जैव संसाधन पर आधारित जानकारी के लिये उसे आवेदन करने से पूर्व राष्ट्रीय जैव विविधता प्राधिकरण का पूर्व अनुमोदन प्राप्त करना आवश्यक है, पूर्व अनुमोदन प्राप्त किये बिना आवेदन नहीं किया जा सकता है। पूर्व अनुमोदन प्राप्त करने के पश्चात् विहित प्ररूप और विहित रीति में राष्ट्रीय जैव विविधता प्राधिकरण को आवेदन नही किया जा सकता है।

किसी आवेदन की प्राप्ति पर, राष्ट्रीय जैव विविधता प्राधिकरण आवश्यक जांच करने के पश्चात् और यदि आवश्यक हो तो इस प्रयोजन के लिये गठित किसी विशेषज्ञ समिति से परामर्श करने के पश्चात्, आदेश द्वारा इस निमित्त बनाये गये किन्हीं विनियमों के अधीन रहते हुये अनुमोदन अनुदत्त कर सकता है। ऐसा अनुमोदन ऐसी शर्तों और निबन्धनों के अधीन होता है जो आवश्यक समझी जायें जिनके अंतर्गत रायल्टी के रूप में प्रभारी का अधिरोपण या आवेदन को नामंजूर करने के कारण सम्मिलित हैं। परन्तु अनुमोदन की नामंजूरी का ऐसा कोई आदेश प्रभावित व्यक्ति को सुनवाई का अवसर दिये बिना नहीं किया जा सकता है। राष्ट्रीय जैव विविधता प्राधिकरण के लिये दिये गये प्रत्येक अनुमोदन की सार्वजनिक सूचना देना आवश्यक है।

5 जैव संसाधन या ज्ञान का अन्तरण

(Transfer of Biological Resource or Knowledge)

जैव विविधता अधिनियम, 2002 की धारा 20 के अनुसार, कोई भी व्यक्ति, जिसे अनुमोदन प्रदान किया गया है किसी ऐसे जैव संसाधन या उससे सहबद्ध ज्ञान को, जो अनुमोदन की विषय–वस्तु है राष्ट्रीय जैव

विविधता प्राधिकरण की अनुज्ञा के बिना अन्तरित नहीं कर सकता है। यदि कोई व्यक्ति किसी जैव संसाधन या उससे सहबद्ध ज्ञान को अन्तरित करना चाहता है तो उसे विहित प्रारूप और रीति में राष्ट्रीय जैव विविधता प्राधिकरण को आवेदन करना चाहता है।

किसी जैव संसाधन या उससे सहबद्ध ज्ञान के अन्तरणसे संबंधित आवेदन की प्राप्ति पर राष्ट्रीय जैव विविधता प्राधिकरण आवश्यक जांच करने के पश्चात् आदेश द्वारा इस निमित्त बनाये गये किन्हीं विनियमों के अधीन रहते हुये अनुमोदन अनुदत्त कर सकता है और यह ऐसी शर्तों और निबन्धनों के अधीन होता है जो आवश्यक समझी जायें जिनके अंतर्गत रायल्टी के रूप में प्रभारों का अधिरोपण या आवेदन को नामंजूर करने के कारण सम्मिलित हैं परन्तु नामंजूर का कोई आदेश प्रभावित व्यक्ति को सुनवाई का अवसर दिये बिना नहीं किया जा सकता है।

राष्ट्रीय जैव विविधता प्राधिकरण द्वारा जैव संसाधन या ज्ञान के अंतरण से संबंधित प्रत्येक अनुमोदन को सार्वजनिक रूप से सूचित किया जाना आवश्यक है।

6. राष्ट्रीय जैव विविधता प्राधिकरण द्वारा फायदे में साम्यापूर्ण हिस्सा बंटाने का अवधारण

(Determination of Equitable Profit Sharing by National Bio-diversity)

अधिनियम की धारा 21 के अंतर्गत राष्ट्रीय जैव विविधता प्राधिकरण द्वारा फायदे में साम्यापूर्ण हिस्सा बंटाने का अवधारण से संबंधित प्रावधान दिया गया है जिसके अनुसार राष्ट्रीय जैव विविधता प्राधिकरण अनुमोदन प्रदान करते समय यह सुनिश्चित करता है कि ऐसी शर्तों एवं निबन्धनों का, जिनके अधीन अनुमोदन प्रदान किया गया है, उपलब्ध जैव संसाधनों के उपयोग से उद्भूत फायदों, उनके उपोत्पादों, उनके सहयोग से सहबद्ध नये परिवर्तनों तथा व्यवहारों और उनसे संबंधित उपयोजनों तथा ज्ञान का ऐसे अनुमोदन के लिये आवेदन करने वाले व्यक्ति, संबंधित स्थानीय निकाय और फायदों के दावेदारों के बीच पारस्परिक रूप मसे करार किये गये शर्तों एवं निबंधनों के अनुसार फायदे में साम्यापूर्ण हिस्सा बंटाना सुनिश्चित है।

राष्ट्रीय जैव विविधता प्राधिकरण द्वारा फायदे में साम्यापूर्ण हिस्सा बंटाने के अवधारणा को निम्नलिखित किसी या सभी रीति में लागू किया जा सकता है, अर्थात्

(क) राष्ट्रीय जैव विविधता प्राधिकरण या जहां फायदे के दावेदारों को, ऐसे दावेदारों के रूप में पहचाना जाता है, बौद्धिक सम्पदा अधिकारों का संयुक्त स्वामित्व देना।

(ख) प्रौद्योगिकी का अन्तरण।

(ग) ऐसे क्षेत्रों में उत्पादन, अनुसंधान और विकास एककों का अवस्थान जो फायदे के दावेदारों के बेहतर जीवन स्तर को सुकर जाते हैं।

(घ) भारतीय वैज्ञानिक संगम, फायदों का दावा करने वाले व्यक्ति और जैव संसाधन, जैव सर्वेक्षण और जैव उपयोग के अनुसंधान और विकास में लगे स्थानीय व्यक्ति फायदे का दावा करने वाले।

(ङ) फायदे का दावा करने वालों के लिये की गयी सहायता के लिये बौद्धिक पूंजी निधि की स्थापना।

(च) फायदे का दावा करने वालों को धनीय प्रतिकर और अन्य गैर धनीय फायदों का संदाय जो राष्ट्रीय जैव विविधता प्राधिकरण द्वारा आवश्यक समझे जायें।

जहां धन की आवश्यक राशि का हिस्सा बंटाने का आदेश दिया जाता है, वहां राष्ट्रीय जैव विविधता प्राधिकरण ऐसी राशि को राष्ट्रीय जैव विविधता निधि में जमा करने का आदेश दे सकता है। परन्तु जहां जैव संसाधन या ज्ञान किसी विनिर्दिष्ट व्यष्टि या व्यष्टि –समूह या संगठन के परिणामस्वरूप उपलब्ध था वहां राष्ट्रीय जैव विविधता प्राधिकरण यह निदेश दे सकता है कि राशि का किसी करार के निबन्धनों के अनुसरण में विशिष्ट व्यष्टि या व्यष्टि समूह या संगठन को तुरन्त संदाय किया जाये।

संदर्भ ग्रंथ सूची

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About the Book :

The title of the book "Environment and Sustainable Development: Perspectives and Issues" itself represents that the book is having topics related to current environmental problems and its possible solutions. This edition of book focuses on the issues related to sustainable use and management of natural resources and e-waste management. Several methods to handle a wide spectrum of environmental issues are taken into account in numerous chapters. Climate change is one of the greatest challenges of the 21st century. Climate is changing across our planet, largely, as a result of human activities. Some of the book chapters also provide a holistic coverage of the climate change policies and role of India. Climate change and various infectious diseases, proposes a comprehensive set of solutions to resolve various issues related to environment.

The impacts of climate change are becoming increasingly severe, natural resources are being depleted at an alarming rate, and the gap between the rich and poor is widening. The need for sustainable development has never been more pressing than present. Therefore, this book makes a valuable contribution to the ongoing conversation, challenges and opportunities around many critical issues.

The chapter in the book explore a wide range of topics related to sustainability, including the role of renewable energy, the need for sustainable agriculture, the importance of community engagement, and the impact of climate change. The authors come from diverse academic and professional backgrounds, and they are expert at their disciplines. The authors come from diverse academic and professional background, and their insight provide a valuable contribution to the ongoing conservation around environmental protection and sustainable development. The editors of this book are to be commended for bringing together such a diverse group of contributors, and for presenting a balanced and nuanced exploration of these complex issues. Their dedication and commitment to promote sustainable development are evident on each and every page of this volume. This book, if becomes helpful to address the current environmental issues and plays even a little role in nation building exercise in achieving the sustainable development goals, our team will be encouraged and be able to breathe a sigh of relief.

In the present book, the contributors have put in serious research work to cover a wide range of issues relating to environmental management and problems concerning resource depletion. And have also made several important recommendations for the implementation of policies by which the processes of development can become sustainable. The book will contribute towards understanding strategies for policy-makers, administrator and NGOs to work towards strengthening the capacities for sustainable development at all levels.

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