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(CBCS)
IN
GEOGRAPHY

Semester-IV

Self-Learning Material

Paper Code: GEO/DSE/EG/T-419

Paper: Environmental Geography- II: ENVIRONMENT AND DEVELOPMENT (Special Paper)

DIRECTORATE OF OPEN AND DISTANCE LEARNING (DODL)

UNIVERSITY OF KALYANI

Kalyani, Nadia West
Bengal, India

GEO/DSE/EG/T-419	**Environmental Geography- II: ENVIRONMENT AND DEVELOPMENT (Special Paper)**
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Unit-2: The Tragedy of the Commons	Dr. Ayan Rudra
Unit-3: Earth Summits: 1972, 1992 and 2012	Dr. Ayan Rudra
Unit-4: Montreal Protocol and Kyoto Protocol	Dr. Ayan Rudra
Unit-5: Conference of the Parties	Dr. Ayan Rudra
Unit-6: Concept and methods of alternative agriculture	Dr. Ayan Rudra
Unit-7: Use and misuse of forest resources and forest conservation	Dr. Ayan Rudra
Unit-8: Industry and environment; issues and challenges with special reference to tourism industry	Dr. Ayan Rudra
Unit-9: Environmental Impact Assessment	Dr. Ayan Rudra
Unit-10: Environmental impact of river valley projects – Narmada dispute with special reference to environmental movement	Dr. Ayan Rudra
Unit-11: Environmental Performance Index	Dr. Ayan Rudra
Unit-12: Environmental Audit	Dr. Ayan Rudra

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Director's Message

Satisfying the varied needs of distance learners, overcoming the obstacle of distance and reaching the unreached students are the threefold functions catered by Open and Distance Learning (ODL) systems. The onus lies on writers, editors, production professionals and other personnel involved in the process to overcome the challenges inherent to curriculum design and production of relevant Self Learning Materials (SLMs). At the University of Kalyani a dedicated team under the able guidance of the Hon'ble Vice-Chancellor has invested its best efforts, professionally and in keeping with the demands of Post Graduate CBCS Programmes in Distance Mode to devise a self-sufficient curriculum for each course offered by the Directorate of Open and Distance Learning (DODL), University of Kalyani.

Development of printed SLMs for students admitted to the DODL within a limited time to cater to the academic requirements of the Course as per standards set by Distance Education Bureau of the University Grants Commission, New Delhi, India under Open and Distance Mode UGC Regulations, 2020 had been our endeavour. We are happy to have achieved our goal.

Utmost care and precision have been ensured in the development of the SLMs, making them useful to the learners, besides avoiding errors as far as practicable. Further suggestions from the stakeholders in this would be welcome.

During the production-process of the SLMs, the team continuously received positive stimulations and feedback from Professor (Dr.) Manas Kumar Sanyal, Hon'ble Vice- Chancellor, University of Kalyani, who kindly accorded directions, encouragements and suggestions, offered constructive criticism to develop it within proper requirements. We gracefully, acknowledge his inspiration and guidance.

Sincere gratitude is due to the respective chairpersons as well as each and every member of PGBOS (DODL), University of Kalyani. Heartfelt thanks is also due to the Course Writers-faculty members at the DODL, subject-experts serving at University Post Graduate departments and also to the authors and academicians whose academic contributions have enriched the SLMs. We humbly acknowledge their valuable academic contributions. I would especially like to convey gratitude to all other University dignitaries and personnel involved either at the conceptual or operational level of the DODL of University of Kalyani.

Their persistent and co-ordinated efforts have resulted in the compilation of comprehensive, learner-friendly, flexible texts that meet the curriculum requirements of the Post Graduate Programme through Distance Mode.

All the Self Learning Materials are self writing and collected from e-book, journals and websites.

Director
Directorate of Open and Distance Learning
University of Kalyani

Syllabus

SEMESTER-IV						
Paper Code	**Paper**	**Theory/ Practical**	**Internal Assessment / Evaluation**	**Examination / Report/ Viva-Voce**	**Credit**	**Marks**
GEO/DSE/EG/ T-419	**Environmental Geography- II: ENVIRONMENT AND DEVELOPMENT (Special Paper)**	Theory	10	40 (Semester-end Examination)	4	50
Unit-1: Environment, development and population **Unit-2:** The Tragedy of the Commons **Unit-3:** Earth Summits: 1972, 1992 and 2012 **Unit-4:** Montreal Protocol and Kyoto Protocol **Unit-5:** Conference of the Parties **Unit-6:** Concept and methods of alternative agriculture **Unit-7:** Use and misuse of forest resources and forest conservation **Unit-8:** Industry and environment; issues and challenges with special reference to tourism industry **Unit-9:** Environmental Impact Assessment **Unit-10:** Environmental impact of river valley projects – Narmada dispute with special reference to environmental movement **Unit-11:** Environmental Performance Index **Unit-12:** Environmental Audit						
Mode of Internal Evaluation: Class test						

Contents

1.1 INTRODUCTION

Environmental Geography is the interactions between humans and nature in space and time. Environmental geography is the branch of geography that describes the spatial aspects of interactions between humans and the natural world. It requires an understanding of the dynamics of climatology, hydrology, biogeography, geology and geomorphology, as well as the ways in which human societies conceptualize the environment.

'Environment refers to the sum total of conditions which surrounded man at a given point in space and time.'[C.C.Park, 1980] Environmental studies are the interdisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. It is a broad field of study that includes also the natural environment, built environment and the sets of relationship between them. There are different principles of Environmental Geography……

1. Environmental System or ecosystem is the fundamental ecological unit for the study of the Environmental Geography.

2. The biospheric ecosystem is governed by discernible processes.

3. There is continuous creation, maintenance, destruction and recreation of surface materials of the earth.

4. Physical and biological processes operate according to the law of uniformitarianism.

5. Natural environmental system is Governed by homeostatic mechanism.

6. There is reciprocal relationship between abiotic and biotic components of the natural environmental system.

7. The energy flow and circulates of nutrients in the biospheric ecosystem help in the sustenance of life on the planet earth.

The environment is a complex of many variables which surrounds man as well as all living organisms. This means environment includes things or events surrounding us and their interaction. It is an interaction between living beings (plants/ animals) and their environment, which includes physical non-living components like air, river, ocean or land, mountain, plateau etc. It also includes interaction among living beings. It is thus a multi directional system of interaction. The system is made up of living and non-living physical components of Earth. Environmental geography, one of the branches of geography, comes in parts of human geography and physical geography. Although Environmental geography is basically the study of environment it is not termed as "geography of environment". This is because the term of Environmental geography puts more stress on man-environment relationships.

Some other disciplines only focus on one or few of aspects of environment while environmental geography deals with the environment in its totality and analyses the time-space relationship between man and the environment. On the other hand it is the study of systematic description of different components of environment and interactions of human with these components. A major part of environmental geography is the examination of landforms and waterway patterns resulting from the actions of water and streams. This is also referred to in geologic circles as geomorphology.

Environmental geography constituting important set of analytical tools is capable of assessing the impact of human presence on the environment and measure the result of human activity on natural landforms and cycles..

1.2 LEARNING OBJECTIVES

The present section aims to introduce the following topics –

- Existing association between environment, population and development.
- Influences of demographic aspects on environment.
- Concepts of the tragedy of the commons.
- Different Earth Summits and their principles.
- The Montreal Protocol and Its Implications for Climate Change
- The Kyoto Protocol - Climate Protection –The Key Issues.
- Different Conference of the Parties.
- Issues and challenges of agriculture and the concept of alternative farming.
- Use and misapplications of forest resources and process of forest conservation.
- The concept and purpose of Environmental Impact Assessment.
- Environmental movement like ‘Narmada Banchao Andolan'.
- Drivers of Environment performance Index and measuring climate performance.
- Environmental Audit- its concept objectives and advantages.

1.3 ASSESSMENT OF PRIOR KNOWLEDGE

Discussion about nature, scope and relevance of environmental geography is necessary. Discussion about recent trends in environmental research is necessary.

1.4 LEARNING ACTIVITIES

The preparation of short notes and essays on different topics will be discussed in Personal Contact programs (PCPs).

1.5 FEEDBACK OF LEARNING ACTIVITIES

Debate and discussion on various topics discussed in the class may be conducted. Class seminar on various topics may be arranged.

UNIT: - 1

Environment, development and population

Introduction: - Analyses of the unsustainability of rapid rates of population growth have largely focused on the resulting damage done to human resource development and per capita income in developing countries. However, these consequences are a symptom of a more basic problem: the imbalance between rates of population growth and the availability of natural resources (such as arable land, water, and forests) to meet developmental needs at a feasible technological level. The time has come to look at population and family planning from a different perspective-one that takes account of the nexus among population, environment, and development issues. To outline these relationships, the major conclusions of recent studies are briefly analyzed. The relationships are then explored in more detail, especially a much-neglected area-the linkages among water supplies, population growth, and economic development (Husain, 1993).

Relationship between Man and Environment continues since the early existence of man on the Earth. Mankind's relationship with the environment has passed through several stages, commencing with primitive time in which human beings lived in a stage of symbiosis with nature, followed by a period of growing mastery over nature, up to the industrial age and culminating into material-intensive growth patterns of the contemporary era. In India, population, environment and development issues have emerged as a chronic problem, because the process of development could not pace with the growth of population. India, for decades has been facing the adverse consequences of gradual degradation of environment in the form of drought, flood, rainfall, ill health and pollution etc. slow development processes and rapid growth of population pressurized the huge population to exploit the available resources more that result into the environmental degradation. It is seen predominant in urban area because of the rapid growth of urban population due to migration from rural to urban areas and rapid process of industrialization (Kumar and Mohanta, 2003).

For centuries "both demographers and natural scientists have sought to integrate their fields into an understanding of how population can shape the environment, and likewise how the environment can shape population" (Lepczyk et al., 2011). The field of study of population and environment is characterized by a wide variety of research topics, covering issues as growth and distribution of human population, water pollution, introduction of exotic species, habitat fragmentation, deforestation, emissions of pollutants to atmosphere and climate change. As the topics are so wide and varied, for its analysis this field borrows theoretical and methodological elements from different disciplines (Adamo, 2015; Lutz et al., 2002).

Rapid population growth is one of the most dramatic conditions of modern life. The world's population is now about 5 .4 billion, and growing at just under 2% per year. Never before has the human population grown so rapidly or reached such large absolute numbers. This growth is both good and bad news. On the positive side, it represents a major triumph over death and disease and the limits the earth might place on extracting its resources. Modern technology has kept people alive longer and in better health than ever before. It has also made human

labor vastly more productive. Modem economic development, based on fossil fuels, demonstrates the success of the human species in carving out a niche for itself. Success has a cost, however. And it may be far greater than even the most severe pessimist has imagined. Fossil fuel technology, and the human growth that it implies, constitutes a massive assault on the natural environment. Modern production and consumption greatly increase the emission of greenhouse gases into the atmosphere. This threatens to raise the earth's global temperature faster than in the past and to unprecedented levels. Other unnatural gases, chlorofluorocarbons (CFCs), have dramatically reduced stratospheric ozone and increased ultraviolet radiation reaching the earth's surface. This threatens both human health by causing skin cancer and visual impairment and, more importantly, by affecting the food chain. Thousands of new chemicals are assaulting the earth, air, and water. Some of the new chemicals are extremely toxic and natural biological processes cannot degrade them. Finally, increased population translates into increased demand for land. Deforestation and desertification result when people invade marginal lands with technologies that degrade rather than protect the land (Ness, 1994).

Linkages between Population, Environment and Development

There have been different and varied ways in which researchers, whether social or natural, have tried to understand the relationships between population dynamics and environment changes. From its beginnings in the late 18th century to the present, population and environment studies have evolved into an increasingly consolidated body of theories, methods, and techniques (Lutz et al., 2002).

Population growth and changes in environment: - The growth and size of the population is one of the ways in which demographic changes affect the environment more directly, because growing populations require more resources, which implies in principle that they will have greater impacts on the environment. Although, in most population and environment studies, population growth is mentioned as a key factor in environmental changes, it is especially at the end of 1960s, during the 1970s and part of 1980s that the analysis was especially focused on it even going so far as to limit the concept of 'population' to that of demographic growth (Ehrlich, 1968). The premise underlying the early studies was based on the fact that population growth does not have to outweigh the increase in food supply (Malthus, 1798). And for several years it was considered that population growth in developing countries was the major cause for ecological degradation (Humel et al., 2012).

Various models have been developed to describe the linkages between population, environment and development. These include the IPAT and PDE models.

The IPAT Model: - The IPAT model demonstrates the general relationships between (I)mpact on environment, (P)opulation, (A)ffluence and (T)echnology. According to the Model, I = PAT where I is the Impact on the environment; P represents the Population (absolute size, growth rate, distribution); A reflects the Affluence (usually measured as GNP per capita); and T demonstrates the impact of Technology (amount of pollution per unit of GNP). Generally, the I=PAT formula mean that environmental Impact is a joint function of

Population x Affluence x Technology (UN 1993). According to this model the people's lifestyle, incomes and social organisations usually determine consumption patterns. The technologies in use determine the extent to which human activities damage or sustain the environment and the amount of waste associated with any level of consumption (UNFP A 1991). Population determines how many persons there are and it acts as a multiplier that fixes the total impact.). These three factors, compound each other's impacts. In other words, for any given change in technology, any given level of consumption patterns, any level of poverty, the more people there are, the greater is the overall impact on the environment. This equation yields insights of the impacts that population growth and distribution can have on the quality and quantity of critical natural resources (Ehrlich and Ehrlich, 1990).

The PDE Model: - This model demonstrates that there are strong linkages between population, development and the environment. Any change in one of these factors may necessarily influence changes in the other two factors. The study on reversed migration patterns in the Kondoa Eroded Areas (KEA) was based on the logic of the PDE Model that examines the linkages between population change (P), socioeconomic development (D) and environmental factors (E). Figure 1 demonstrates these linkages. The model aims at enhancing scientific understanding and demonstrating the \ long-term consequences of alternative policies on demographic, developmental II and environmental spheres. It also gives a broad accounting framework that specifies the most important and immediate effects of one sector to another.

Demographic dynamics and their influences on environment: The ways in which population growth can occur, differentially mark the impact on the environment. Increased fertility and migration are mechanism by which population growth may arise. Increased of migration, may have a much more sudden impact on the environment, as a result of the need to increase goods, products, services and infrastructure in the destination places. On the other hand, an increase in fertility could take many more years to have a noticeable impact (Lepczyk et al., 2011).

Population composition can also have an effect on environment. Increased life expectancy means that people live longer, use more time natural resources and affect environment longer, but the impact is different, particularly when a greater proportion of population reaches retirement age: modifications to homes, requirement of new facilities, and health care infrastructure, which can alter the ecosystem and landscape. For example, contributing disproportionately to carbon emissions from heating their homes (they spend more time at home and feel the cold more intensely), or by their residues of pharmaceuticals released into the environment (they use more medicines than younger people). On the other hand, young people (under age 24) ―such as those that characterize the population of less developed countries and rural areas― is more propensity to migrate, and as result increasing levels of urbanization and therefore, intensified urban environmental problems (Hunter, 2000b).

There is a global trend towards a decrease in household size and, the number of households increasing faster than population growth. In some countries this has led to a decrease in the number of people per house. In general, smaller size households make higher energy use, and

results in higher CO2 emissions per head, while larger households consume proportionately fewer resources than the smaller ones. The size and structure of households offers valuable input in considering demographic influences on the environment. However, environmental impacts of demographic changes differ significantly from place to place and relationships that exist on one scale often not exist on other scales. This spatial variation is crucially important when analysing population-environment interactions. The dispersal and density of population, in other words, its distribution, has main implications for environmental change: in less-developed regions where the majority of the population is concentrated and population growth is higher, pressures on resources are greater; the relative pressures exerted on local environments can be modified due to the redistribution of the population produced by migration and; the increasing population living in urban areas as well as their different consumption patterns, generate especially complex problems for the environment (Hunter, 2000a).

Environmental Implications of Specific Population Factors: - According to recent United Nations estimates, global population is increasing by approximately 80 million—the size of Germany—each year. Although fertility rates have declined in most areas of the world, population growth continues to be fuelled by high levels of fertility, particularly in Asia and Africa. In numerous Middle Eastern and African nations, the average number of children a woman would be expected to have given current fertility levels remains above 6.0—for example, 6.4 in Saudi Arabia, 6.7 in Yemen, 6.9 in Uganda, and as high as 7.5 in Niger. Even in areas where fertility rates have declined to near replacement levels (2.1 children per couple), population continues to grow because of "population momentum," which occurs when a high proportion of the population is young.

Population Size: - No simple relationship exists between population size and environmental change. However, as global population continues to grow, limits on such global resources as arable land, potable water, forests, and fisheries have come into sharper focus. In the second half of the twentieth century, decreasing farmland contributed to growing concern of the limits to global food production. Assuming constant rates of production, per capita land requirements for food production will near the limits of arable land over the course of the twenty-first century. Likewise, continued population growth occurs in the context of an accelerating demand for water: Global water consumption raised six fold between 1900 and 1995, more than double the rate of population growth.

Population Distribution: - The ways in which populations are distributed across the globe also affect the environment. Continued high fertility in many developing regions, coupled with low fertility in more-developed regions, means that 80 percent of the global population now lives in less-developed nations. Furthermore, human migration is at an all-time high: the net flow of international migrants is approximately 2 million to 4 million per year and, in 1996, 125 million people lived outside their country of birth. Much of this migration follows a rural-to-urban pattern, and, as a result, the Earth's population is also increasingly urbanized. As recently as 1960, only one-third of the world's population lived in cities. By 1999, the percentage had increased to nearly half (47 percent). This trend is expected to continue well into the twenty-first century. The distribution of people around the globe has three main

implications for the environment. First, as less developed regions cope with a growing share of population, pressures intensify on already dwindling resources within these areas. Second, migration shifts relative pressures exerted on local environments, easing the strain in some areas and increasing it in others. Finally, urbanization, particularly in less-developed regions, frequently outpaces the development of infrastructure and environmental regulations, often resulting in high levels of pollution.

Population Composition: - Composition can also have an effect on the environment because different population subgroups behave differently. For example, the global population has both the largest cohort of young people (age 24 and under) and the largest proportion of elderly in history. Migration propensities vary by age. Young people are more likely than their older counterparts to migrate, primarily as they leave the parental home in search of new opportunities. As a result, given the relatively large younger generation, we might anticipate increasing levels of migration and urbanization, and therefore, intensified urban environmental concerns. Other aspects of population composition are also important: Income is especially relevant to environmental conditions. Across countries, the relationship between economic development and environmental pressure resembles an inverted U-shaped curve; nations with economies in the middle-development range are most likely to exert powerful pressures on the natural environment, mostly in the form of intensified resource consumption and the production of wastes. By contrast, the least-developed nations, because of low levels of industrial activity, are likely to exert relatively lower levels of environmental pressure. At highly advanced development stages, environmental pressures may subside because of improved technologies and energy efficiency (Crouse et al., 2019).

Population, development, and environment in India: - High population growth and continued economic development have caused serious environmental damage in the Asia Pacific region. However, the recent experience is that the pace of environmental degradation is faster in developing countries than in developed countries. To this end, the study seeks to assess the impact of population pressure on India's environment, with particular reference to the degradation of natural endowments like land and water resources and the resultant environmental pollution in the six regions of India. The rapid economic growth and expansion of infrastructure development in recent decades have not come without serious environmental consequences particularly in the southern, northern, and western regions. But in the eastern, north-eastern, and central regions of the country, environmental damage has been mainly due to rapid population growth. In India, rapid population growth and expansion of developmental activities have both greatly aggravated resource depletion and degradation of the environment. The extent of environmental degradation varies across countries and regions of the world For example; poverty has been the major cause of depletion of natural resources and environmental degradation in Africa, but in the Asia Pacific region both rapid population growth and continued economic development are found to be the major causes of environmental pollution In contrast, in the United States, where population density is much lower than in India, the main cause of environmental damage has been the extremely high per capita consumption of resources and the consequent high carbon emissions Two factors can be identified as environmental threats, viz: (i) proximate causes such as population growth,

poverty, and population density and (ii) ultimate factors, i.e., developmental imperatives like urbanization, industrialization, and economic development, all of which often result in unsustainable use of natural resources and eventual degradation of the environment. India's economic development has accelerated in the past two decades. India's efforts to reduce population growth have been impressive, as shown by the steady decline in both growth rate and absolute numbers. This has not, however, been coupled with environmental conservation. The degree of environmental pollution differs across regions in accordance with characteristics such as poverty ratio, size and density of population, etc. Besides, economic development and reduction in population growth have not been uniform across regions and states in India. The skewed development across regions has aggravated regional inequality in socio-economic development, which has grave implications for environmental issues for obvious reasons (Lakshmana, 2013).

Environmental issues have not received priority attention, apparently due to our preoccupation with economic development. The central, eastern, and north-eastern regions of India still have huge populations, which indeed cause higher levels of poverty (40% in central and 35% in eastern regions) and overuse of natural resources like forest, water, and land(Scott et al. 1997).Huge population, low quality of human resources, and inadequate levels of socio-economic development are the major challenges in the context of conservation of natural resources and protection of the environment in the central, eastern, and north-eastern regions of India. On the other hand comparatively low population growth and higher levels of economic development cause environmental stress in southern and western regions (Kumar, 2001).

A. Poverty and environment in India: **-** It is generally accepted that environmental degradation, rapid population growth, and stagnant productivity are the causal factors for acute poverty in many countries of Asia. Most of India's poor live in rural areas and are engaged in agriculture. The efficacy of government intervention through various schemes implemented under Five Year Plans to eradicate poverty and provide employment is a matter of debate. Nevertheless, the poverty ratios in India have been reduced over time. Traditionally the problem of poverty and unemployment was rampant in rural India but conditions in urban India were better; hence, due to rural influx into cites during recent decades, there has been a continuous rise in urban population and further it is accumulating in class I cites. The rural–urban migration is mainly a result of rural failure and urban success: increased urban growth has resulted in uncontrolled migration into cities, which has created an unhealthy growth of cities. Further, the poor quality of urbanization has led to land degradation and air and water pollution in urban areas. Against this background, environmental damage due to overuse of natural resources is more acute in the central and eastern parts, followed by the western, southern, and north-eastern regions of the country. In fact, the northern region has experienced a lower degree of environmental degradation attributable to total poverty, unlike other regions.

B. Impact of growing urbanization on the environment in India: **-** During the post-liberalization period, India has witnessed a rural influx into urban areas which has caused tremendous pressure on fertile agricultural land and resultant environmental degradation. The

poor quality of India's urban centres has been worsened by the burden of this rural influx: there is environmental degradation on a large scale. Increased urban population over the past 30 years is of greater significance in the western region compared with other regions. However, there is also a big jump in the share of urban population out of the total population in the north-eastern region. Nevertheless, rapid urbanization in the north-eastern region seems to be mainly accounted for by an increasing rural–urban migration. In 2011 the western region, with 16.76% of the total land area, had double the proportion of population, i.e., 31.33% of the total. Similarly, the northern region with 14% of land area had 18% of population in the same time-span. This means that the most populous cities are located in the western and northern regions, and therefore one could conclude that urban growth and urbanization has led to increased use of natural resources; as a result, environmental pollution would be expected to be higher in the western and northern cities. In contrast, the southern, central, and north-eastern regions have a lower proportion of urban population and larger geographical areas. This indicates that the population pressure on urban land and its impact on environmental pollution in these regions would be relatively lower than in other regions of the country (Lakshmana, 2013).

C. Development versus environment in India: **-** In recent years, the creation of SEZ and population growth have resulted in diversion of huge tracts of agricultural and for non-agricultural purposes like construction of new industrial estates, peripheral roads, dams, railway lines, and residential use. Diversion of considerable agricultural land for SEZ in the name of promoting exports through increased industrial development threatens biodiversity, and causes eco-degradation in the countryside. At present there are about 762 SEZ throughout the country at various stages of completion, and for this purpose vast tracts of agricultural land have been acquired by the government. The total land area of India is 2,973,190 km2 , of which about 1,620,388 km2 (55%) is currently used for agriculture. The area allocated to SEZ is about 2061 km2 , i.e., 0.12% of the total land area. This particular aspect has resulted in overexploitation of natural resources in the country. Shrinking of agricultural land has several adverse consequences, apart from environmental damage and ecological imbalance. Its ill-effects could manifest in various ways such as declining food production, movement of agricultural laborers into manufacturing and construction industries, decline in net sown area, etc. The high priority accorded to promotion of exports through increased industrial development has often resulted in the diversion of agricultural land to industrial and other purposes, and this has been to the detriment of agricultural production and food security (Shetty, 2002)

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UNIT: - 2

The Tragedy of the Commons

Introduction: - Garrett Hardin's now famous polemic, "The Tragedy of the Commons," has been tremendously influential in the more than thirty years since its original publication (in 1968). His simple but powerful parable of herdsmen sharing a common pasture has sparked debate in a wide range of disciplines and given birth to an extensive research effort conducted by numerous scholars. The essence of Hardin's parable of tragedy is that herdsmen sharing a common pasture are led, by the inexorable logic of individually rational decisions for optimizing personal gain, to ultimately overstock their herds and destroy their shared resource. Although Hardin's argument was originally made with the problem of human population growth in mind, it has become widely accepted as a general theoretical framework to explain diverse cases of resource over-exploitation, and has had a considerable influence on resource policy around the world. Hardin's thesis has also met with sharp criticism, and it is in the context of such critique that most contemporary research on the problem of managing "common property" or "common pool" resources has taken place. Critics have argued that both resource systems and property regimes are more diverse and complex than Hardin's thesis allows. They have also demonstrated that common property regimes have a history of success, especially in local and/or traditional resource management contexts. Despite the veracity of these critiques, Hardin's thesis remains relevant today, particularly as pressure on resources begin to be felt at a global level. The political and moral questions raised by his parable of herdsmen sharing a common pasture must today be confronted in the context of the possible demise of global commons, such as the oceans and the atmosphere.

More than thirty years have passed since the first publication of Garrett Hardin's now famous polemic, "The Tragedy of the Commons." The argument that Hardin originally intended as an ecologist's interpretation of the problem of unfettered human population growth has subsequently become widely accepted as a general theoretical framework to explain diverse cases of resource over-exploitation. Hardin's simple parable of the inexorable logic that leads the users of a common pasture to overstock their herds—and so destroy the commons—has apparent parallels in the degradation of a wide range of common goods such as fisheries, grasslands, forests, water resources, and the atmosphere. In fact, the "tragedy of the commons" is often invoked as a catchall explanation for the origins of the ecological crisis that currently confronts the human species. And, for those who accept the veracity of Hardin's pessimistic diagnosis, the only solution to the crisis is seen to lie in the elimination of the commons—either through the institution of private property or by way of a strong, even authoritarian state.

Certain questions results from the concept of the tragedy of the commons according to Ian Angus (2008). They are as follows:

i. Will shared resources always be misused and overused?
ii. Is community ownership of land, forests and fisheries a guaranteed road to ecological disaster?

iii. Is privatization the only way to protect the environment and the third world poverty?

Concept

The Tragedy of the Commons refers to a scenario in which commonly held land is inevitably degraded because everyone in a community is allowed to graze livestock there. It was embraced as a principle by the emerging environmental movement. The tragedy of the commons is quite a pernicious myth. Garret Hardin‘s main purpose was that only answer to the tragedy of the commons was to move all common lands or rights to the use of land into private ownership- thereby establishing clear ―property rights‖ The tragedy of the commons states that individuals acting independently and rationally according to each's self-interest behave contrary to the best interests of the whole group by depleting some common resource. The term is taken from the title of an article written by Hardin in 1968, which is in turn based upon an essay by a Victorian economist on the effects of unregulated grazing on common land.

The key message from William Forster on the commons is summarized as follows the key message is:

3 common lands or rights to the use of land into private ownership- thereby establishing clear ―property rights‖ The tragedy of the commons states that individuals acting independently and rationally according to each's self-interest behave contrary to the best interests of the whole group by depleting some common resource. The term is taken from the title of an article written by Hardin in 1968, which is in turn based upon an essay by a Victorian economist on the effects of unregulated grazing on common land. "Commons" in this sense has come to mean such resources as atmosphere, oceans, rivers, fish stocks, the office refrigerator, energy or any other shared resource which is not formally regulated; not common land in its agricultural sense. Hardin based his argument on a story about the commons in rural England. (The term ―commons‖ was used in England to refer to the shared pastures, fields, forests, irrigation systems and other resources that were found in many rural areas until well into the 1800s. Similar communal farming arrangements existed in most of Europe, and they still exist today in various forms around the world, particularly in indigenous communities.) ―Picture a pasture open to all,‖ Hardin wrote. A herdsman who wants to expand his personal herd will calculate that the cost of additional grazing (reduced food for all animals, rapid soil depletion) will be divided among all, but he alone will get the benefit of having more cattle to sell. Inevitably, ―the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd.‖ But every ―rational herdsman‖ will do the same thing, so the commons is soon overstocked and overgrazed to the point where it supports no animals at all. The key message from William Forster on the commons is summarized as follows the key message is: "If a person puts more cattle into his own field, the amount of the subsistence which they consume is all deducted from that which was at the command, of his original stock; and if, before, there was no more than a sufficiency of pasture, he reaps no benefit from the additional cattle, what is gained in one way being lost in another. But if he puts more cattle on a common, the food which they

consume forms a deduction which is shared between all the cattle, as well that of others as his own, in proportion to their number, and only a small part of it is taken from his own cattle. In an enclosed pasture, there is a point of saturation, if I may so call it, (by which, I mean a barrier depending on considerations of interest), beyond which no prudent man will add to his stock. In a common, also, there is in like manner a point of saturation. But the position of the point in the two cases is obviously different. Were a number of adjoining pastures, already fully stocked, to be at once thrown open, and converted into one vast common, the position of the point of saturation would immediately be changed" (Lloyd, 1833).

The Tragedy in Review:

A. The Population Problem: - Hardin's article is primarily focused on the problem of world population growth, and a largely forgotten contribution of his argument is its still relevant criticism of technologically based solutions to this challenge. He argues that runaway population growth belongs to a set of problems for which technical solutions do not exist. Rather, such problems make it necessary to re-examine fundamental principles of morality, and to confront tough political questions about what is just versus what is necessary. In this respect, Hardin's polemic is a powerful attack against both the pervasive faith in technological solutions, and the associated cornucopian view that the resources of the earth are essentially limitless. In place of this worldview Hardin posits one which recognizes not only the fact of the earth's ultimate finitude, but also the reality of scarcity which confronts so many of the planet's inhabitants.

The political issues which Hardin raises revolve around the question, "what shall we maximize?" He claims that confronting the population question forces us to abandon Bentham's goal of "the greatest good for the greatest number." This is because it is neither desirable nor possible to maximize these two variables (greatest good and greatest number) at the same time. Maximizing population necessarily means decreasing to a bare minimum the "good" available to each individual. Hence, the optimum population, which will maximize the good available to each individual, must be less than the maximum possible population. Hardin is quick to admit that determining what is "good," and what might be an optimum population for the realization of that good, are difficult tasks. Nevertheless, he is convinced that positive action based upon rational analysis of these two questions is necessary if humanity is to avert a population disaster.

B. The Inexorable Logic of Tragedy: - Engaging in positive action based upon rational analysis is Hardin's political formula for a resolution of the population problem. Therefore, though he does not seek a technical answer to the challenge, he is certainly a proponent of rational scientific management. This approach forms the basis for his critique of liberalism, with its doctrines of individual rights and laissez-faire economics. Hardin stages his argument as a direct attack on Adam Smith's classic thesis that individuals in pursuit of their own gain are led by the invisible hand of the market to simultaneously advance the general public interest. Based upon the need for rational scientific management, Hardin proposes to examine the veracity of Smith's assumption, and to decide if the liberal freedoms it anchors are consistent with or antagonistic to the requirements of achieving an optimum population.

It is in this context, as direct evidence for his case against liberal freedoms, that Hardin recounts his now famous parable of herdsmen who share a common pasture. This story is a tragedy in the dramatic sense, its conclusion predetermined by the "remorseless working" of the logic which is established as its premise. In this common pasture the herdsmen approach their shared resource as "Smithian" individuals, operating according to a basic rationality of personal gain, calculated in terms of marginal utility. Each herdsman sees that the benefits from each animal that he adds to his herd accrue to him, while the losses from increased pressure on the pasture are distributed amongst all users. Hence, he rationally concludes that adding as many animals as possible is his best strategy for economic gain. Of course, the pasture can support only a limited number of animals, and it is ultimately destroyed. The tragedy results from the systematic and relentless progression toward ruin which is written into the logic of a political order that upholds freedom in the commons. This is a political order that Hardin sees at work in the range lands of the American West, in the world's oceans, in America's national parks, and generally in relation to the earth's air and water. Of course, this political order is also what Hardin sees as the root of the population crisis, the freedom to breed being analogous to the freedom to add animals to a herd.

C. Preventing the Tragedy: - Mutual Coercion, Mutually Agreed Upon: - Given the stark nature of the tragedy as Hardin portrays it, there are a limited number of solutions that he can offer. He suggests that private property constitutes part of the solution, though his position is by no means a carte blanche for the total privatization of all public goods. He recognizes, for instance, that the institution of private property often makes the production of pollution economically rational. Furthermore, he suggests that certain commons, such as the earth's air and water, cannot be privatized and must be protected in some other way. The tool which he finds at hand to prevent tragedy in such commons—and population is included here—is administrative law. Hardin is perfectly aware that his argument for the regulation of population by administrative law is bound to be repugnant to most people, offending the popular morality—enshrined, as he observes, in the Universal Declaration of Human Rights— which understands the right of family planning to lie with the family. He argues, however, that morality is (or at least should be) system sensitive. In his words, "the morality of an act is a function of the state of the system at the time it is performed." Hence, in the context of a global population boom, the freedom to breed is "intolerable." In this circumstance, and others like it, the only solution is for society to adopt "mutual coercion, mutually agreed upon (Latta, 2009)."

Criticisms and Issues of Debate: - Over many decades, Elinor Ostrom has documented how various communities manage common resources grazing lands, forests, irrigation waters, fisheries equitably and sustainably over the long term. The Nobel Committee's recognition of her work effectively debunks popular theories about the Tragedy of the Commons, which hold that private property is the only effective method to prevent finite resources from being ruined or depleted. What Ostrom has demonstrated is the existence of social control mechanisms that regulate the use of the commons without having to resort to property rights.‖ She found the tragedy of the commons not as prevalent or as difficult to solve as Hardin maintained, since locals have often come up with solutions to the

commons problem themselves; when the commons is taken over by non-locals, those solutions can no longer be used. Robert Axelrod contends that even self-interested individuals will often find ways to cooperate, because collective restraint serves both the collective and individual interests (Axelrod 1984).

The most common criticism of Hardin's article concentrates on his failure in distinguishing between common property and the free-access property. Critiques argue that what Hardin termed as an "open to all" pastureland as a common property, is in actuality an open-access property. So, in order to have a better understanding of 'The Tragedy of the Commons" scenario, it is important to know about the nature and the legal rights attached to different kinds of property regimes. Property has been defined as any object or right that can be owned. In this paper, property would be referred to as social institution and not as any inherent natural or physical qualities of the resource (as that is done in physical and biological world). Ownership involves possession. In simple societies to possess something is to own it. Beyond possession, ownership in modern societies implies the rights to use, prevents others from using, and disposes of property, and it implies the protection of such rights by the government (Rahman, 2003).

So Hardin's later claim that historical facts don't matter was an attempt to rewrite his own history. He only claimed the story was ―just a model after it had been thoroughly disproved.

Applications in Management of Natural resources: - The tragedy of the commons according to Wikipedia can be considered in relation to environmental issues such as sustainability. The commons dilemma stands as a model for a great variety of resource problems in society today, such as water, forests, fish, and non-renewable energy sources such as oil and coal. Situations exemplifying the "tragedy of the commons" include the overfishing and destruction of the Grand Banks, the destruction of salmon runs on rivers that have been dammed – most prominently in modern times on the Columbia River in the Northwest United States, and historically in North Atlantic rivers – the devastation of the sturgeon fishery – in modern Russia, but historically in the United States as well – and, in terms of water supply, the limited water available in arid regions (e.g., the area of the Aral Sea) and the Los Angeles water system supply, especially at Mono Lake and Owens Lake. Other situations exemplifying the "tragedy of the commons" include congestion caused by driving cars. There are many negative externalities of driving; these include pollution, carbon emissions, and traffic accidents. For example, every time 'Person A' gets in a car, it becomes more likely that 'Person Z' – and millions of others – will suffer in each of those areas.

Modern Solutions: - Articulating solutions to the tragedy of the commons is one of the main problems of political philosophy. In absence of enlightened self-interest, some form of authority or federation is needed to solve the collective action problem. In a typical example, governmental regulations can limit the amount of a common good that is available for use by any individual. Permit systems for extractive economic activities including mining, fishing, hunting, livestock raising and timber extraction are examples of this approach.

Similarly, limits to pollution are examples of governmental intervention on behalf of the commons. Alternatively, resource users themselves can cooperate to conserve the resource in the name of mutual benefit. Another solution for some resources is to convert common good into private property, giving the new owner an incentive to enforce its sustainability (Anukwonke, 2015).

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UNIT: - 3

Earth Summits: 1972, 1992 and 2012

Introduction: - The Earth Summits are decennial meetings of world leaders, organized since 1972 with help of the United Nations, to help defining ways to stimulate sustainable development at the global level. The aim is to bring together the best individuals and organizations humanity can bring forward from all kind of categories of life, to identify and update what are humanity's most pressing challenges, to quantify them, identify solutions and develop a plan of action not to run into a wall. This plan of action is called Agenda 21 and implemented by many local governments under the name Local Agenda 21. The plan of action is designed as a TQM - Total Quality Manual, designed smartly and opens enough, so that also organizations, companies and individuals can use it as a basis for their own plan of action and guidance not to miss out on important issue; it helps speed up understanding and identifying partners by e.g. using similar wordings and symbols. The 2000-2015 Millennium Development Goals and the 2015-2030 Global Goals are results from these Earth Summits. The first summit took place in Rio de Janeiro (Brazil) in 1992. Last Earth Summit, called Rio+20, also took place in Rio de Janeiro in 2012.

Stockholm represented a first taking stock of the global human impact on the environment, an attempt at forging a basic common outlook on how to address the challenge of preserving and enhancing the human environment. As a result, the Stockholm Declaration espouses mostly broad environmental policy goals and objectives rather than detailed normative positions. However, following Stockholm, global awareness of environmental issues increased dramatically, as did international environmental law-making proper. At the same time, the focus of international environmental activism progressively expanded beyond trans-boundary and global commons issues to media-specific and cross-sectorial regulation and the synthesizing of economic and development considerations in environmental decision-making. By the time of the Rio Conference, therefore, the task for the international community became one of systematizing and restating existing normative expectations regarding the environment, as well as of boldly positing the legal and political underpinnings of sustainable development. In this vein, UNCED was expected to craft an “Earth Charter”, a solemn declaration on legal rights and obligations bearing on environment and development, in the mold of the United Nations General Assembly’s 1982 World Charter for Nature (General Assembly resolution 37/7). Although the compromise text that emerged at Rio was not the lofty document originally envisaged, the Rio Declaration, which reaffirms and builds upon the Stockholm Declaration, has nevertheless proved to be a major environmental legal landmark.

Twice this century, the international community has felt the need to discuss and consider, in a global forum, problems encompassing both the environment and development. In 1972, there was the United Nations Conference on the Human Environment (Stockholm Conference). Twenty years later, the international community convened the United Nations Conference on Environment and Development.

Earth Summit: 1972: - United Nations Conference on Human Environment, 1972 (Stockholm Conference) was the first world conference to make the environment a major issue. The participants adopted a series of principles for sound management of the environment including the Stockholm Declaration and Action Plan for the Human Environment and several resolutions. The Stockholm Declaration, which contained 26 principles, placed environmental issues at the forefront of international concerns and marked the start of a dialogue between industrialized and developing countries on the link between economic growth, the pollution of the air, water, and oceans and the well-being of people around the world. The Action Plan contained three main categories: 1) Global Environmental Assessment Program, 2) Environmental management activities, and 3) International measures to support assessment and management activities carried out at the national and international levels.

Highlights: - In announcing the 1972 UN Conference on the Human Environment in Stockholm (the "Stockholm Conference"), the UN General Assembly stated that the "main purpose" of the conference was to serve as a practical means to encourage and provide guidelines for action by Governments and international organizations designed to protect and improve the human environment. The UN General Assembly stated that the conference should endeavor to promote and advance guidelines for action by Governments and international organizations to remedy and prevent impairment of the environment, through international cooperation, while taking into consideration the particular importance of enabling developing countries to forestall the occurrence of such problems.

I. The Stockholm Declaration provided the first global set of principles for future international cooperation on environmental issues.
II. The Conference led to the establishment of the United Nations Environment Program (UNEP).
III. The Conference was the first UN event that supported civil society participation.
IV. The Stockholm Conference began a new era of global cooperation to search for solutions to reconcile economic development and environmental management and paved the way for the concept of sustainable development.

Stockholm Declaration: - The Stockholm Conference agreed upon a Declaration containing 26 principles concerning the environment and development; an Action Plan with 109 recommendations, and a Resolution.

- "Man is both creature and molder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. Through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale.
- The protection and improvement of the human environment is a major issue which affects the well-being of people and economic development throughout the world, it is the urgent desire of the people of the whole world and the duly of all Governments.

- In our time man can transform his surroundings, and the wise use of resources can bring to all people the benefits of development and the opportunity to enhance the quality of life.
- We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social degradation of man, in the man-made environment.
- In developing countries, most of the environmental problems are caused by under-development. Millions continue to live far below the minimum levels required for a decent human existence, deprived of adequate food and clothing, shelter and education, health and sanitation. Therefore, the developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment.
- Indutria1ized countries should make efforts to reduce the gap between themselves and the developing countries. In industrialized countries, environmental problems are generally related to industrialization and technological development.
- The natural growth of the population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted.
- Along with social progress and the advance in production, science and technology, the capability of man to improve the environment should be increased. There are broad prospects for the enhancement of environmental quality and the creation of good life.
- To defend and improve the human environment for present and future generations has become an imperative goal for mankind - a goal to be pursued together with and in harmony with, the established and fundamental goals of peace and worldwide economic and social development.
- To achieve this environmental goal will demand the acceptance of responsibility by citizens and communities and by enterprises and institutions at every level, all sharing equitably in common efforts. Individuals in all walks of life as well as organizations in many fields, by their values and the sum of their actions, will shape the world environment of the future.
- Local and national governments will bear the greatest burden for large scale environmental policy and action within their jurisdictions. International co-operation is also needed to raise resources to support the developing countries in carrying out their responsibilities in this field.
- A growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive co-operation among nations and action by international organizations in the common interest.
- The Conference calls upon Governments and people to exert efforts for the preservation and improvement of the human environment, for the benefit of all the people and their posterity".

Principles of the Stockholm Declaration: -

- Human rights must be asserted, apartheid and colonialism condemned
- Natural resources must be safeguarded
- The Earth's capacity to produce renewable resources must be maintained
- Wildlife must be safeguarded
- Non-renewable resources must be shared and not exhausted
- Pollution must not exceed the environment's capacity to clean itself
- Damaging oceanic pollution must be prevented
- Development is needed to improve the environment
- Developing countries need assistance
- Developing countries need reasonable prices for exports to carry out environmental management
- Environment policy must not hamper development
- Developing countries need money to develop environmental safeguards
- Integrated development planning is needed
- Rational planning should resolve conflicts between the environment and development
- Human settlements must be planned to eliminate environmental problems
- Governments should plan their appropriate population policies
- National institutions must plan the development of states' natural resources
- Science and technology must be used to improve the environment
- Environmental education is essential
- Environmental research must be promoted, particularly in developing countries
- States may exploit their resources as they wish but must not endanger others
- Each nation must establish its standards
- There must be cooperation on international issues
- International organizations should help to improve the environment
- Weapons of mass destruction must be eliminated

The Stockholm Conference motivated countries around the world to monitor environmental conditions as well as to create environmental ministries and agencies. Despite these institutional accomplishments, including the establishment of UNEP, the failure to implement most of its action programs has prompted the UN to have follow-up conferences (Carraro, 1997).

The First Earth Summit in 1972: raising awareness internationally: - The environment was taken seriously for the first time at the 1972 Stockholm Earth Summit. This meeting in Sweden – one of the first countries to set up a sustainable development agenda in the 1960s – was a turning point in terms of environmental issues' importance on the international stage. Although few concrete actions came out of it, the Stockholm Summit laid the foundations to tackle the ecological crisis, in particular through the creation of the United Nations Environment Program (UNEP). Leaders then undertook to meet every ten years to review the state of the planet. In 1982, the second summit was held in Nairobi, Kenya, home of the

United Nations Environment Program (UNEP). With Cold War tensions at their highest, no concrete decisions were made.

Earth Summit: 1992:

Preamble: - The United Nations Conference on Environment and Development, Having met at Rio de Janeiro from 3 to 14 June 1992. Reaffirming the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972, and seeking to build upon it With the goal of establishing a new and equitable global partnership through the creation of new levels of co-operation among States, key sectors of societies and people, Working towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system, Recognizing the integral and interdependent nature of the Earth, our home.

The United Nations Conference on Environment and Development (UNCED), also known as the "Earth Summit", was held in Rio de Janeiro, Brazil, from 3-14 June 1992. This global conference held on the occasion of the 20th anniversary of the first Human Environment Conference in Stockholm, Sweden, in 1972, brought together political leaders, diplomats, scientists, representatives of the media and non-governmental organizations (NGOs) from 179 countries for a massive effort to focus on the impact of human socio-economic activities on the environment. A 'Global Forum' of NGOs was also held in Rio de Janeiro at the same time, bringing together an unprecedented number of NGO representatives, who presented their vision of the world's future in relation to the environment and socio-economic development.

The Rio de Janeiro conference highlighted how different social, economic and environmental factors are interdependent and evolve together, and how success in one sector requires action in other sectors to be sustained over time. The primary objective of the Rio Earth Summit was to produce a broad agenda and a new blueprint for international action on environmental and development issues that would help guide international cooperation and development policy in the twenty-first century.

The Earth Summit had many great achievements: the Rio Declaration and its 27 universal principles, the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity; and the Declaration on the principles of forest management. It also led to the creation of the Commission on Sustainable Development, the holding of the first world conference on the sustainable development of small island developing states in 1994, and negotiations for the establishment of the agreement on straddling stocks and highly migratory fish stocks. Through treaties and other documents signed at the conference, most of the world's nations nominally committed themselves to the pursuit of economic development in ways that would protect the Earth's environment and non-renewable resources.

Principles of Rio Conference: - The Rio Conference has set forth the following principles with the “goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people, and working

towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system" (https://www.cbd.int/doc/ref/rio-declaration.shtml).

Principle 1: "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 2: States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their resources according to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 3: The right to development must be fulfilled to equitably meet the developmental and environmental needs of present and future generations.

Principle 4: To achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 5: All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

Principle 6: The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.

Principle 7: States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. Given the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

Principle 8: To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 9: States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.

Principle 10: Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate

access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 11: States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

Principle 12: States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided. Environmental measures addressing trans-boundary or global environmental problems should, as far as possible, be based on an international consensus.

Principle 13: States shall develop national laws regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control of areas beyond their jurisdiction.

Principle 14: States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health.

Principle 15: To protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 16: National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Principle 17: Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Principle 18: States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those

States. Every effort shall be made by the international community to help the States so afflicted.

Principle 19: States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

Principle 20: Women have a vital role in environmental management and development. Their full participation is therefore essential to achieving sustainable development.

Principle 21: The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership to achieve sustainable development and ensure a better future for all.

Principle 22: Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.

Principle 23: The environment and natural resources of people under oppression, domination and occupation shall be protected.

Principle 24: Warfare is inherently destructive of sustainable development. States shall therefore respect international law to provide protection for the environment in times of armed conflict and cooperate in its further development, as necessary.

Principle 25: Peace, development and environmental protection are interdependent and indivisible.

Principle 26: States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.

Principle 27: States and people shall cooperate in good faith and a spirit of partnership in the fulfillment of the principles embodied in this Declaration and the further development of international law in the field of sustainable development" (Declaration, 1992).

Earth Summit: 2012:

In June 2012, the United Nations Conference on Sustainable Development (UNCSD or Rio+20), will take place in Rio de Janeiro and once again direct the world's attention to the urgent challenges that face humanity. Poverty, over-exploitation of natural resources, climate change and economic crises are challenges which have long demanded the determined cooperation of the international community. However, poorer nations have little faith in the actual will of wealthy nations to commit to combating these problems on the scale required. A further obstacle is the structural weakness of the international institutions dealing with these issues. Against this backdrop, chances for a successful summit in Rio are moderate. Rio+20, however, is the opportunity during this decade, and perhaps beyond, to lend new

momentum to international environment and development policies and implement the desperately needed reforms. Germany is a key player in this process: a strong economy and pioneer of policies geared to sustainability, an initiator of innovative projects to combat poverty and environmental degradation, and a mediator in the debate on reforms of the UN.

In the run-up to the Rio Conference, a package of proposals for bringing new momentum to global sustainability policies is being negotiated. This Research Paper will discuss the most important ones. The first key issue on the conference agenda is the concept of a Green Economy in the Context of Sustainable Development and Poverty Eradication (GESDPE). Moreover, the formulation of Sustainable Development Goals (SDGs) has been suggested. The second key issue on the agenda is the reform of the UN Institutional Framework for Sustainable Development (IFSD). The proposed reforms involve upgrading the United Nations Environment Program (UNEP) and reforming the Commission on Sustainable Development (CSD). These two points are closely linked.

In June 2012, twenty years after the first Earth Summit in 1992, world leaders will once again gather in Rio to negotiate The Future We Want. The United Nations Conference on Sustainable Development (UNCSD) has the challenging aim of giving new momentum to achieving a balanced pathway of social, ecological and economic development for all countries in the international community. In view of this objective, the conference will focus on two main themes:

A. Formulating an economic concept that is compatible with the need to protect natural resources and the climate: a Green Economy in the Context of Sustainable Development and Poverty Eradication (GESDPE).
B. Reforming the UN Institutional Framework for Sustainable Development (IFSD) to create a solid basis from which to support and coordinate the implementation of sustainability policies.

The conference must achieve its aim of renewing political commitment to implement international sustainable development policies. Whether it will succeed in doing so depends on a variety of factors: the extent to which member states regard implementation of UN sustainability policies as insufficient, member-state positions on and commitment to the proposed reforms and, above all, the G20 member's political will to make the conference aims more binding and to step up their efforts to achieve them.

Rio+20 Objectives

The main three objectives of the Rio+20 Conference were:

- To secure renewed political commitment for sustainable development,
- To assess the progress to date and the remaining gaps in the implementation of the outcomes of the major summits on sustainable development, and
- To address new and emerging challenges.

The conference focused mainly on two themes:

1. Green economy in the context of SD and poverty eradication; The concept of green economy focuses primarily on the intersection between environment and economy.
2. The institutional framework for SD. Sustainable development was recognized as an overreaching goal for institutions at the national, regional and international levels. The need to enhance the integration of Sustainable Development in the activities of all relevant United Nations Agencies, Programme and funds, and the International financial institutions, within their mandates was highlighted.

Conclusions: - The Green Economy is supposed to form the core of a global economic policy concept, planned to enshrine the principles of sustainable development at the UN level. Despite the long list of hoped-for positive effects associated with a Green Economy, support for the corresponding targets, indicators or instruments for implementation is still far from unanimous. From a diplomatic point of view, the UNCSD decision to avoid a top-down approach in defining the Green Economy in the Context of Sustainable Development and Poverty Eradication (GESDPE) and allow it to take shape in practice is useful; however, a solid GESDPE concept does require a minimum of tangible criteria to be successful at the global level. Further, clear commitment is needed on the part of industrialized countries to increase support for investments in the identified key economic areas, or to make the promised transfer payments. The Zero Draft and later draft outcome document formulations have been kept deliberately vague and open for strategic reasons and can be easily aligned with growth-oriented economic priorities. The lack of a solid and comprehensive definition of what the Green Economy actually is will make it very difficult to assess whether policies and business activities are genuinely committed to sustainable development. The failure to adequately anchor the polluter-pays principle within the concept is already showing a negative impact: national industries that could potentially damage the environment, the climate, natural resources or have negative social impacts will not face severe consequences. Finally, there is always a danger of "green-washing" – purportedly green methods of production that are just deceptive attempts to brush up a public image (David et al., 2011).

The major economic powers seem reluctant to draw on Green Economy elements in their battle to manage the financial and economic crisis. This raises concerns that the big players will pay no more than lip service to the concept. So far, the initiatives developed by the OECD and the few envisaged by the G20 have scarcely made the G20 members take the Green Economy any more seriously. No real effort is being made to curtail counterproductive measures like subsidies for environmentally damaging practices, and environmentally-friendly technologies are still under-funded. The greatest risk is that the multi-faceted approach of the Green Economy will be cut back and limited to environment and energy technologies, a move that would effectively sweep financial market stability and the aim of reducing poverty off the negotiation table (Dröge and Simon, 2011).

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UNIT: - 4

Montreal Protocol and Kyoto Protocol

Introduction: - The depletion of the ozone layer by man-made chemicals was discovered in the mid-1970s. It was once described by the Nobel prize-winning scientist Paul Crutzen as "the worst disaster to hit the global environment". The international response embodied in the Montreal Protocol has been widely regarded as the most successful environmental protection agreement ever reached to date. The Protocol has contributed significantly to reversing a problem with grave implications for life on earth. The Montreal Protocol on Substances that Deplete the Ozone Layer is the landmark multilateral environmental agreement that regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (ODS). When released into the atmosphere, those chemicals damage the stratospheric ozone layer, Earth's protective shield that protects humans and the environment from harmful levels of ultraviolet radiation from the sun. Adopted on 16 September 1987, the Protocol is to date one of the rare treaties to achieve universal ratification (https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol).

In 1985 the Vienna Convention established mechanisms for international co-operation in research into the ozone layer and the effects of ozone depleting chemicals (ODCs). 1985 also marked the first discovery of the Antarctic ozone hole. On the basis of the Vienna Convention, the Montreal Protocol on Substances that Deplete the Ozone Layer was negotiated and signed by 24 countries and by the European Economic Community in September 1987. The Protocol called for the Parties to phase down the use of CFCs, halons and other man-made ODCs. The Montreal Protocol represented a landmark in the international environmentalist movement. For the first time whole countries were legally bound to reducing and eventually phasing out altogether the use of CFCs and other ODCs. Failure to comply was accompanied by stiff penalties. The original Protocol aimed to decrease the use of chemical compounds destructive to ozone in the stratosphere by 50% by the year 1999. The Protocol was supplemented by agreements made in London in 1990 and in Copenhagen in 1992, where the same countries promised to stop using CFCs and most of the other chemical compounds destructive to ozone by the end of 1995. Fortunately, it has been fairly easy to develop and introduce compounds and methods to replace CFC compounds. In order to deal with the special difficulties experienced by developing countries it was agreed that they would be given an extended period of grace, so long as their use of CFCs did not grow significantly. China and India, for example, are strongly increasing the use of air conditioning and cooling devices. Using CFC compounds in these devices would be cheaper than using replacement compounds harmless to ozone. An international fund was therefore established to help these countries introduce new and more environmentally friendly technologies and chemicals. The depletion of the ozone layer is a worldwide problem which does not respect the frontiers between different countries. It can only be affected through determined international co-operation (Sivasakthivel and Reddy, 2011).

The Montreal Protocol and Its Implications for Climate Change: - In the context of international environmental treaties, the Montreal Protocol has seen unparalleled success.

Ratified by almost every country in the world, and with both the developed and developing world broadly achieving their production phase-out targets for ozone depleting substances (ODSs), the agreement is on track to significantly reduce a major environmental and health threat. Stratospheric ozone is expected to revert to pre-1980s levels during the second half of this century, achieving the primary goal of the protocol. Yet the agreement failed to directly address another threat associated with these emissions: global warming. Both existing ODSs and their industry substitutes, hydrofluorocarbons (HFCs), have severe global warming potential (GWP)- in some cases more than 10,000 times that of carbon dioxide (CO2), the most prevalent greenhouse gas emitted by human activities. While focusing on the global phase-out of ODS production, the treaty has done little to address existing banks of ODSs or incentivize their controlled destruction. The next 20 years will be crucial in determining the ultimate impact of ODSs on the atmosphere. If ODS banks remain unaddressed, there is a considerable risk that these chemicals will be released into the atmosphere within this timeframe, with significant implications for global warming and ozone depletion. Only if these gases are collected and destroyed or recycled in a controlled, responsible manner can an environmental threat be considered to have been averted (Albrecht and Parker, 2019).

Background: - At the meeting held on 10 July 2009, the Subcommittee on Ozone Layer Protection (Products Containing Scheduled Substances) (Import Banning)(Amendment) Regulation 2009 (the Subcommittee) requested the Research and Library Services Division to provide background information on the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol). The Montreal Protocol is an international treaty adopted in 1987 to protect the ozone layer by phasing out the consumption and production of a number of substances responsible for ozone depletion. Against the above background, the purpose of this information note is to provide the Subcommittee with information on the background leading to the adoption of the Montreal Protocol, as well as the regulatory framework established under the treaty. The preferential treatment for developing signatory countries and the effectiveness of the Montreal Protocol will also be discussed (https://biotech.law.lsu.edu/blog/0809in23-e.pdf).

The Montreal Protocol on Substances that Deplete the Ozone Layer is an important Multilateral Agreement regulating the production, consumption, and emissions of ozone-depleting substances (ODSs). It is an important part of international environmental conventions and protocols. This article gives background to the Montreal Protocol, shares some details on the Ozone layer, important points on the Montreal Protocol, successes associated with the Montreal Protocol, and association of India with the Montreal Protocol.

Ozone depletion: - The stratospheric ozone layer forms a thin shield in the upper atmosphere, protecting life on Earth from the sun's ultraviolet (UV) rays. It has been called the Earth's sunscreen. In the 1980s, scientists found evidence that the ozone layer was being depleted. Depletion of the ozone layer results in increased UV radiation reaching the Earth's surface, which in turn leads to a greater chance of overexposure to UV radiation and the related health effects of skin cancer, cataracts, and immune suppression. This fact sheet explains the importance of protecting the stratospheric ozone layer (Anwar et al. 2015). The ozone layer is a layer in Earth's atmosphere which contains relatively high concentrations of

ozone (O3). This layer absorbs 93-99% of the sun's high frequency ultraviolet light, which is potentially damaging to life on earth. Over 91% of the ozone in Earth's atmosphere is present here. It is mainly located in the lower portion of the stratosphere from approximately 10 km to 50 km above Earth, though the thickness varies seasonally and geographically. The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. Its properties were explored in detail by the British meteorologist G. M. B. Dobson, who developed a simple spectrophotometer (the Dobson meter) that could be used to measure stratospheric ozone from the ground. Between 1928 and 1958 Dobson established a worldwide network of ozone monitoring stations which continues to operate today. The "Dobson unit", a convenient measure of the total amount of ozone in a column overhead, is named in his honor (Sivasakthivel and Reddy, 2011).

The ozone layer is not really a layer at all, but has become known as such because most ozone particles are scattered between 19 and 30 kilometers (12 to 30 miles) up in the Earth's atmosphere, in a region called the stratosphere. The concentration of ozone in the ozone layer is usually under 10 parts ozone per million. Without the ozone layer, a lot of ultraviolet (UV) radiation from the Sun would not be stopped reaching the Earth's surface, causing untold damage to most living species. In the 1970s, scientists discovered that chlorofluorocarbons (CFCs) could destroy ozone in the stratosphere. Ozone is created in the stratosphere when UV radiation from the Sun strikes molecules of oxygen (O2) and causes the two oxygen atoms to split apart. If a freed atom bumps into another O2, it joins up, forming ozone (O3). This process is known as photolysis. Ozone is also naturally broken down in the stratosphere by sunlight and by a chemical reaction with various compounds containing nitrogen, hydrogen and chlorine. These chemicals all occur naturally in the atmosphere in very small amounts. In an unpolluted atmosphere there is a balance between the amount of ozone being produced and the amount of ozone being destroyed. As a result, the total concentration of ozone in the stratosphere remains relatively constant. At different temperatures and pressures (i.e. varying altitudes within the stratosphere), there are different formation and destruction rates. Thus, the amount of ozone within the stratosphere varies according to altitude. Ozone concentrations are highest between 19 and 23 km (Morrisette, 2015).

Causes of Ozone Depletion: - Ozone depletion occurs when the natural balance between the production and destruction of stratospheric ozone is tipped in favour of destruction. Although natural phenomena can cause temporary ozone loss, chlorine and bromine released from man-made compounds such as CFCs are now accepted as the main cause of this depletion (Angell and Korshover, 2005). It was first suggested by Drs. M. Molina and S. Rowland in 1974 that a man-made group of compounds known as the chlorofluorocarbons (CFCs) were likely to be the main source of ozone depletion. However, this idea was not taken seriously until the discovery of the ozone hole over Antarctica in 1985 by the Survey. Chlorofluorocarbons are not "washed" back to Earth by rain or destroyed in reactions with other chemicals. They simply do not break down in the lower atmosphere and they can remain in the atmosphere from 20 to 120 years or more. As a consequence of their relative stability, CFCs are instead transported into the stratosphere where they are eventually broken

down by ultraviolet (UV) rays from the Sun, releasing free chlorine. The chlorine becomes actively involved in the process of destruction of ozone (Sivasakthivel and Reddy, 2011).

Facts of Montreal Protocol: - The Protocol was signed in 1987 and entered into force in January 1989. The protocol gives provisions to reduce the production and consumption of ODSs to protect the ozone layer (https://www.unenvironment.org/ozonaction/who-we-are/about-montreal-protocol).

- It phases down the use of ODSs in a stepwise, time-bound manner.
- It gives different timetables for developing and developed countries.
- All member parties have specific responsibilities related to the phasing out of various groups of ozone-depleting substances, controlling ODS trade, reporting of data annually, controlling export and import of ODs, etc.
- Developing and developed countries have equal but differentiated responsibilities.
- However, both groups of nations have time-bound, binding, and measurable commitments under the protocol, making it effective.
- Under the protocol, there is a provision for it to be amended and adjusted according to the new scientific, economic, and technological advancements made.
- The Protocol has undergone nine amendments or revisions.
- The governance body for the protocol is the Meeting of the Parties. Technical support is given by the Open-ended Working Group. Both meet once every year.
- The Parties are aided by the Ozone Secretariat, which is based at the headquarters of the UN Environment Programme (UNEP) at Nairobi.
- It has been ratified by 197 Parties (196 member states of the UN plus the EU) making it the first United Nations treaty to be ratified by every country in the world.
- The Montreal Protocol's provisions relate to the following:

➢ Article 2: Control measures
➢ Article 3: Calculation of control levels
➢ Article 4: Control of trade with non-Parties
➢ Article 5: Special situation of developing countries
➢ Article 7: Reporting of data
➢ Article 8: Non-compliance
➢ Article 10: Technical assistance

And, other topics

- The ODSs regulated by the Protocol are listed in:

➢ Annex A: CFCs, halons
➢ Annex B: other fully halogenated CFCs, carbon tetrachloride, methyl chloroform
➢ Annex C: HCFCs
➢ Annex E: Methyl bromide
➢ Annex F: HFCs

- Multilateral Fund: The Multilateral Fund for the Implementation of the Montreal Protocol was set up in 1991 to help developing countries to comply with the provision of the Protocol. This is under Article 10 mentioned above.
- ➢ It provides financial and technical assistance to developing member countries whose yearly per capita consumption and production of ODSs is less than 0.3 kg.

The activities of the Fund are implemented by four bodies:

- UNEP
- UN Development Program (UNDP)
- UN Industrial Development Organization (UNIDO)
- World Bank

Success of Montreal Protocol: - The work of the Montreal Protocol is not done and much remains to be accomplished before the protection of the ozone layer can be assured for this and future generations. Nevertheless, the Parties to the Protocol have accomplished a great deal since the treaty was adopted in 1987. The successes are as follows (https://ozone.unep.org/sites/default/files/Key_achievements_of_the_Montreal_Protocol_2012.pdf):

A. Truly global participation: As noted above the Montreal Protocol is the only treaty ever to achieve universal ratification; it thus demonstrates the world's commitment to ozone protection and, more broadly, global environmental protection.

B. Healing the ozone layer: Results from continuing global observations have confirmed that atmospheric levels of key ozone depleting substances are going down and it is believed that with continued, full implementation of the Protocol's provisions the ozone layer should return to pre-1980 levels by the middle of this century.

C. Achieving major reduction goals: By 2010 virtually all Parties had reported compliance with their phase out obligations in respect of CFCs, halons, carbon tetrachloride, methyl chloroform, n-propyl bromide and chlorobromomethane. As a consequence, the Protocol has now led to the phase-out of 98 per cent of the historic levels of production and consumption of ozone-depleting substances.

D. Supporting developing countries: With the assistance of the Multilateral Fund for the Implementation of the Montreal Protocol developing countries had, by mid-2011, permanently phased out over 260,000 tonnes of ozone depleting substances that had been used to produce various products;

E. High rates of compliance: Taking into account all parties to the Protocol and all their phase-out commitments, the parties have achieved a compliance rate of over 98 per cent. Further, in the process of phasing-out many countries, both developed and developing, have met their phase-out targets well ahead of schedule;

F. Health benefits: Controls implemented under the Montreal Protocol have enabled the global community to avoid millions of cases of fatal skin cancer and tens of millions of cases

of non-fatal skin cancer and eye cataracts. The United States estimates that by the year 2065 more than 6.3 million skin cancer deaths will have been avoided in that country alone and that efforts to protect the ozone layer will have saved it an estimated US$4.2 trillion in healthcare costs over the period1990–2065. In addition, in 2011 the United States Environmental Protection Agency estimated that more than 22 million Americans born between 1985 and 2100 would avoid suffering from cataracts thanks to the Montreal Protocol;

G. Climate benefits: The Protocol has also delivered substantial climate benefits. Because most ozone depleting chemicals are also greenhouse gases, the Protocol has already averted greenhouse gas emissions equivalent to more than 135 billion tonnes of carbon dioxide. These significant reductions make the Montreal Protocol one of the prime contributors to the fight against global warming;

H. Global recognition: In 1995, recognition of the importance of protecting the ozone layer and the contribution of science to doing so came in the form of the Nobel Prize for Chemistry, which was awarded to Sherwood Rowland, Mario Molina and Paul Crutzen for their pioneering work on ozone depletion. In addition, in 2003, political recognition of the Protocol came in the statement of then United Nations Secretary General Kofi Annan, who termed the Montreal Protocol "perhaps the single most successful international environmental agreement to date". More recently, the United Nations Secretary-General Ban Ki-moon said that "among the considerable number of multilateral agreements agreed between states over the past 40 years, the … Montreal Protocol stands out. The manner in which this instrument for repairing and recovering the Earth's protective shield has been financed and implemented serves as an inspiring example of what is possible".

Kyoto Protocol: - The Kyoto Protocol is an international agreement that brings into operation the United Nations Framework Convention on Climate Change (UNFCCC). It is the first set of international rules designed to implement the UNFCCC. UNFCCC is a multilateral environmental treaty that came into force on 21 March 1994, at the Earth Summit, New York City in the year 1992, to combat climate change. Its role is to fight global warming by reducing greenhouse gas concentrations in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system. The Kyoto Protocol is based on the principles and provisions of the Convention and follows its annexbased structure. It only binds developed countries, and places a heavier burden on them under the principle of 'common but differentiated responsibility and respective capabilities', because it recognizes that they are largely responsible for the current high levels of GHG emissions in the atmosphere. The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations. As of today, there are 192 parties to the Kyoto Protocol.

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capabilities", because it recognizes that they are largely responsible for the current high levels of GHG emissions in the atmosphere.

Without a doubt, climate change is first among the global environmental threats facing civilization at the beginning of the XXI Century. The true importance of this problem is demonstrated by the tremendous adaptation costs the global community must pay even today to protect itself from a growing number of natural disasters. Extremely hot temperatures, droughts, forest fires, floods, hurricanes and tornadoes, a lack of drinking water and food, and the spread of diseases previously unheard of — this is only a partial list of the grave consequences of global climate change already taking place. The world community now realizes the importance of the effects of climate change and is making a concerted effort to adequately address this problem. The Intergovernmental Panel on Climate Change (IPCC) established by the United Nations in 1988 unanimously concluded that anthropogenic activities have thrown the global climate system out of balance, thus becoming one of the principal causes of observed and predicted climatic changes. The United Nations Framework Convention on Climate Change (UN FCCC) was signed at the World Summit on the Environment and Development in Rio de Janeiro in 1992, and the Kyoto Protocol to the Convention was adopted in 1997 (https://wwfint.awsassets.panda.org/downloads/kyotoqaeng.pdf).

Climate Protection –The Key Issues: - Rational decision-making in climate policy requires balancing the cost of greenhouse gas emission abatement and the benefits of avoided undesirable consequences of global warming. Classical cost–benefit analysis provides the appropriate framework for measuring all negative and positive policy impacts and resource uses in the form of monetary costs and benefits. An emission mitigation policy that allocates society's resources efficiently maximizes net benefits: Emissions reduction efforts are taken up to the level where the marginal benefit equals the marginal cost. Combating global warming constitutes the problem of providing a global public good. Public goods are commodities for which the cost of extending the service to an additional individual is zero and for which it is impossible (or expensive) to exclude individuals from enjoying it. These features of non-rivalry and non-excludability apply to climate protection. A first-best, i.e. globally efficient, response policy to climate change requires an international environmental policy which takes into account the benefits for all countries that emission abatement in a single country produces. Given complete information, a global cost–benefit analysis could tell us how much greenhouse gas (GHG) emissions should be abated, when and by whom. However, at a decentralized level, individual rational countries only pursue their own interests and neglect the positive externalities of their reduction measures for other countries. Thus, the level of GHG emission reductions will be too low (Böhringer, 2003).

Principles of the Kyoto Protocol: - The Kyoto Protocol is based on the principle of 'Common But Differentiated Responsibilities (CBDR) '. It puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere. According to the CBDR, the Kyoto Protocol divides the responsibilities of different countries into two ways:

1. Historical Polluters (Developed Countries): - Historically, the biggest polluting developed countries are polluting the earth since the Industrial Revolution. These countries include- the US, UK, France, Japan, Russia, etc. Under the CBDR, developed countries like the US, UK, Russia, etc. must contribute more towards the implementation of ways to reduce GHGs. They must do so by:

● Accepting the certain binding limits on GHG emissions.

● Contributing funds towards reducing GHG emissions in the developing and the least developed countries.

2. Recent Polluters (Developing Countries): - Recently polluting developing countries are countries that have been polluting since the 1950s. These include countries like China, India, Brazil, etc. Such countries should do everything possible to cut down their GHG emissions. But these countries are not bound, and every initiative taken by these countries is voluntary.

Responsibilities and Targets of the Kyoto Protocol: - The Kyoto Protocol is designed to assist countries in adapting to the adverse effects of climate change. It facilitates the development and implementation of techniques that can help increase resilience to the impacts of climate change. One of the major features of the Kyoto Protocol is that it sets obligatory targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. The protocol does not set reduction targets for developing countries on the principle that the developed countries that have created the problem should take the first steps to clean it up. However, rapidly developing economies such as those of China and India will have a huge impact on GHG emissions in the future. The lack of developing country commitments is one of the reasons why the United States refused to ratify Kyoto.

Doha Amendment: - In Doha, Qatar, on 8 December 2012, the Doha Amendment to the Kyoto Protocol was adopted for a second commitment period, starting in 2013 and lasting until 2020. As of 28 October 2020, 147 Parties deposited their instrument of acceptance, therefore the threshold of 144 instruments of acceptance for entry into force of the Doha Amendment was achieved. The amendment entered into force on 31 December 2020. During the first commitment period, 37 industrialized countries and economies were in transition, and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reducing GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first (https://unfccc.int/kyoto_protocol).

The Kyoto mechanisms: - One important element of the Kyoto Protocol was the establishment of flexible market mechanisms, which are based on the trade of emissions permits. Under the Protocol, countries must meet their targets primarily through national measures. However, the Protocol also offers them an additional means to meet their targets by way of three market-based mechanisms:

- International Emissions Trading

- Clean Development Mechanism (CDM)
- Joint implementation (JI)

These mechanisms ideally encourage GHG abatement to start where it is most cost-effective, for example, in the developing world. It does not matter where emissions are reduced, as long as they are removed from the atmosphere. This has the parallel benefits of stimulating green investment in developing countries and including the private sector in this endeavour to cut and hold steady GHG emissions at a safe level. It also makes leap-frogging—that is, the possibility of skipping the use of older, dirtier technology for newer, cleaner infrastructure and systems, with obvious longer-term benefits—more economical.

Monitoring emission targets: - The Kyoto Protocol also established a rigorous monitoring, review and verification system, as well as a compliance system to ensure transparency and hold Parties to account. Under the Protocol, countries' actual emissions have to be monitored and precise records have to be kept of the trades carried out. The UN Climate Change Secretariat, based in Bonn, Germany, keeps an international transaction log to verify that transactions are consistent with the rules of the Protocol. Reporting is done by Parties by submitting annual emission inventories and national reports under the Protocol at regular intervals. A compliance system ensures that Parties are meeting their commitments and helps them to meet their commitments if they have problems doing so. Adaptation The Kyoto Protocol, like the Convention, is also designed to assist countries in adapting to the adverse effects of climate change. It facilitates the development and deployment of technologies that can help increase resilience to the impacts of climate change. The Adaptation Fund was established to finance adaptation projects and programmes in developing countries that are Parties to the Kyoto Protocol. In the first commitment period, the Fund was financed mainly with a share of proceeds from CDM project activities. In Doha, in 2012, it was decided that for the second commitment period, international emissions trading and joint implementation would also provide the Adaptation Fund with a 2 percent share of proceeds (https://unfccc.int/kyoto_protocol).

Conclusions: - More than 10 years of climate policy negotiations have produced the Kyoto Protocol, the first legally binding international agreement on climate protection, which may enter into force in the near future. Given the large uncertainties in the science of climate change and the fundamental incentive problems of sovereign states, it is clear that a perfect (first-/second best) climate policy cannot be achieved in practice. The Kyoto Protocol is thus necessarily only one out of much possible imperfect architecture to address the risks posed by global climate change. Opponents to the Protocol have condemned it as a “deeply flawed agreement that manages to be both economically inefficient and politically impractical” (McKibbin and Wilcoxen 2002, p.107). This article sustains a more positive perspective on the Kyoto architecture. Key elements of the Protocol comply with basic economic principles. The Protocol is based on a control mechanism that allows iterative adjustment and movement toward evolving goals. A system of periodically negotiated five-year periods supports a flexible approach that allows policy-makers to adjust their decisions according to better information obtained in the future

The Protocol constitutes the first international environmental agreement that builds on market based instruments to determine cost-efficient responses to the undisputed need for GHG abatement. After tough bargaining, Kyoto came up with a burden-sharing scheme for the first commitment period that all major Parties (with exception of the US) have accepted as a "fair" compromise, hereby reflecting historic responsibilities for the GHG externality as well as ability to pay. On the other hand, it must be clearly stated that the Kyoto Protocol - as it stands now – has not achieved a decisive breakthrough in international climate policy. In the first place, sink credits, hot air through emissions trading and, in particular, U.S. repudiation will make Kyoto ineffective in environmental terms during the first commitment period. Second, it has yet to be negotiated what must be done after the first commitment period.

Given the shared belief that substantial global emission reduction is required in the long run, the major challenge remains as to how we can push institutional settings that promote comprehensive international cooperation. In the first place, this requires incentives for developing countries to participate. Ultimately, this comes down to how abatement duties - or emission entitlements – should be allocated across countries over a longer time horizon. This issue has already dominated previous climate negotiations and proved extremely difficult to solve, even though the overall abatement targets under discussion were very moderate in comparison with the long-term requirements suggested by the IPCC. Consequently, some pragmatic reconciliation of the equity-efficiency divide must be at the top of the research and policy agenda. In the second place, a credible system of direct or indirect sanctions must be developed that can deter free-riding. Applied research should be dedicated to the question of which sanction mechanisms are likely to provide concrete improvements in practice. A final caveat should be made: Kyoto, as it stands now, has emerged from tedious bargaining. In this paper, both the indicated perspective of amendments as well as possible alternatives is discussed from a theoretical point of view. One can hardly predict how the theoretical proposals will materialize in practice after passing the negotiation process (Böhringer, 2003).

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UNIT: - 5

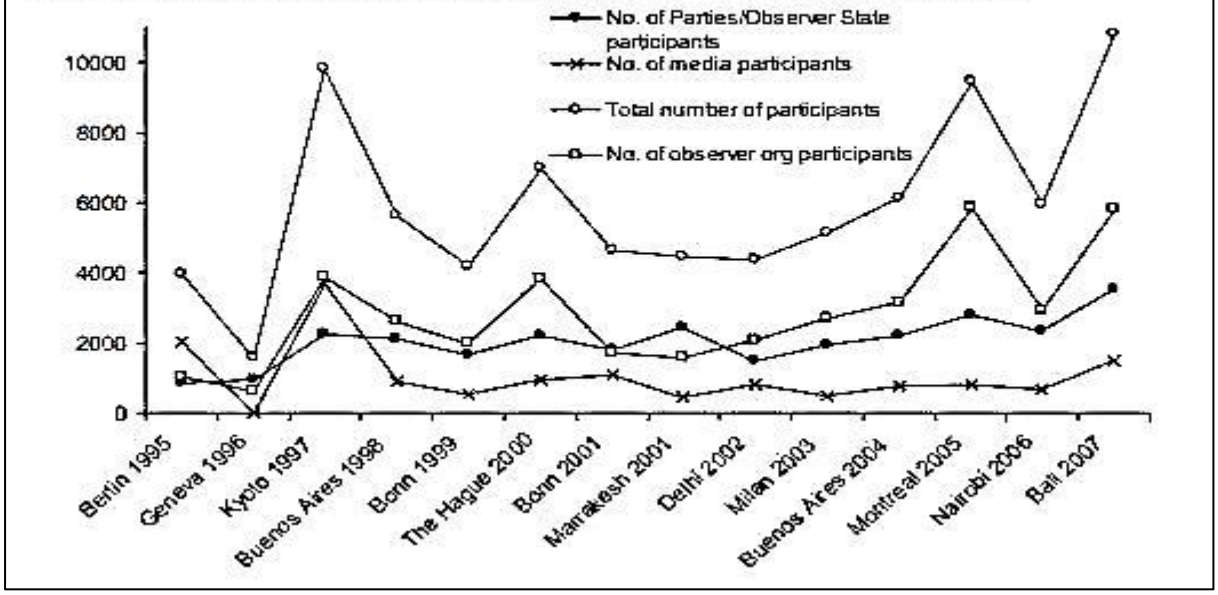
Conference of the Parties

Introduction: - If climate change negotiations do not appear legitimate to various groups, it may impede their ability to reach and implement agreements. One factor in attaining increased legitimacy is to secure a forum for input to the negotiations outside the formal negotiations, a forum where Parties, civil society, business, trade unions, and others, who all have a stake in the outcome of the negotiations, can present their views. Starting with the parallel conferences arranged at the United Nations Conference on the Human Environment in 1972, civil society involvement has grown to become an integral part of the UN negotiating process. Civil society involvement has grown to become an integral part of the UN negotiating process. The side events at the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) are today the most visible component of and the only formal avenue of civil society involvement in international climate negotiations. This study assesses the extent to which side events effectively: a) provide input to the negotiations and b) contribute to the construction of the climate regime. Through surveying organizers of and participants in side events as well as COP delegates, we have analyzed i) who attends side events, ii) why they attend them, iii) why organizations arrange side events, and iv) the outcome of side events.

A common conception is that the side events should provide a forum for input to the negotiations. Wide participation in side events is expected to increase the legitimacy of both the negotiating process leading up to agreements and the results achieved at COPs. By involving a wider range of stakeholders and perspectives, side events can be said to legitimise climate governance through fostering inclusiveness – i.e., engaging a range of major stakeholders in the process leading up to multilateral decisions on climate change (Seyfang 2003). Our starting point was the question of input legitimacy and the procedural framework for the diffusion of ideas in the negotiations. However, as this study will demonstrate, side events also promote other objectives, most notably capacity building.

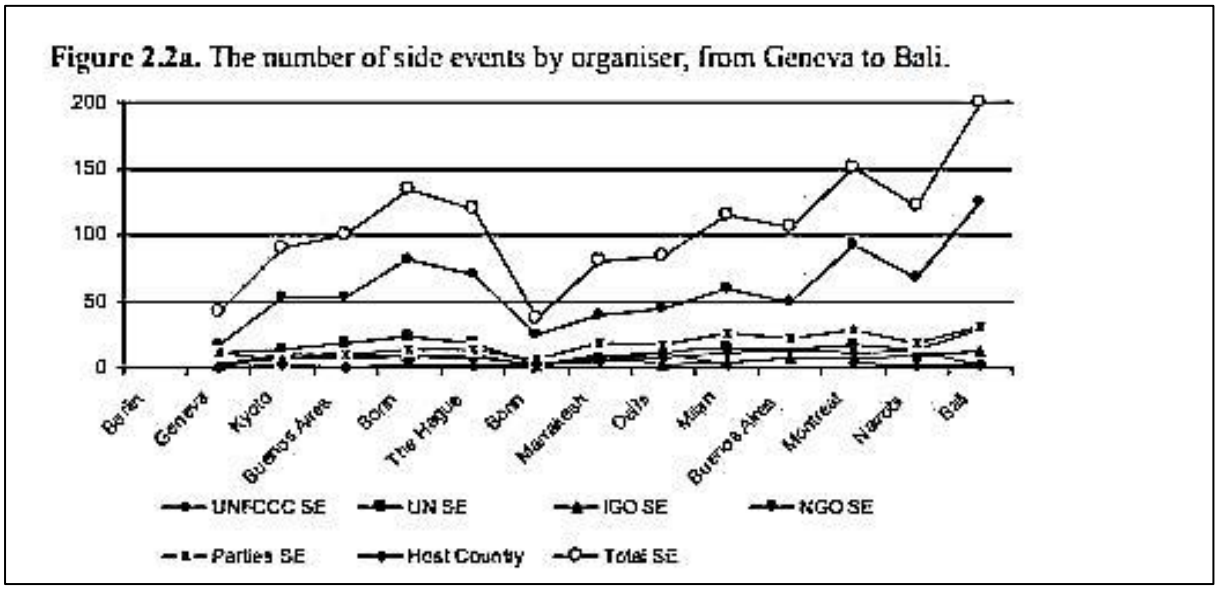
History of side events at UNFCCC COP: - Side events have been organised in COP and Subsidiary Body (SB) sessions of the UNFCCC since the first one in Berlin in 1995.2 Figures 2.1 and 2.2 below present the total number of participants as well as composition in terms of Party, media, and observer organisation (e.g., NGOs) participants at COP and SB sessions from 1995 to 2007.

Figure 2.1. Total number of participants and composition in terms of Party, media, and observer organisation (e.g., NGOs) participants at COP sessions from 1995 to 2007.



Source: - Hjerpe et al., 2008, page- 13

Figure 2.2a. The number of side events by organiser, from Geneva to Bali.



Source: - Hjerpe et al., 2008, page- 14

Figure 2.1 shows that four COPs attracted significantly larger attendance than did the others, in chronological order: Kyoto 1997 (COP 3), The Hague 2000 (COP 6), Montreal 2005 (COP 11), and Bali 2007 (COP 13). The total number of participants at these events was almost 10,000 in Kyoto, 7,000 in the Hague, 9,400 in Montreal, and nearly 11,000 in Bali. At other COPs, total participation was between 4,000 and 5,000 participants. Linear regression suggests that the total number of participants has increased by approximately 300 per year. The attendance rates of Party, observer organisation, and media participants have evolved in different ways. The proportion of observer organisation attendance has basically followed the evolution of the total number of participants and thus displays the same four spikes. It

increased rapidly from about a quarter of all participants in Berlin to about half of total attendance since Buenos Aires. Media representatives have made up approximately 10% of total COP attendees. Media attendance was by far the highest in Kyoto, where it reached almost 4,000 media participants, followed by the first COP, in Berlin, where it reached 2,000. After Kyoto, media attendance was declining until Bali, when a significant increase was noticeable and 1,500 media participants were present. Roughly every third COP attendee is a Party participant. The number of Party participants totalled approximately 1,000 at the first two COPs and then varied only slightly between 1,500 and 2,200 from Buenos Aires I to Buenos Aires II, except at Marrakesh 2001. In the last three years, Party participation has increased, reaching almost 3,000 in Montreal and 3,500 in Bali. Attendance at SB sessions increased between sessions 20 and 26. The number of Party participants at SB sessions has increased significantly, while observer organisation attendance has increased more slowly. Concurrently, media attendance has increased dramatically from three to 57 per SB session.

The UNFCCC secretariat has estimated the total number of side event participants over the past four years based on a head count at the beginning of each event. The estimated average number of side event participants was 64 (Buenos Aires II), 116 (Montreal), 48 (Nairobi), and 84 (Bali), compared with the actual average number of participants at UNFCCC-organised events over the same period: 64, 87, 85, and 118, respectively. After this short background on the history of COPs of the UNFCCC, we turn to the most recent COP, the 13th COP of the UNFCCC, held in Bali, Indonesia 3–14 December 2007. In the following sections, we will identify the participants and organisers, why they were involved in side events, and their expectations of the COP (Hjerpe et al., 2008).

COP1, 1995: Berlin, Germany:

Backdrop: - The first COP came off the back of the 11th session of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change . This had itself come after the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 at the United Nations Conference on Environment and Development (the Rio 'Earth Summit'), which followed Thatcher's 1990 call at the second World Climate Conference for negotiating "a successful framework convention on climate change in 1992" (Magrini, 2021).

Negotiations: - The principle focus of COP1 was to kickstart negotiations to strengthen the global response to climate change4 . Negotiations were guided by recommendations from both the Subsidiary Body for Scientific and Technological Advice, the Intergovernmental Negotiating Committee, and the Intergovernmental Panel on Climate Change (IPCC).

Key Agreements: - Parties agreed to submit national communications, detailing their measures for limiting anthropogenic emissions, with the aim of launching a coordinated global effort. Parties agreed such national communications would be subject to 'in-depth' review. Such reviews would "describe expected progress in the limitation of emissions by sources and enhancement of removals by sinks of greenhouse gases", "describe expected

progress in cooperation to prepare for adaptation" and "aggregate data across national communications with respect to inventories, projections, effects of measures and financial transfers, but without adding up the individual national total for projections and the effects of measures"(https://unfccc.int/cop5/resource/docs/cop1/07a01.pdf) .

COP2, 1996: Geneva, Switzerland:

Backdrop: - As the second session, COP2 was where parties would now have to delve into the details of negotiating a globally coordinated response to climate change.

Negotiations: - Negotiations made progress with Northern states, particularly the US, which "finally accepted the need for binding emission reductions to combat climate change" though still pushing for greater participation from Southern states. The US and others argued their climate action, without some participation from 'developing countries', would harm their trade competitiveness, which delayed negotiations but brought further forward the importance of assessing how developing countries would decarbonise (Climate Policy, 1995).

Key Agreements: - Parties agreed on working to set binding quantitative targets to limit emissions by industrialised countries (those Northern states). As such, parties endorsed the results of the IPCC second assessment report, which was thanks to COP1's establishing of this review process for national communications. Given disagreements stalling COP2, the Geneva Ministerial Declaration was noted by the parties (and annexed in the report), but was not adopted (https://www.downtoearth.org.in/climate-change/cop-02).

COP3, 1997: Kyoto, Japan:

Backdrop: - With COP2 unsuccessful at signing legally-binding, quantitative targets, the world reconvened in Kyoto a year later for the third session of COP. With significant anticipation, delegates negotiated the first momentous COP deal.

Negotiations: - Understanding the target-setting of emissions was the principal aim of COP3, delegations arrived with their initial proposals, which varied enormously. The US proposal was to stabilise emissions17. The EU proposal was a 15% cut for the 2008-2012 period. This compares to the 1990 IPCC report suggesting 60% reduction was needed. Now, developing countries were on the card for action, easing concerns present among the industrialised nations at previous negotiations. The COP3 President set this tone from the start, welcoming delegates by saying "[worldwide strategy against climate change] should be based on three principles: developed countries should take the lead now in committing themselves to reduce greenhouse gas emissions below 1990 levels; developing countries should also take actions to address the issue of climate change in promoting their sustainable development;{…} and developed countries should strengthen their partnership with developing countries through the provision of financial and technological support for mitigating global greenhouse gas emissions.

Key Agreements: - The Kyoto Protocol was adopted by the end of the Conference, though not signed by the US until COP4 and later still not ratified by the US. The US maintained that it disapproved of any international agreement not involving action from developing nations, so it wasn't until 2004 when Russia signed into the protocol that the protocol had to be acted on. Nonetheless, the Protocol's eventual coming into force established carbon markets and held developed countries to legally binding emissions reduction targets (Harrison, 2021).

COP4, 1998: Buenos Aires, Argentina:

Backdrop: - With the Kyoto Protocol adopted, COP4 and COP5 were left with defining the precise details of the deal and its mechanisms before they entered into action.

Negotiations: - While the purpose of the summit was principally to produce a rulebook for the operationalisation of the Kyoto Protocol, negotiations once again returned to the question of developing country participation. As a result, Argentina – as the host – became the first developing country to announce its intention of a binding climate target alongside the Kyoto Protocol's Annex 1 countries. Kazakhstan later joined Argentina in this announcement (US Department of State Archive, 1998).

Key Agreements: - The summit of COP4 produced the 'Buenos Aires Action Plan', a two-year action plan for advancing the Kyoto Protocol to reality. The plan established: -

- Rules for the Protocol's market-based mechanisms (emissions trading, JI, and the Clean Development Mechanism).
- Compliance rules, including consequences for non-compliance.
- Development and transfer of cleaner, climate-friendly technologies to less developed nations.
- Consideration of adverse impacts of climate change and response measures.

COP5, 1999: Bonn, Germany:

Backdrop: - Having established many of the rules and procedures necessary for the enactment of the Kyoto Protocol at COP4, parties convened at COP5 to polish off technical details. The outgoing COP4 President remarked in her opening statement in Bonn that "developing countries were rapidly becoming a significant source of additional greenhouse gas emissions", which added a layer of complexity to all future negotiations: the scale of action necessary was now much greater (Lang).

Negotiations: - Remaining negotiations concerned "the adoption of the guidelines for the preparation of national communications by countries, capacity building, transfer of technology, and flexible mechanisms" (The Scottish Parliament, 2021).

Key Agreements: - Mainly a technical summit, there were few notable conclusions. Parties were invited, however, to "contribute to [Buenos Aires Action Plan] preparatory work [ahead of COP6], substantively and, as appropriate, financially, inter alia to support adequate

participation of developing countries, in particular the least developed countries and the small island developing states."

COP5 also concluded a list of capacity-building needs of developing country parties, addressing head on the hurdles in the way of globally impactful climate action:

- Institutional capacity building
- Capacity-building under the clean development mechanism
- Human resource development
- Technology transfer
- National communications
- Adaptation
- Public awareness
- Coordination and cooperation
- Improved decision-making

COP6, 2000: The Hague, The Netherlands; 2001: Bonn, Germany:

Backdrop: - The Kyoto Protocol was nearing its final details, but this momentous two-stage COP would see the political difficulties of climate action flare up enormously.

Negotiations: - The outgoing COP5 President pinpointed a principal sticking point for negotiations in his opening remarks in The Hague. "He recalled that the Kyoto Protocol would enter into force once it had been ratified by 55 Parties, incorporating Annex I parties accounting in total for at least 55% of the total CO2 emissions for 1990. Therefore, a bridge of understanding providing mutual benefits must be built between developed and developing countries. This might include agreement to count as the reduction by developed countries a part of the emissions absorbed by sinks, and provision by the developed countries of effective and efficient financial assistance to developing countries.

Key Agreements: - The outcome of tough and prolonged negotiations over flexibility mechanisms, the mechanics of the Kyoto Protocol emissions trading and sinks were agreed upon:

- Emissions trading: trade of carbon credits among those Annex-1 countries committed to binding targets35.
- JI: join implementation established so that one country can claim carbon credits for financing projects in other Annex-1 countries35.
- CDM: the Clean Development Mechanism was agreed upon so that developed countries can claim emissions credit for financing decarbonisation projects in developing countries, even where these developing countries have no binding targets35.
- Sinks: concessions achieved on the contribution of sinks towards emissions reductions, though with limits set on a country-by-country basis.

COP8, 2002: New Delhi, India:

Backdrop: - Outgoing COP7 President opens with remarks on how "The Marrakesh Accords symbolised the transition from theory to practice, that is, from the elaboration of the rules of the Kyoto Protocol to its implementation".

Negotiations: - Sustainable development was a key feature of this particular climate summit. COP8 President opened with: "The links between climate change and sustainable development had highlighted the problems of poverty, land degradation, access to water and food, human health, and the use of energy. {…} Climate change in the context of sustainable development would be addressed in the envisaged Delhi Declaration.

Key Agreements: - By the end of the summit, Parties had agreed to adopt the Delhi Declaration on Climate Change and Sustainable Development, having made no substantive progress on the implementation of the Kyoto Protocol, despite initial objectives. The Delhi Declaration makes no further commitments to reduce greenhouse gas emissions, making no reference to the Kyoto Protocol in its first draft47. It had been hoped that, as the Kyoto Protocol had outlined, there would be negotiation of the targets for the second commitment period for Annex B countries. Negotiations, however, were unable to bring developing country polluters, such as China, into legally-binding commitments and so the summit fell flat on this point, to the frustration of Australia and the US – both had yet to ratify the Kyoto Protocol. Parties, did however, agree to these key principles of the Delhi Declaration:

- Urge Parties to ratify Kyoto Protocol.
- Parties should promote sustainable development, integrated with national development programmes.
- National sustainable development strategies should integrate more fully climate change objectives in key areas such as water, energy, agriculture, and biodiversity.
- Parties should continue to meet targets set out in previous national communications and in line with the Kyoto Protocol, irrespective of its ratification or not.
- Adaptation to the adverse effects of climate change is a [newly] high priority for all countries, in particular those vulnerable developing nations.

COP9, 2003: Milan, Italy:

Backdrop: - The CDM had been made operational in the period between COP8 and COP9, initiating the start of projects by 2004. The outgoing COP8 President remarked at the opening of COP9 that for developing countries, "[adaptation] entailed considerable costs {…} therefore necessary to operationalize as early as possible the Special Climate Change Fund and the Least Developed Countries Fund" left unfinished at COP8. The President also called on Parties to "reconfirm faith in multilateral cooperation.

Negotiations: - Again, there was a reluctance from many developing countries for them to decarbonise. The outgoing COP8 President opened COP9 saying "no new commitments

should be introduced for developing countries". The incoming COP9 President, like various of his predecessors, emphasised COP9 should look to implement the Kyoto Protocol. He cited the "very large number of states that had ratified it and wished to proceed with its implementation {…} and available scientific scenarios on the future development of the global climate alarming (UNFCCC, 2003).

Key Agreements: - COP9 was unable to deliver the Kyoto Protocol in action, although did transpire significant climate leadership from the EU and various other Annex-1 countries. The implementation of the Special Climate Change Fund and LDC Fund were achievements relative to previous COPs, though themselves lacked a truly coordinated and comprehensive approach.

COP11, 2005: Montreal, Canada:

Backdrop: - Parties came to COP11 with a "solid and broad scientific basis on which to take immediate action to eliminate the causes of climate change" in the words of the outgoing COP10 President63. Climate risks were also at the fore of delegates' minds, given 2005 had seen extreme weather, including a devastating US hurricane season64. Hung in the air was the hope the Kyoto Protocol would become operational (Adam, 2005).

Negotiations: - The US and Australian delegations came to COP11 remaining still outside the Kyoto Protocol. So, the passing of legal accords concerning the entering into force of the Kyoto Protocol excluded the US and Australia from negotiations. US and Australian delegations did, however, involve themselves in later negotiations, which did not involve legally binding climate action.

Key Agreements: - The Kyoto Protocol was brought into force eight years after its conception, including the much-anticipated emissions trading. Notably, this included a "strengthened" clean development mechanism, one of those key flexibility mechanisms to facilitate green investment in developing countries and quieting concerns from some developed countries, notably those of the Umbrella Group who had ratified Kyoto, about the feasibility of emission reduction commitments. Funding for the CDM totalled over $13m, as agreed in Montreal. Another flexibility mechanism was also launched, with the governing body for Joint Implementation being set up at COP11 (Hallman, 2005).

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UNIT: - 6

Concept and methods of alternative agriculture

Introduction: - Sustainability and food security are the major challenges faced by third world countries for the past several decades. Most of the third world countries are also facing problems of climate change, increasing population, overexploitation of natural resources and resource degradation associated with rapid economic growth. Among the scientific and policy circles there are controversies in using inorganic chemicals and biotechnology for sustaining the agricultural production. There is no critical comprehensive review on sustainability of alternative farming systems and their relative advantages over conventional, chemicalized and hi-tech agriculture for decision making at various levels. This review tries to fulfill the knowledge gap in this vital sector. The first part of the review discuss the current status of agro-ecosystems, with emphasis on their threats in terms of food security, long term sustainability, impacts on ecosystem services and climate change.

We also evaluate the ecological, economic, social and cultural sustainability of inorganic agriculture. This analysis points emerging issues such as environmental degradation, loss of ecosystem services, non-sustainability and threats to food security in the context of global population growth and climate change. Hence there is an urgent need for identifying potential alternative farming strategies to achieve long term sustainability and food security as indicated by several leading workers in the field. The next section traces the background and evolution of alternative farming systems with their scope and importance. Then we classified potential sustainable farming techniques practiced in various parts of the world. For that we review potentials, constraints, strategies and case studies for ten alternatives farming techniques and four innovative endogenous farming techniques from India.

The alternative farming techniques that were field tested and perfected over several generations in the past portrayed the following advantages over chemical farming:

(1) eco-friendly by protecting and revving life support systems and ecosystem services, (2) higher cost benefit ratio, benefiting the farmers as well as the consumers, (3) control and reduction of bioaccumulation and bio magnification, (4) reduction in air, water and soil pollution caused by various pesticides and other chemicals, (5) control of health hazards in humans and livestock, and (6) conservation and sustainable use of on-farm biodiversity, including traditional cultivated germplasm and natural resources in agro systems. Alternative farming techniques-Bio dynamic farming-Eco farming-HOMA-India-LEISA-Integrated farming systems-No tillage farming-Natural farming-Organic farming-Permaculture-Polyculture-Sustainability-Urban and Peri-Urban farming-Zero budget natural farming (Padmavathy and Poyyamoli, 2011).

Issues and Challenges in Agriculture: - Currently global agriculture faces several critical issues in terms of food security, climate change, ecosystem degradation, biodiversity loss and various effects on ecosystem services. Hence, an in depth analysis of each of these issues is warranted.

A. Food Security: - Household and national food security are complex and complicated goals influenced by many factors such as technologies, human capacities, policies, prices, trade and infrastructural context. Demand for food is certain to increase with increasing population pressure and income, even though this demand and ability to supply the demand are not equal in all communities. Indeed, today's total global agricultural production is sufficient to feed the current world population and both necessary technologies and multilateral environmental agreements are available to help meet development and conservation needs (FAO, 2009).

The projections by the Food and Agriculture Organization for the period of 1999 to 2030 estimate an increase of global agricultural production by 56% with arable land expansion accounting for 21% of production growth in developing countries. For this same period, the share of irrigated production in developing countries is projected to increase from 40 to 47% (FAO 2006).

B. Climate Change and Agriculture: - Agriculture faces a complex and unique challenge in the context of climate change. First, agriculture is particularly vulnerable due to its dependence on weather and climatic conditions. The sector is already experiencing negative impacts from higher temperatures, more variable rainfall, invasive pests, and more frequent extreme weather events, which will worsen as climate change accelerates. At the same time, agriculture is itself a major source of global greenhouse gas (GHG) emissions, both directly (through on-farm emissions linked to production) and indirectly (through land use change due to agricultural expansion). Overall, agriculture, forestry and other land use (AFOLU) represents around one-fifth (22%) of global anthropogenic GHG emissions. Half of this stems from on-farm emissions of methane and nitrous oxide, and the other half from CO2 emissions resulting from land use, land use change and forestry (LULUCF). Methane has a particularly strong influence on temperatures in the short term, and mitigation of this gas is important for stabilizing climate change by mid-century. In the absence of action, emissions from agriculture will continue to rise, and the sector's share of total emissions may increase as other sectors decarbonize (https://www.oecd.org/agriculture/ministerial/documents/Agriculture%20and%20Climate%20Change.pdf).

Agriculture is extremely vulnerable to climate change. Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Changes in precipitation patterns increase the likelihood of short- run crop failures and long-run production declines. Although there will be gains in some crops in some regions of the world, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security (Mendelsohn and Williams 2006).

C. Ecosystem Degradation and Biodiversity Loss in Agro ecosystems: - Humans have converted an estimated 38.2% or 4973 million ha of the Earth's land surface area to agriculture i.e. temporary or permanent crops and pastures, at the expense of natural habitat and this figure is forecast to reach 60% in the next 100 years (FAOSTAT, 2008). The ecosystem services and bio diversity are severely affected by chemical intensive agricultural and high tech practices. There are several studies to prove how the farming practices influence the species richness and abundance of taxa in agro ecosystems (Araujo et al. 2009).

However globalization and agricultural intensification have diminished the varieties traditionally used, with only 30% of the available crop varieties dominating global agriculture. These, together with only 14 animal species, provide an estimated 90% of the worlds consumed calories (FAO 2008). Globally, over 1,000 (87%) of a total of 1,226 threatened bird species are impacted by agriculture. More than 70 species are affected by agricultural pollution, 27 of them seriously. Pesticides and herbicides pose a threat to 37 threatened bird species globally, in addition to deleterious effects of agricultural chemicals on ground water (BirdLife 2008).

D. Impacts on Ecosystem Services: - Agriculture produces more than just crops. Agricultural practices have environ- mental impacts that affect a wide range of ecosystem services, including the maintenance of water cycle and water quality, pollination, nutrient cycling, soil retention, carbon sequestration, and biodiversity conservation. In turn, the impacted ecosystem services affect agricultural productivity. Understanding the contribution of various agricultural practices to the range of ecosystem services would help inform choices about the most beneficial agricultural practices. Measuring the impact of alternative agricultural practices on ecosystem services and of ecosystem services on agricultural production is a big challenge (Badgley et al. 2007).

The following are reported as the major impacts of agricultural practices on Ecosystem services (Tilman et al. 2002):

• The use of resources such as food, water, and timber has increased rapidly continues to grow, sometimes unsustainably

• Fossil fuel use has intensified, thus leading to greater greenhouse gas emission

• Human interventions have led to changes in the regulation of climate, disease, and other ecosystem processes

• Loss of agro biodiversity especially the pollinators and decomposers is accelerated, due to the indiscriminate use of agro chemicals

• The use of ecosystems for recreation, spiritual enrichment, and other cultural purposes is growing. However the capacity of ecosystems to provide these services has declined significantly.

E. Energy Use in Agriculture: - Agriculture is a modest user of energy relative to other economic sectors accounting for an estimated 3.5% of commercial energy use in developed countries and 4.5% in developing countries. In addition, the production of the mineral fertilizers on which modern, intensive agriculture has come to rely to replenish nutrient-depleted soils requires significant energy. Up to fivefold increase in fertilizer prices between 2005 and 2008 was strongly influenced by the soaring oil price during this period, alongside production capacity constraints linked to the availability of phosphates, potash and other mineral ores (Piesse and Thirtle 2009). In developing countries, fertilizers require the highest commercial energy in- puts, followed by machinery and irrigation. The Agriculture: Toward 2000 study assumed that significant increases in commercial energy application will be

needed to boost agricultural yields and farm earnings. Its two scenarios for the year 2000 project an average increase of 7.5% per year in commercial energy use in agriculture in 90 developing countries, resulting in more than a quadrupling of energy use between 1980 and 2000 (FAO 1981).

Evolution of Alternative Farming Strategies: - The interest in the sustainability of agricultural and food systems can be traced to environmental concerns that began to appear in the 1950s–1960s. However, ideas about sustainability date back at least to the oldest surviving writings from India, China, Greece and Rome (Pretty et al. 2006). Today there is an urgent need of sustainable agricultural technologies and practices that (1) do not have adverse effects on the environment i.e. partly because the environment is an important asset for farming (2) are accessible to and effective for farmers (3) lead to both improvements in food productivity and have positive side effects on environmental goods and services. Sustainability in agricultural systems incorporates concepts of both resilience i.e. the capacity of systems to buffer shocks and stresses, and persistence i.e. the capacity of systems to continue over long periods. This culminates in many wider economic, social and environmental outcomes (Bradford and Wichner, 2009).

Alternative Farming Practices and Their Effectiveness: - Four major points can be raised about the effectiveness of alternative farming practices, namely (van Zyl, 1990):

1. Farmers who adopt alternative farming systems often have productive and profitable operations, even though these farms usually function with relatively little help from commodity income and price support programs or extension.
2. Alternative farming practices are not a well-defined set of practices or management techniques. Rather, they are a range of technological and management options used on farms striving to reduce costs protect health and environmental quality and enhance beneficial biological interactions and natural processes.
3. Well-managed alternative farming systems nearly always use less synthetic chemical pesticides, fertilizers, and antibiotics per unit of production than comparable conventional farms. Reduced use of these inputs lowers productions costs and lessens agriculture's potential for adverse environmental and health effects without necessarily decreasing and in some cases increasing percent crop yields and the productivity of livestock management systems.
4. Alternative farming practices typically require more information, trained labour, time and management skills per unit of production than conventional farming.

Types of Alternative Farming Techniques: - Environmental sustainability is a major driving force for the development and adoption of sustainable farming practices where monoculture production of agriculture and forestry commodities has led to reduced biodiversity and loss of wildlife habitat, increased non-point source pollution of ground and surface water, and deterioration of family farms. The different forms of integrated land-use systems that

embrace the concepts of sustainable agriculture include (Fukuoka 1985; Sachchidananda and Rajiv, 1999):

1. Organic farming
2. Bio-dynamic farming
3. No tillage farming
4. Urban and Peri-urban Farming
5. Natural farming
6. Eco-farming
7. Permaculture
8. Polyculture
9. Integrated farming system
10. Floating Farming

1. Organic Farming: - 0rganic farming is the use of agricultural production system reliant on green manure, compost, biological pest control, and crop rotation to produce crops, livestock and popularity. Organic centered agricultural production system fosters the cycling of the resources to conserve biodiversity and promote ecological balance. The use of green manure, cover crops, animal manure, and soil rotation , to interrupt the habitation of pests and diseases, improve soil fertility, and maximize the soil's biological activity are the primary aspects of organic farming. In the other words, organic farming does not allow the use of synthetic chemical fertilizer, antibiotic, herbicides, or pesticides .Thus, the objective of organic farming is agricultural production of fibers, grains, vegetables, flowers, fruits, foods, and animal products such as milk, eggs, and meat is the best natural way.

Objective of Organic Farming: - Organic farming may be adopted,

a. Increase genetic diversity.

b. Promote more usage of natural pesticides.

c. Make sure the right soil cultivation at the right time.

d. Keep and build good soil structure and fertility.

e. Control pasts, diseases and weed

Principle of Organic Farming: -

a. Principle health:- Organic agriculture must contributed to the health and well being of soil, plants, animals and human in earth.

b. The principle of ecological balance:- We must model organic farming on living ecological system. Moreover, the methods of organic farming must fit the ecological balance and cycle.

c. Principle of fairness:- Organic farming provides a good quality of life and helps in reducing soil infertility.

d. Principle of care: - We should practice organic agriculture in a careful and responsible way to help the present and future generation and the environment.

Organic agriculture world over involves certain basic steps as like:

A. Green manuring: - A green manure is a type of cover crop grown primarily to add nutrients and organic matter to the soil for soil improvement and soil protection. Typically a green manure crop is grown for a specific period, plowed and incorporated into the soil.

Leguminous green manures contain nitrogen-fixing symbiotic bacteria in root nodules that fix atmospheric nitrogen in a form that plants can use.

Green manures increase the percentage of organic matter (biomass) in the soil, thereby improving water retention, aeration, and other soil characteristics.

The root systems of some varieties of green manure grow deep in the soil andbring up nutrient resources unavailable to shallower-rooted crops.

Common cover crop functions of weed suppression and prevention of soil erosion and compaction are often also taken into account when selecting and using green manures.

Some green manure crops, when allowed to flower, provide forage for pollinating insects.

B. Bio fertilizers: - Biofertilizers are the substance which contains symbiotic nutrients fixating living microbes which are capable of colonizing in rhizosphere and enhances plant growth by increasing the availability of primary nutrients or by synthesizing growth promoting.

C. Crop rotation: - Crop rotations serve to provide new above-and below-ground habitats as each new crop has a distinct chemical and biological make-up, introducing new vegetation types to the landscape eventually increases crop residues to the soil ecosystem. Different crop residues promote or inhibit different soil organisms which may have inhibitory or growth promoting effects to subsequent crops. By interrupting the continuous presence of a crop host, crop rotation serves to break the build-up in the cycles of weeds and insects and diseases, thus eliminating the need for pesticide application. Fallow periods i.e. ground left uncultivated for an extended period of time, allow a limited amount of secondary succession to advance and hence the recovery of the diversity of both terrestrial and below-ground species are possible (Magdoff and Harold 2000).

D. Cover cropping: - Cover cropping is an ideal cropping pattern adopted specifically for soil improvement purposes. Both annual and perennial cover crops used to harnessing natural resources effectively in above-and below-ground biodiversity. Cover crops may provide a physical temporary habitat for many different species of ground-nesting birds, small mammals as well as nectar and pollen sources for many species of insects. The habitat value of cover crops varies by species and variety therefore cover crops must be carefully selected to meet specific management objectives. Cover crops root system improves water penetration and prevents soil erosion (Burgos and Talbert 1996).

E. Soil Health Management: - Enhancing soil quality is essential for maintaining agricultural productivity and minimizing environmental degradation. Organic farming plays a key role in maintaining soil quality.

2. Bio-dynamic Farming: - Biodynamic agriculture is an advanced organic farming system that is gaining increased attention for its emphasis on food quality and soil health. A fundamental tenet of biodynamic agriculture is that food raised bio-dynamically is nutritionally superior and tastes better than foods produced by conventional methods. This is a common thread in alternative agriculture, because other ecological farming systems make similar claims for their products. Demeter, a certification program for bio-dynamically grown foods, was established in 1928. As such, Demeter was the first ecological label for organically produced foods. Today biodynamic agriculture is practiced on farms around the world, on various scales, and in a variety of climates and cultures. However, most biodynamic farms are located in Europe, the United States, Australia, and New Zealand. In a nutshell, bio dynamics can be understood as a combination of "biological dynamic" agriculture practices. "Biological" practices include a series of well-known organic farming techniques that improve soil health. "Dynamic" practices are intended to influence biological as well as metaphysical aspects of the farm (such as increasing vital life force), or to adapt the farm to natural rhythms (such as planting seeds during certain lunar phases).

3. No Tillage farming: - Tillage is a critical soil management practice used for weed control, seed bed preparation, root growth stimulation, soil moisture control, soil temperature control, soil compaction alleviation and incorporation of crop residues and manure. No-till farming avoids these effects by excluding the use of tillage practice. By this way of farming, crop residues or other organic amenities are retained on the soil surface, sowing and fertilizing is done with minimal soil disturbance. It sometimes involves in problems like residue management, increased weed and disease infestations and this can be avoided by crop rotations and cover crops (Fukuoka 1978).

4. Urban and Periurban Farming: - Over the last decades urban and peri-urban agriculture (UPUA) in the Global North has gained increasing awareness and interest by society, policy and research. On the one hand, it is due to the good connectivity of the topic to public and stakeholder debates on food issues (quality, transparency, traceability, security, regional production, organic production, sovereignty, short food supply chains). On the other hand, due to large societal and economic transformations the debates (on sustainable land use and urban development, economic competitiveness, ageing and migration, quality of life, adaptation to climate change and resilience) are taking place in a less integrated way. More than in the past UPUA is perceived as a multifunctional solution, partly because civil society is involved in the co- development of innovative practices and governance models. Urban agriculture is as old as human civilization, with the history of cities intertwined with that of agriculture. Food production only separated from human habitation as agriculture industrialized. Before refrigeration, livestock came to town for slaughter, or were kept in urban fields and gardens from where livestock products were sourced. Such a situation is still found in many African towns and cities, and many of the urban parks in industrialized country cities were previously 'commons' where citizens grazed live-stock. Farmers would

come to urban markets; supermarkets and suburban food terminals appeared only in the 1960s.

5. Natural Farming: - Do nothing Farming also known as Natural Farming (NF) is an alternative farming method to chemical or traditional farming. Natural framing is used to emphasize the importance of "spatially" and "temporarily" overlapping the growing crops, plants and animals so that we can utilize their synergistic effects. Natural Farming with indigenous microorganisms is a distinctive approach to organic farming practiced successfully in more than 30 countries, in home gardens and on a commercial scale (Prell 2010). Natural Farming is unique in that it is not meant to be commercialized but rather practiced by individual farmers with cheap, easily available ingredients and microbes or mycorrhizae indigenous to each locale or farm. These microorganisms are:

• cultured in a simple wooden box of rice

• mixed with brown sugar and stored in a crock

• further propagated on rice bran or wheat mill run

• mixed with soil and cultured again

6. Eco-farming: - Eco-farming or site-appropriate agriculture involves treating both regions used for agriculture and individual farms as ecological systems. "Site" restricted to natural conditions like soil, climate and temperature. The demand for stability and sustain-ability stems from the obligation of each generation to pass on to future generations an environment that remains capable of guaranteeing the fundamentals of human existence. Consideration must also be given to economic development i.e. price–cost ratios, incomes; farm-specific conditions i.e. access to factors of production and the internal forces influencing a farm's operations like self-sufficiency, risk minimization and preservation of soil fertility. Countries must develop forms of agriculture that permit a high degree of self-sufficiency and decentralization at national and regional levels (Egger 1990).

The essential characteristics of these eco farming systems are:

- maximal but sustainable use of local resources
- minimal use of purchased inputs, only as complementary to local resources
- emphasis on subsistence cropping, combined with complementary production for the market
- ensuring the basic biological functions of soil-water-nutrients-humus
- maintaining a diversity of plant and animal species as a basis for ecological balance and economic stability, with primary emphasis on local species, varieties and races
- conserving life support systems and ecosystem services
- creating an attractive overall land cape which gives satisfaction to the local people.

7. Permaculture: - Permaculture is the conscious design, maintenance of agriculturally productive ecosystems, stability and resilience of natural ecosystems. It is the harmonious integration of landscape, food, energy and shelter. Without permanent agriculture there is no

possibility of a stable social order. Permaculture is a design concept for sustainable, food producing landscapes mimicking the diversity and resilience of natural ecosystems. Although concepts included in permaculture design have been in practice for millenia by various cultures worldwide, the term “permaculture” as it is currently understood was first coined in Tasmania by Bill Mollison and David Holmgren in the mid 1970’s.

8. Polyculture: - Polyculture is agriculture using multiple crops in the same space. It improves diversity of natural ecosystems and avoids monoculture. It includes crop rotation, multi-cropping, intercropping, companion planting, beneficial weeds and alley cropping. When compared to monocultures, polycultures have consistently shown lower populations of pest, weeds and it’s their indeterminable effects to crop. Increases in the variety of food sources and micro-habitats increased difficulty of pest populations in polycultures to locate dispersed patches of host crop, so thus limits the growth of pest populations and stabilize predator–prey and parasitoids-host population dynamics.

9. Integrated Farming Systems: - Integrated Farming System (IFS) is a sustainable system of agriculture where sequential linkages between two or more farming activities are utilized. IFS ensures maximum utilization of resources, reduces risk of crop failure and provides additional income to farmers and food for small scale farming household. Integrated farming system involves recycling of by-products and interconnected nutrient flow of one system as input for other, thus maximizing the production from a unit area at minimum cost. This system paves path for an organic agriculture management system that can augment integrated soil water fertility management (ISWFM) and can boost biodiversity and biological cycles. The Green revolution technologies are often associated with environmental harm. Such damage is caused by the excessive use of “Mineral Fertilizer & Chemical Pesticide”. Integration of various agricultural enterprises viz., cropping, animal husbandry, fishery, forestry etc. have great potentialities in the agricultural economy. These enterprises not only supplement the income of the farmers but also help in increasing the family labour employment.

10. Floating Farming: - Floating farming is a way of producing food in areas that are waterlogged for long periods. It is mainly aimed at adapting cultivation to increased or prolonged flooding. The system uses floating beds of rotting vegetation that act as compost for crop growth. The beds can float on the water's surface, thus creating agricultural land areas in a wet area. Floating farming is an ancient and traditional farming system, practiced in some regions of the world. This form of in-situ hydroponics or soil-less culture is sustainable and comparable with cultivation techniques.

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UNIT: - 7

Use and misuse of forest resources and forest conservation

Introduction: - A forest is a complex ecosystem which is predominantly composed of trees, shrubs and is usually a closed canopy. Forests are storehouses of a large variety of life forms such as plants, mammals, birds, insects and reptiles etc. Also the forests have abundant micro-organisms and fungi, which do the important work of decomposing dead organic matter thereby enriching the soil. Nearly 4 billion hectares of forest cover the earth's surface. It is roughly 30 percent of its total land area. The forest ecosystem has two components- the non-living (biotic) and the living (abiotic) component. Climate, soil type are part of the non-living component and the living component includes plants, animals and other life forms. Plants include the trees, shrubs, climbers, grasses and herbs in the forest. Forests are our treasures which provide us a wide variety of commodities such as timber, fuel wood, fodder, fibre, fruits, herbal drugs, cosmetics and many types of raw materials used by the industries. A great variety of mammals and birds which live in the forests, serve as useful living resources. Forests play a great role in soil formation, water conservation and regenerating of oxygen. Trees fix CO2 in their biomass and through transpiration (loss of moisture to atmosphere) they moderate the climate. Can you imagine what would happen if forest does not exist in the world. As mentioned above, it performs certain functions which can be directly observed. But there are certain functions which cannot be directly observed like purification of air, carbon sink etc.

Use of Forest Resources: - Forests are among the most diverse and widespread ecosystems on earth, and have many functions: they provide timber and other forest products; have cultural values; deliver recreation benefits and ecosystem services, including regulation of soil, air and water; are reservoirs for biodiversity; and act as carbon sinks. The impact from human activities on forest health and on natural forest growth and regeneration raises widespread concern. Many forest resources are threatened by overexploitation, fragmentation, degradation of environmental quality and conversion to other types of land use. The main pressures result from human activities, including agriculture expansion, transport infrastructure development, unsustainable forestry, air pollution and intentional burning of forests.

Forests are natural habitats for many animals. The trees supply oxygen to the atmosphere. They affect the rainfall in a particular region. They also provide us with wood, medicines, food, perfumes, paper, clothes, etc. Trees are the world's largest storehouses of carbon which is important to maintain global temperatures. The rise in carbon levels is believed to be the main reason behind global warming. In spite of the advantages of forests, deforestation has become very rampant in the modern era causing several problems like pollution, soil erosion, and climate change. Here are some of the reasons that explain the importance of forests for all living beings and why they should be preserved proactively. The major importances are as given below (https://www.vedantu.com/chemistry/importance-of-forest): -

a. Uses of Trees to Absorb Greenhouse Gases: - Forests maintain the ecosystem by absorbing greenhouse gases like carbon dioxide that are believed to be the reason for climate change. Carbon is stored in the biomass within the forests. Tropical forests alone harbor a huge amount of carbon (around a quarter of a trillion tons) that can be disastrous if it is released into the atmosphere.

b. Importance of Trees to Provide a Natural Habitat: - Forests provide a sustainable environment for the survival of millions of animals. It is home to several species including snakes, turtles, crocodiles, insects, birds, butterflies, monkeys, and other wild animals. It provides an ecosystem for the animals to thrive. The forest floor is also a rich medium for microorganisms, which are essential for the conversion of dead matter into nutrients. Forests are also home to indigenous people who depend on them for their livelihood.

c. Importance of Forests as Watershed Regions: - Forest-based water tables, rivers, streams, and lakes are critical sources of water. The green cover preserves the water reserves from sun radiation. The Amazon forest is home to the world's largest watershed and river system.

d. Importance of Forests to Support Biodiversity: - Globally, around 90% of the species including various plants and animals thrive in forests. They offer the necessary habitat and support biodiversity. They are home to the genes of biodiversity.

e. Importance of Forests to Purify the Air: - Photosynthesis is a critical function of plants to generate food and energy. Plants, shrubs, and trees absorb carbon dioxide from the atmosphere during the daytime and release oxygen. According to an estimate, an acre of mature trees can provide oxygen for 18 people. They act as giant lungs purifying the air in the atmosphere by removing carbon dioxide and maintaining balanced levels of oxygen that we breathe every day. Trees absorb odours and pollutant gases like ammonia and sulphur dioxide out of the air. These toxins are trapped in the leaves and barks.

f. Importance of Trees to Regulate Global Temperatures: - Forests provide green cover which absorbs the Sun's radiation and keeps the temperature down. They regulate atmospheric temperature through evapotranspiration and breeze. Forests also promote rainfall that helps in maintaining the water table and a cool climate. Deforestation has the opposite effect causing the global temperature to rise dramatically.

g. Importance of Forests to Enrich the Soil: - Dead leaves and broken branches ultimately are converted to soil through the decomposition process and this conversion enriches the soil with nutrients. Microorganisms present in the soil convert the biodegradable material to simpler particles that can be utilized by the plants again. Trees have very strong roots that hold the soil intact in cases of floods or any other reasons that cause soil erosion. They are very critical in hilly areas or stream slopes as they slow the runoff and keep the soil intact. Uncontrolled soil erosion can destroy the fertile soil leading to barren conditions.

h. Importance of Forests to Regulate the Water Cycle: - Forest is an important component of the water cycle process. They regulate evaporation, condensation, and precipitation of the

water. They also nourish the aquifers thereby replenishing groundwater supplies. Trees allow the rainwater to flow down the trunk into the soil thereby preventing the stormwater from carrying pollutants to the ocean. They act as giant sponges that filter water and recharge the water table.

i. Importance of Forests in Our Life: - Forests are rich in herbs, plants, and trees of medicinal value. The extracts, seeds, leaves, and bark from these plants and trees treat several diseases while being non-toxic to the human body. Some examples include quinine, curare, rosy periwinkle, wild yams, extracts of willow trees, calabar bean, and samambaia.

j. Forests Provide Economic Benefits: - Forests have a lot to offer to human beings. Every component of a tree including leaves, branches, stem, bark, fruits, seeds, and root are useful. Forests provide wood, timber, raw materials, vegetables, and fruits, which have significant economic value. The timber is used in construction and making furniture. Wood is also essential in the production of paper. The rubber extracted from trees is used to make several products. Even green waste has economic significance. Millions of trees are chopped off every year to support the increasing need of human beings. We have to take proactive measures to preserve forests and increase the green cover in the interest of millions of living beings that depend on them. Thus, there are two types of benefits of forests on an economic front and they are direct benefits and indirect benefits. For instance, the contribution of forests towards the national income of India is increasing gradually. About 0.86 % of the forest wealth of India was contributed towards the gross domestic product in the year 1970-71. It has increased gradually to 1.8% in 1990-91. All the direct benefits are accounted for by forest resources that contribute around 2.9 % to the net domestic product for the country as a whole. Also, about 179 million cattle, 58 million buffaloes, and 120 million other livestock are provided for by the forests of the country. The forest has been declared the home of 500 types of animals.

Misuse of Forest Resources: - Forest decline here is interpreted as deforestation, forest degradation or a combination of both. These terms are not precise. The Food and Agriculture Organization of the United Nations defines deforestation as the “sum of all transitions from natural forest classes (continuous and fragmented) to all other classes” (FAO 1997). The loss of forest cover attributed to these transitions must occur over less than 10% of the crown cover for the phenomenon to qualify as deforestation.

Human beings evolved in the natural systems as a result of interactive forces among the preexisting biological forms. Though late to arrive on the evolutionary scene, man is the only life form to initiate drastic interventions in nature. He has always been using natural resources amend his dwellings to meet his basic, social and cultural needs. The customs, traditions, practices, beliefs, and, ensured a balance between human needs and environmental conservation in ancient times. However, with passage of time this symbiotic relationship was gradually replaced by destructive dependence. His activities became heavily dependent on his surroundings that the process of development became synonymous with divestment of natural ecosystems. At some point during this phase he apparently forgot that the ecosystem has certain carrying capacity that reflects a limit to its exploitability

Similarly, Pearce and Brown (1994) identified two main forces affecting deforestation. They are:

- Competition between humans and other species for the remaining ecological niches on land and in coastal regions. This factor is substantially demonstrated by the conversion of forest land to other uses such as agriculture, infrastructure, urban development, industry and others.

- Failure in the working of the economic systems to reflect the true value of the environment. Basically, many of the functions of tropical forests are not marketed and as such are ignored in decision making. Additionally, decisions to convert tropical forests are themselves encouraged by fiscal and other incentives.

A. Direct Causes

1. Expansion of farming land: - About 60 per cent of the clearing of tropical moist forests is for agricultural settlement with logging and other reasons like roads, urbanization and Fuel wood accounting for the. Tropical forests are one of the last frontiers in the search for subsistence land for the most vulnerable people worldwide (Myers, 1992). Millions of people live on the tropical forest with less than a dollar a day where a third of a billion are estimated to be foreign settlers. However, as the land degrades people are forced to migrate, exploring new forest frontiers increasing deforestation. Deforestation is proxied by the expansion of agricultural land. This is because agricultural land expansion is generally viewed as the main source of deforestation contributing around 60 per cent of total tropical deforestation (Chakravarty et al. 2012).

2. Forest and other plantations: - Plantations are a positive benefit and should assist in reducing the rate of deforestation. The fact that plantations remove the timber pressure on natural forests does not translate eventually into less, but rather into more deforestation. Indeed, it is feared that agricultural expansion which is the main cause of deforestation in the tropics might replace forestry in the remaining natural forests. The impact of timber plantations could thus turn out to be quite detrimental to tropical forest ecosystems. Tree crops and rubber in particular plays a more important role in deforestation in Indonesia than subsistence-oriented shifting cultivation. Unfortunately about one-half of the plantations in the tropics are established on native forest cleared for the purpose. Moreover plantations can promote deforestation by constructing roads that improve access of the shifting cultivators and others to the forest frontier (Kartodihardjo and Supriono, 2000).

3. Logging and fuel wood: - Logging does not necessarily cause deforestation. However, logging can seriously degrade forests. Logging in Southeast Asia is more intensive and can be quite destructive. However, logging provides access roads to follow-on settlers and log scales can help finance the cost of clearing remaining trees and preparing land for planting of crops or pasture. Logging thus catalyzes deforestation (Putz et al., 2001).

4. Overgrazing: - Overgrazing is more common in drier areas of the tropics where pastures degraded by overgrazing are subject to soil erosion. Stripping trees to provide fodder for grazing animals can also be a problem in some dry areas of the tropics but is probably not a

major cause of deforestation. Clear cutting and overgrazing have turned large areas of Qinghai province in China into a desert. Overgrazing are causing large areas of grasslands north of Beijing and in Inner Mongolia and Qinghai province to turn into a desert. One man who lived in a village on the eastern edge of the Qinghai-Tibet plateau that was being swallowed up by sand told the New York Times, "The pasture here used to be so green and rich. But now the grass is disappearing and the sand is coming." Huge flocks of sheep and goats strip the land of vegetation. In Xillinggol Prefecture in Inner Mongolia, for example, the livestock population increased from 2 million in 1977 to 18 million in 2000, turning one third of the grassland area to desert. Unless something is done the entire prefecture could be uninhabitable by 2020. Overgrazing is exacerbated by sociological phenomena called "the tragedy of the common." People share land but raises animals for themselves and try to enrich them by rising as many as they can. This leads to more animals than the land can support. Grassland in Qinghai that can support 3.7 million sheep had 5.5 million sheep in 1997 (Hays, 2008 web page).

5. Fires: - Fires are a major tool used in clearing the forest for shifting and permanent agriculture and for developing pastures. Fire is a good servant but has a poor master. Fire used responsibly can be a valuable tool in agricultural and forest management but if abused it can be a significant cause of deforestation (Repetto, 1988).

6. Mining: - Mining is very intensive and very destructive. The area of land involved is quite small and it is not seen as a major cause of primary deforestation. Mining is a lucrative activity promoting development booms which may attract population growth with consequent deforestation. The deforestation rate due to mining activities in Guyana from 2000 to 2008 increased 2.77 times according to an assessment by the World Wildlife Fund-Guianas. Similarly, in the Philippines, mining, along with logging, has been among the forces behind the country's loss of forest cover: from 17 million hectares in 1934 to just three million in 2003 or an 82 per cent decline.

7. Urbanization/industrialization and infra-structure: - Expanding cities and towns require land to establish the infrastructures necessary to support growing population which is done by clearing the forests. Tropical forests are a major target of infra-structure developments for oil exploitation, logging concessions or hydropower dam construction which inevitably conveys the expansion of the road network and the construction of roads in pristine areas.

8. Air pollution: - Air pollution is associated with degradation of some European and North American forests. The syndrome is called "Waldsterben" or forest death. In 1982, eight per cent of all West German trees exhibited damage that rose to about 52 per cent by 1987 (Raloff, 1989) and half of the trees reported dying of Waldsterben in the Alps. High elevation forests show the earliest damage including forests in the north-east and central United States.

9. Tourism: - National parks and sanctuaries beyond doubt protect the forests, but uncautioned and improper opening of these areas to the public for tourism is damaging. Unfortunately, the national governments of tropical and sub-tropical countries adopt tourism

for easy way of making money sacrificing the stringent management strategies. Further, many companies and resorts who advertise themselves as eco-tourist establishments are in fact exploiting the forests for profit. In Cape Tribulation, Australia, for example, the rain forest is being threatened by excessive tourism.

B. Indirect Causes

The World Rainforest Movement's 'Emergency Call to Action for the forests and their Peoples' asserts that "deforestation is the inevitable result of the current social and economic policies being carried out in the name of development. It is in the name of development that irrational and unscrupulous logging, cash crops, cattle ranching, large dams, colonisation schemes, the dispossession of peasants and indigenous peoples and promotion of tourism is carried out (Chakravarty et al. 2012).

1. Colonialism: - Erstwhile colonies of the colonial powers like Britain, France, Spain or Portugal are now the Third World Countries or the developing nations mostly have the tropical rainforests except Australia and Hawaii were exploited for their natural resources and their indigenous people's rights destroyed by the colonial powers. All these countries have indigenous populations who had their own system of land management and/or ownership in place for thousands of years before the intervention of colonists from rich industrialized nations. Colonialism turned previously self-sufficient economies into zones of agriculture export production. This process continues even today in different form of exploitation and the situation is worsening (Colchester and Lohmann, 1993).

2. Exploitation by industrialized countries: - Wealthy countries or the erstwhile colonial powers having deficit of their own natural resources are mainly sustaining on the resources of the financially poorer countries those are generally natural resource rich. Twenty per cent of the world's population is using 80 per cent of the world's resources. Unfortunately also the governments of these poor resource rich countries had generally adopted the same growth-syndrome as their western neighbours or their erstwhile colonial master giving emphasis on maximizing exports, revenues and exploiting their rich natural resources unsustainably for short-term gains. Moreover, corruption in government, the military and economic powers is well known. The problem is further worsened by the low price of the most Third World exports being realized in the international market (Colchester and Lohmann, 1993).

3. The debt burden: - Pursuing the guided development agenda, the financially poorer countries are on a heavy international debt and now feeling the urgency of repaying these huge debts due to escalating interest rates. Such a situation compels these debt ridden poorer countries to exploit their rich natural resources including their forests partly to earn foreign exchange for servicing their debts. For instance, construction of roads for logging operations in some South-east Asian countries was funded by Japanese aid which allowed the Japanese timber companies to exploit the forests of these countries. Understandably, these timber companies profitably exploited the forests while the South-east Asian countries were left owing Japan money for construction of their roads (Colchester and Lohmann, 1993).

4. Overpopulation and poverty: - The role of population in deforestation is a contentious issue. The impact of population density on deforestation has been a subject of controversy. Poverty and overpopulation are believed to be the main causes of forest loss according to the international agencies such as FAO and intergovernmental bodies. It is generally believed by these organizations that they can solve the problem by encouraging development and trying to reduce population growth. Conversely, the World Rainforest Movement and many other NGOs hold unrestrained development and the excessive consumption habits of rich industrialized countries directly responsible for most forest loss. However there is good evidence that rapid population growth is a major indirect and over-arching cause of deforestation. More people require more food and space which requires more land for agriculture and habitation. This in turn results in more clearing of forests.

5. Transmigration and colonization schemes: - Transmigration of people to the forest frontier whether forced or voluntary due to development policy or dislocation from war is the major indirect cause of deforestation. Moreover, governments and international aid agencies earlier believed that by encouraging colonization and transmigration schemes into rainforest areas could alleviate poverty of the areas in the financially poorer countries. Such schemes have miserably failed but hurted the indigenous people and the environment. In Indonesia, the Transmigrasion Program of 1974 had caused annual deforestation of two lakh hectares (Colchester and Lohmann, 1993).

6. Land rights, land tenure and inequitable land distribution and resources: - Cultivators at the forest frontier often do not hold titles to land (absence of property rights) and are displaced by others who gain tenure over the land they occupy. This means they have to clear more forest to survive. Poorly defined tenure is generally bad for people and forests (Chomitz et al., 2007).

7. Economic causes (development/land conversion value, fiscal policies, markets and consumerism): - The relationship between development and deforestation is complex and dynamic. One point of view is that development will increase land productivity and thereby reduce the need to clear forests to meet food requirements. Another is that development will produce further capital and incentive to expand and clear more forest. The former may be the case when constrained by a fixed food demand. The latter may be the case when food demand may not be satisfied owing to a continuing export market and rising internal population with rising levels of consumption. Profits from deforestation vary from less than a dollar to thousand dollars per hectare depending on location, technologies and land use systems (Chomitz et al., 2007).

8. Undervaluing the forest: - Forests gain value only when they are cleared for obtaining legal title through ‘improvement’. The extraction of non-wood forest products has been suggested as a way to add value to the forest but it is not economical when compared to clearing options. If some means could be devised where those who benefit from the environmental values could pay the forest owners or agents of deforestation for them, then the option to not clear would become more competitive. Alternatively, if the national governments value the environmental benefits, it could apply a tax or disincentives to clear.

However, even though maintenance of the environmental services is essential for sustained economic development, deforesting nations usually have more immediate goals and are unprepared to take this step.

9. Corruption and political cause: - The FAO identified forest crime and corruption as one of the main causes of deforestation in its 2001 report and warned that immediate attention has to be given to illegal activities and corruption in the world's forests in many countries. Illegal forest practices may include the approval of illegal contracts with private enterprises by forestry officers, illegal sale of harvesting permits, under-declaring volumes cut in public forest, underpricing of wood in concessions, harvesting of protected trees by commercial corporations, smuggling of forest products across borders and allowing illegal logging, processing forest raw materials without a license (Contreras-Hermosilla, 2000).

Forest Conservation

Forest conservation is the preservation and the protection of forest. It is the practice of planting and maintaining forested area for the benefit and sustainability of future generations. The conservation of forest also stands and aims at the quick shift in the composition of tree species and age distribution. Forest conservation involves the upkeep of the natural resources within a forest that are beneficial to both humans and the environment. Conservation of forest is the practice of planting more trees and maintaining the forested areas for the sustainability for future generations. Forests are an important natural resource and are beneficial to humans in several ways. But due to increasing deforestation activities, it has become essential to conserve forests throughout the world. Deforestation is the permanent destruction or loss of forests for the expansion of lands for agriculture, livestock, etc. The process of destructing forests for the expansion of agricultural land is referred to as shifting cultivation. Forest conservation is the practice of planting more trees and maintaining the forested areas for the sustainability and benefit of future generations. Forests are vital for the sustenance of human life, therefore, there needs to be an increasing awareness regarding their conservation.

Ways to Conserve the Forest (https://www.toppr.com/guides/evs/whose-forests/forest-conservation/)

1. Controlled Deforestation: - While deforestation cannot be avoided completely, we must look to control it. Young and immature trees should not be felled as far as possible. We must look to avoid large-scale commercial deforestation as well. Adapting practices such as clear-cutting or selective cutting will be beneficial in the long run.

2. Protect against Forest Fires: - Forest fires are the most common and deadly cause of loss of forests. They can start due to natural causes or can be accidents caused by man or even intentional in some cases. Once a fire spreads in a forest it is very difficult to control. Precautions must be taken for such incidents. Making fire lanes, spreading chemicals to control fire, clearing out dry leaves and trees etc. are required to protect forest from fires.

3. Afforestation: - This is the process by which we plant more trees in the area. We try to increase the forest cover by manual transplantation, or fresh plantation of trees. It is an

attempt to balance our ecosystem to reduce the effects of deforestation and environmental pollutions of all types.

4. Better Farming Practices: - Slash and burn farming, overgrazing by cattle, shifting agriculture are all farming practices that are harmful to the environment and particularly to forests. We must keep all these practices under control. Jhoom farming is one such practice we can employ to combat forest pollution. In the North-east areas of India, where the land is kept barren after cutting the crops. Weeds and creepers and wild plants grow on this land and make it fertile again in time. And then the land is cultivated again.

5. Involving the Local Communities: - Forests are homes to many tribal communities. These communities have a very organic relationship with the forests, and most of their livelihoods are also forest dependent. It is therefore imperative to involve their participation in the conservation of forests.

6. Prevention of exploitation of forestry and forest products is necessary for the conservation of forest.

7. The existing forests should be protected from diseases by spraying chemicals, antibiotics or development of pest-resistant strains of trees.

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UNIT: - 8

Industry and environment; issues and challenges with special reference to tourism industry

Introduction: - Development is a multidimensional process involving qualitative changes in the socioeconomic and political structures, popular attitudes, national institutions, as well as in the acceleration of economic growth, reduction of inequalities and eradication of poverty. Developmental projects such as construction of roads, highways, bridges and industries needs to be undertaken to accelerate the pace of economic growth. Such projects could either help indigenous people in improving their lives or may deteriorate their livelihood, cultural heritage depending on how they are managed. It may also lead to tremendous alienation from common property resources such as forests, land, fodder and water bodies. In recent years with the growing pace of industrialization, intensive work has been done on impact of industries on lives and livelihood and regarding people's perception of restoration and preservation of common property resources from industrial hazards. In modern society, industrial waste constitutes a toxicological and epidemiological risk as it penetrates into the soil, air, groundwater, and surface water bodies and vegetation directly or indirectly affecting people's health (Cherniaeva ,2013).

Besides these, industrialization has created various problems such as involuntary displacement of human population, loss of traditional sustainable livelihoods and landholdings and increase in ecological imbalances in the region. While benefits such as employment have accrued from economic development projects but changes in land use and in people's occupations may have adverse impact on their future livelihoods (Chandy et al., 2012).

The peculiarities of human existence and economic activity have been a source of environmental variability from all over the world. The Industrial Revolution, which began in 1750, is considered the introduction of climate change. Carbon dioxide (CO2) emissions are significantly lower than before the inauguration of industrialization. Greenhouse gas (GHG) concentrations are significantly higher than they were at the beginning of the industrial era, meaning atmospheric CO2 concentrations have reached 409.8 ppm (parts per million) in 2019, higher than at any point in at least the past 800,000 years (Lindsey 2019). Identifying the factors responsible for high CO2 emissions will help policymakers to develop effective policies for controlling CO2 emissions, protecting the environment, and protecting human health in the region. Economically, the main challenges are poverty, unemployment, and low incomes, faced by developing countries, and the environmental protection agencies. In addition, efforts are being made to uplift the low-income households in developing countries, which will lead to new negative consequences in the form of global warming, depletion of natural resources, and environmental pollution (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8739025/).

In the field of environmental economics, many studies have developed several hypotheses to explicate the environmental impact of human and economic activities; conspicuous among these are environmental Kuznets curve (EKC) that explains the relationship between

economic growth and environmental degradation; the pollution haven hypothesis (PHH) which explains the association globalization and environmental degradation; and the Stochastic Impacts by Regression on Population, Affluence, and Technology (STIRPAT) that asserts the relationship among population growth and environmental degradation.

Grossman and Krueger (1991), who was the pioneer among those who explained EKC, established in his findings that economic growth affects environment quality differently in three different stages of growth. At the first stage of growth, due to scale effects, as growth increases demand for natural resources like land for economic activities, so economic activities badly affect environmental degradation; hence scale effect indicates the rising portion of inverted U-shaped EKC. Similarly, the second stage is the turning point of the U-shaped EKC; due to composition effects, the structure of the economy started to transform and the country started to prefer environmental-friendly economic activities. At the third stage which is the rising portion of U-shaped EKC, due to technical effects, a country replaced traditional technologies with environmental-friendly technologies in the production process. Moreover, following Grossman and Krueger (1991), many researchers conducted their study to verify the EKC in their context and found mixed results; for instance, some studies support the EKC hypothesis and found that EKC is established in the case of Pakistan, Ghana, Malaysia, Tunisia, France, and 99 high-, middle-, and low-income countries.

Similarly, pollution haven hypothesis (PHH) postulates that trade liberalization and inflow of FDI are also responsible for high CO2 emission. Pollution haven hypothesis established that multinational companies that come to low developing nations invest in pollution-intensive products due to convenient environmental regulatory policies and send heavy profit to their home countries. In this way, developed nations enjoy a high growth rate at the expense of bad environmental quality in poor nations (Cole, 2004).

Environmental Impacts on Tourism: - The quality of the environment, both natural and man-made, is essential to tourism. However, the relationship of tourism with the environment is complex. It involves many activities that can have adverse environmental effects. Many of these impacts are linked with the construction of general infrastructure such as roads and airports, and of tourism facilities, including resorts, hotels, restaurants, shops, golf courses and marinas. The negative impacts of tourism development can gradually destroy environmental resources on which it depends. Tourism especially, marine and coastal tourism is one the fastest growing areas within the world's largest industry. Yet despite increased awareness of the economic and environmental significance of tourism, it is only in recent years, scientific researchers have emerged (Hall, 2014).

Negative impacts from tourism occur when the level of visitor use is greater than the environment's ability to cope with this use within acceptable limits of change. Uncontrolled conventional tourism poses potential threats to many natural areas around the world. It can put enormous pressure on an area and lead to impacts such as soil erosion, increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts a strain on water resources, and it can force local populations to compete for the use of critical resources (Sunlu, 2002).

Over the last twenty years there has been a growing awareness of the impact tourism has on the environment and societies in which tourism takes place. As mass tourism first developed along the Spanish coast and other areas, there was little concern for the negative impacts that tourism was having on the environment of the area or on the lives of the people living in the area. In recent years, concepts such as eco-tourism, responsible tourism and sustainable tourism have emerged. This is as a result of more research being undertaken into the range of impacts tourism creates and the ways in which these impacts can be managed more carefully (https://hwb.gov.wales/api/storage/8e18c0d6-3393-42c3-ae62-09648421cc61/Section7-ImpactsofTourism.pdf).

It is usual to classify the positive and negative impacts of tourism under the following headings:

A. Environmental impacts

B. Economic impacts

C. Social impacts

D. Cultural impacts

A. Environmental impact of tourism can be discussed in two ways as: positive environmental impact of tourism and negative environmental impact of tourism (https://ijariie.com/AdminUploadPdf/ENVIRONMENTAL_IMPACT_OF_TOURISM_1436.pdf).

I. Positive Environmental Impact of Tourism:

1. Direct financial contribution: - The conservation of sensitive areas and habitat can be contributed directly by tourism. Revenue from park-entrance fees and similar sources can be allocated specifically to pay for the protection and management of environmentally sensitive areas. Special fees for park conservation and operation can be collected fromtourists or may be from tour operators.

2. Contributions to Government Revenues: - Like Indian government who collects money in more far-reaching and indirect ways that are not linked to specific parks or conservation areas. The funds collected through User fees, income taxes, taxes on sales or rental of recreation equipment, and license fees for activities such as rafting and fishing helps immensely to the Indian government to manage natural resources. The funds which are collected from various taxes can be used for the betterment of the environment by implementation of different conservation programs and other associated activities like for the maintenance of the park and paying salaries to park ranger.

3. Improved Environmental Management and Planning: - For better environmental management of tourism there is a need of providing better hotel facilities which will increase the benefits to natural environment. Advance planning can bring tourism development, destructive and costly mistakes can be avoided, preventing the gradual deterioration of environmental assets significant to tourism. The development of tourism has encouraged the

government of India towards this direction leading to improved and quality environmental management.

4. Raising Environmental Awareness: - Tourism has immense potentiality to increase public appreciation of the environment and also spreading awareness for various environmental problems when it brings people into closer contact with nature and the environment. This interaction definitely will heighten awareness of the value and importance of nature among the community and lead to environmentally conscious behavior and will force them to involve in various activities to preserve the environment.

5. Protection and Preservation of Environment: - Tourism can play a significant role in contributing for the protection of environment, conserving and restoring different biological diversity and sustainable use of natural resources. Due to presence of attractiveness, pristine sites and natural areas are identified as valuable and the need to keep the attraction alive can motivate in creation of national parks and wildlife parks. For example, in India, new laws and regulations have been enacted to preserve the forest and to protect native species. The coral reefs which are around the coastal areas and the marine life that depend on them for survival are also have been protected by the government of India.

II. Negative Environmental Impact of Tourism:

1. Depletion of Natural Resources: - Development of tourism can put pressure on natural resources when it increases consumption in areas where resources are already scarce.

a. Water resources: One of the most critical natural resources is water and especially fresh water. In tourism industry generally we can see overuse of water inhotels, swimming pools, golf courses and personal use of water by tourists. This lead to water shortages and degradation of water supplies, as well as creation of a greater volume of waste water. In different dryer states like Rajasthan, Gujarat and in Maharashtra the issue of water scarcity is of particular concern.

b. Local resources: Great pressure can be created by tourism on local resources like food, energy and other raw materials that may already be in short supply. Greater extraction and transport of these resources exacerbates the physical impacts associated with their exploitation. Due to the seasonal character of the industry, many destinations have ten times more inhabitants in the high season as in the low season. During peak seasons often high demand is placed upon these resources to meet the high expectations tourists often have (proper heating, hot water, etc.).

c. Land degradation: Important land resources include minerals, fossil fuels, fertile soil, forests, wetland and wildlife. Due to Increase of tourism and it's allied activities at the tourist destinations the recreational facilities has increased the pressure on these resources and on scenic landscapes. There can be seen of tourism impact directly on natural resources, both renewable and nonrenewable, in the provision of tourist facilities is caused by the use of land for accommodation and other infrastructure provision, and the worst sufferer is Forest

resource in the form of deforestation caused by fuel wood collection and land clearing e.g. the trekking in the Himalayan region, Sikkim and Assam.

2. Pollution: - Tourism can cause the same forms of pollution as any other industry: air emissions, noise, solid waste and littering, releases of sewage, oil and chemicals, even architectural/visual pollution.

a. Air and Noise Pollution: Transport by air, road, and rail is continuously increasing in response to the rising number of tourist activities in India. Due to increased emissions of GHG from energy production and use are linked to acid rain, global warming and photochemical pollution. The impacts on the global level can be seen especially from air pollution created by tourist lead to increase of carbon dioxide (CO_2) emissions related to transportation energy use. And it can contribute to severe local air pollution. Some of these impacts are quite specific to tourist activities where the sites are in remote areas like Ajanta and Ellora caves. For example, tour buses often leave their motors running for hours while the tourists go out for an excursion because they want to return to a comfortably air-conditioned bus. Noise pollution from airplanes, cars, and buses, as well as recreational vehicles is an ever-growing problem of modern life. In addition to causing annoyance, stress, and even hearing loss for humans, it causes distress to wildlife, especially in sensitive areas.

b. Solid waste and littering: In areas with high concentrations of tourist activities and appealing natural attractions, waste disposal is a serious problem and improper disposal can be a major despoiler of the natural environment - rivers, scenic areas, and roadsides. IN mountain areas of the Himalayas and Darjeeling, trekking tourists generate a great deal of waste. Tourists on expedition leave behind their garbage, oxygen cylinders and even camping equipment. Such practices degrade the environment particularly in remote areas because they have very few garbage collection or disposal facilities.

c. Sewage: Due to construction of hotels, recreation and other facilities often leads to increased sewage pollution. Wastewater generated through tourism activities has polluted already various seas and lakes surrounding tourist attractions, damaged heavily the flora and fauna. Sewage runoff causes serious damage to coral reefs because it stimulates the growth of algae, which cover the filter-feeding corals, hindering their ability to survive. Changes in salinity and siltation can have wide-ranging impacts on coastal environments. These wage pollution can threaten the health of humans as well as animals. Examples of such pollution can be seen in the coastal states of Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, etc. In India.

B. Economic Impacts:

I. Positive: - Tourism generates income for a variety of businesses and creates a wide range of employment opportunities. At the global scale, tourism is seen as one of the world's largest and fastest growing industries. This trend has continued throughout the last 50 years. Within the United Kingdom, it is estimated that inbound tourism generates about £19 billion each year. Domestic tourism, including day trips and staying visits, generates over £60 billion per year. In terms of employment, it is estimated that in the United Kingdom 1.4 million jobs

are directly related to tourism. As well as generating employment and income, another positive impact of tourism is improvements in infrastructure. These include road and rail improvements, airport development and improvements in utilities, such as water supply and telecommunications. Through these, local people can benefit from the improved facilities which have been provided for tourists.

II. Negative: - Very often a large number of moving visitors into an area pushes up the price of goods and services, meaning that local people have to pay more for food, drinks, transport etc. It is often the case that in popular tourist areas shops provide products for tourists more than they do for local people, meaning that more gift shops and restaurants might open rather than shops providing goods and services for people living in the area. Local people often have to pay additional taxes to help finance additional services which are provided for tourists, such as water treatment facilities and tourist information centres. Some holiday areas have a large number of second homes which are only used for short periods of the year by their owners. This is particularly the case in National Parks and popular coastal areas. The demand for second homes often increases the prices of all housing in the area, making it more difficult for local people, especially young people, to buy their first property. Second home ownership is an example of a negative economic impact of tourism which may be a cause of conflict between local people and tourists. One of the most significant negative economic impacts of tourism is the decline in traditional employment which happens when workers move from industries such as farming, mining and fishing into service jobs in the tourism industry. Another negative impact of tourism is over-dependency. It may be that, as tastes and fashions change, or due to any of a range of external pressures, the number of tourists visiting a particular destination may decrease very suddenly, leading to a loss of employment and businesses closing.

C. Social Impacts:

I. Positive: - One of the major motivating factors for travel is to meet new people and learn about different cultures and tourism often leads to a greater understanding between people living in different societies. Very often, tourists benefit from new and improved facilities which are provided for tourists. This may include attractions and catering facilities – there is nothing stopping people living in a tourist destination from enjoying themselves in restaurants or visiting attractions built mainly for tourist use. Tourists will often gain a greater respect for the lifestyle of the people living in the area they are visiting. Increased tourism also leads to local communities improving their skills and improving their social status. In well-managed tourism developments local people are encouraged to undertake education and training to enable them to feel part of the development.

II. Negative: - There are a number of negative social impacts which have been identified. These are mainly related to conflict between the tourists and the host community. These may result from the behaviour of people living in the area who resent the tourists taking over their community. However, it is often more common that anti-social behaviour from groups of tourists will be the cause of the conflict. Negative social impacts also include increased crime in the area, such as prostitution, illegal gambling and drug dealing and robbery. Very often,

this is not related to local people, but occurs as a result of criminal gangs moving into the area to exploit tourists and sometimes local people as well. In some destinations, local people have been obliged to move away from where they have traditionally lived to make way for tourism development.

D. Cultural Impacts:

I. Positive: - impacts In some cases, tourism may help to preserve traditional customs such as music, dance and theatre, as well as creating a demand for locally-produced foods and drink. Tourism can also stimulate the production and sale of local arts and crafts to meet the needs of visitors and at the same time contribute to the continuation of traditional crafts and skills. Tourism also has an important role to play in reinforcing a region's cultural identity.

II. Negative: - More people now recognize that tourism may bring about a loss of an area's cultural identity, especially in an area which has seen a rapid development of mass tourism. It is easier to provide international food and drink with which tourists are familiar rather than encouraging them to eat foods associated with the area. This has not been helped by the global spread of fast food chains and multinational brands of drinks. Another negative cultural impact of tourism is the staging of events, dance or music specifically for tourists in a way which demeans or makes fun of the local culture of the area, such as some Spanish dancing.

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UNIT: - 9

Environmental Impact Assessment

Introduction: - Environmental Impact Assessment (EIA) is a planning tool generally accepted as an integral component of decision making in Sustainable Development. The course is aimed at providing comprehensive information, on Environment (physical and biological), its degradation due to developmental activities, methods of determining consequences or impacts and possible methods of mitigation, to a group of post graduate, students in Arts, Science and Management. The students who have undergone studies both in theory and practice in respective disciplines and are knowledgeable in specific subjects may not be fully aware on the consequences of developmental projects being planned and executed in the vicinity. They are also anxious to know the world of futurology, so that they are able to visualize the dreams of next generation. The rapid growth of population, improvements in standards of living and concomitant growth of infrastructure have altered the environment, sometimes beyond its power of resilience. These changes have resulted in ecological crisis and have become a matter of grave concern to managers and decision makers throughout the world. The issues both at national and global levels are focusing concern of nodal agencies (Regulatory Departments, Ministries and Boards) to support sustainable development and curb and restrain such acts which tend to produce adverse impacts on living conditions of human, animals, plants and geographical environment (https://www.iitr.ac.in/wfw/web_ua_water_for_welfare/education/Teachers_Manual/Teacher_manual_master_EIA.pdf).

Purpose of Environmental Impact Assessment: - Reasons that have been advanced for introducing EIA are that the increasing scale of resource development schemes and their resulting impacts to the physical environment and communities could no longer be ignored; and that traditional appraisal techniques were inadequate to deal with various environmental and social issues, particularly those having long-term consequences (Garner and O'Riordan, 1982). Concerns for natural systems conservation provided the original driving force for EJA. Human health and higher order socio-economic effects were usually either ignored or given only superficial attention in early studies. Part of the explanation for this passage is that most projects which were required to undergo the EIA process were civil works that primarily impact on natural systems. Nature conservation issues were also highly visible politically in the developed countries during this period and have active and vocal proponents. However, more recently, human health and secondary socio-economic effects have received increased attention, particularly in the aftermath of toxic waste incidents and major public health problems resulting from development projects.

The objective of any ETA requirement is to promote and ensure that planning decisions take into account environmental costs and benefits. In practice, its effectiveness in influencing decisions rests on the following assumptions:

- interested public or 'watchdog' agency scrutiny of environmental issues disclosed by the ETA will reinforce accountability of decision making processes;

- the process can order information on environmental impacts along with economic and technological issues so that more balanced decisions can be made by the project's proponents.

Concept and Legal Basis of Environmental Impact Assessment: - After reading the previous lessons, you must be convinced that sustainable development and environmental conservation are necessary for survival and well-being of future generations. This is Environmental Impact Assessment (EIA). EIA is a tool which helps to evaluate environmental impact of proposed developmental projects or programs are visualized clearance accorded after mitigation strategies are included in the plan. EIA thus proves to be a tool which improves decision making and ensures that the project under construction is environmentally sound and within limits of the capacity of assimilation and regeneration capacities of the ecosystem. Environmental clearance of developmental projects is mandatory for the new project.

Legal bases of environmental impact assessment: - The EIA process will be designed such that its guidelines follow basic legal and policy equipments. For example: EIA is to-

(1) Serve as a primary environmental tool with clear provisions.

(2) Apply consistently to all proposals with potential environmental impacts.

(3) Use scientific practice and suggests strategies for mitigation.

(4) Address all possible factors such as short term, long term, small scale and large scale effects.

(5) Consider sustainable aspects such as capacity for assimilation, carrying capacity, biodiversity protection.

(6) Lay down a flexible approach with and provides for public involvement.

(7) Have in built mechanism of follow up and feedback for complied into mandatory requirements.

(8) Include mechanisms for monitoring, auditing and evaluation.

EIA was introduced in India in 1978, with respect to river valley projects. Later the EIA legislation was enhanced to include other developmental sections since 1941. EIA is now mandatory for 30 categories of projects, and these projects get Environmental Clearance (EC) only after the EIA requirement are fulfilled. EIA appraises the environmental health and social implications of planned developmental projects. It thus links environment with development. The goal of EIA is to ensure environmentally safe and sustainable development.

Process and Procedures of Environmental Impact Assessment: - EIA process and procedure have several components. Each one is separately mentioned below:

Method of carrying out EIA: - Preparation of EIA report comprises the following steps:

(1) Collection of baseline data from primary and secondary sources;

(2) Prediction of impacts based on past experience and mathematical modelling;

(3) Evolution of impacts versus evaluation of net cost benefit; preparation of environmental management plans to reduce the impacts to the minimum;

(4) Quantitative estimation of financial cost of monitoring plan and the mitigation measures;

(5) Preparation of environmental management plans to reduce the impacts to the minimum;

(6) Quantitative estimation of financial cost of monitoring plan and the mitigation measures.

Steps in EIA process: - EIA involves the steps mentioned below. However, EIA process is cyclical with interaction between the various steps.

1. Screening: The project plan is screened for scale of investment, location and type of development and if the project needs statutory clearance.

2. Scoping: The project's potential impacts, zone of impacts, mitigation possibilities and need for monitoring. The EIA agency has to follow the published guidelines by the Ministry of Environment and Forest (MoEF) of government of India.

3. Collection of baseline data: Baseline data is the environmental status of study area.

4. Impact prediction: Positive and negative, reversible and irreversible and temporary and permanent impacts need to be predicted which presupposes a good understanding of the project by the assessment agency.

5. Mitigation measures and EIA report: The EIA report should include the actions and steps for preventing, minimizing or by passing the impacts or else the level of compensation for probable environmental damage or loss.

6. Public hearing: On completion of the EIA report, public and environmental groups living close to project site may be informed and consulted.

7. Decision making: Impact Assessment (IA) Authority along with the experts consult the project-in-charge along with consultant to take the final decision, keeping mind EIA and EMP (Environment Management Plan).

8. Monitoring and implementation of environmental management plan: The various phases of implementation of the project are monitored.

9. Risk assessment: Inventory analysis and hazard probability and index also form part of EIA procedures.

Composition of the expert committees for EIA: -

1. The Committees will consist of experts in the following disciplines:

(i) Eco-system management

(ii) Air/ water pollution control

(iii) Water resource management

(iv) Flora/ fauna conservation and management

(v) Land use planning

(vi) Social Sciences/ Rehabilitation

(vii) Project appraisal

(viii) Ecology

(ix) Environmental Health

(x) Subject Area Specialists

(xi) Representatives of NGOs/persons concerned with environmental issues.

2. The Chairman will be an outstanding and experienced ecologist or environmentalist or technical professional with wide managerial experience in the relevant development.

3. The representative of Impact Assessment Agency will act as a Member- Secretary.

4. Chairman and members will serve in their individual capacities except those specifically nominated as representatives.

5. The membership of a committee shall not exceed 15 members.

Environmental Appraisal Procedure in India: - An Appraisal Committee constituted by the Ministry of Environment and Forests to first scrutinized a project. This committee evaluates the impact of the project based on the data presented by the project authorities. If necessary, the Ministry of Environment and Forests may also with the investors and hold consultations with experts on specific issues as and when necessary. After considering all the facets of a project, environmental clearance is accorded subject to implementation of the stipulated environmental safeguards. In case of projects where the project proponents have submitted complete information, a decision is taken within 90 days. The six regional offices of the Ministry functioning at Shillong, Bhubaneshwar, Chandigarh, Bangaloru, Lucknow and Bhopal undertake monitoring of cleared projects. The primary objectives of this procedure are to ensure adequacy of the suggested safeguards and also to undertake mid-course corrections required. If any changes in the scope of project are identified to check whether review of earlier decision is called for or not.

Coastal Zone Management Plans (CZMPs) are prepared by coastal states or Union Territories as per rules set by CRZ notification 1991. This is prepared based on identification and categorization of coastal areas for different activities and then submitted to the MoEF for approval. The ministry then forms a task force for examining their plans. Sometimes one or more natural resources become limiting resource in a given region and that restrict the scopes of development portfolios. MoEF has been sponsoring carrying capacity studies for different regions (https://www.nios.ac.in/media/documents/333courseE/24.pdf).

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UNIT 10

Environmental impact of river valley projects – Narmada dispute with special reference to environmental movement

Introduction: - Planned development with an integrated approach is necessary to uplift standard of living of people, revive economies and to alleviate poverty. Poorly planned and rapid development can result in disastrous impacts on our basic life-support systems such as clean air and water, productive soil and the earth's rich biotic diversity. Development of river valley projects like dams; reservoirs are one among them, which can cause significant impact on physical-chemical, biological, cultural, bio-diversity, sustainable development and socio-economic components of the environment. Large dams in India, as in several other countries of the world, have been accompanied by significant alterations in the upstream and downstream physical and biological environment (Larry W. Canter, 1985).

In India, Environment Protection Act (1986) through a regulatory instrument, namely Environmental Impact Assessment (EIA) Notification Section 3, under sub-section (1) and sub-section (2) provides that EIA studies are mandatory not only to address the adverse impacts of developmental projects on the life support system, but also to formulate suitable management plans to mitigate and/or minimize the anticipated impacts. Carrying out EIA studies in India is, therefore, mandatory for all medium and large hydroelectric projects (>25 MW). While the environmental impact assessment policies and regulations of Government of India for the project appraisals are well defined, these are rendered ineffective due to inadequate implementation and poor enforcement (Grumbine and Pandit, 2013).

Scoping, one of the earliest stages of EIA process in India, is a tripartite exercise involving the statutory body, the Ministry of Environment, Forests and Climate Change (MoEF & CC), the project proponents and their technical advisors/consultants. This exercise sets the terms of reference (ToR), major goals, concerns, and issues for a particular hydroelectric project that needs to be addressed in the EIA study. One of the major lacunas in scoping relates to low importance accorded to biological diversity in general and still lower to the fish and fisheries. Biodiversity component in the scoping is largely concerned with rare, endangered and threatened taxa and is invariably biased toward the more charismatic species of mammals such as the wild cats. More controversial aspects in public perception such as human socioeconomic and rehabilitation issues, geological discontinuities and risk from seismicity get more prominence in the project ToRs. Human sociocultural issues and geophysical risks are also debated at various government and civil society forums once ToRs have been set and even after a project has been executed, but there is little debate on the ecological impacts and losses due to the developmental activity (Wale and Yalew, 2010).

These development projects often result in unanticipated and undesirable consequences, which may be so drastic as to reduce or even nullify the socio-economic benefits for which the projects are planned. Appropriate steps, including Cumulative Environmental Impact Assessment (CEIA) involving preventive/ameliorative measures can minimize the impacts of these incursions.

There are three essential steps that are necessary for any river valley project to be considered environmentally sensitive:

1. A complete environmental impact assessment should be conducted before the project is considered for clearance, and the results of the analysis should be used to judge the viability and desirability of the project; this would also entail the tentative costing of the impacts and of the preventive/ameliorative measures, as this would have a bearing on the economic/financial viability of the project.

2. If the project is considered viable and desirable on social, economic, environmental, and technical grounds, it is necessary to take preventive and ameliorative measures related to the negative environmental impacts. This requires the formulation of precise and comprehensive work plans, and their implementation.

3. Finally, once the project is commissioned, it is critical to monitor the environmental impacts, and the progress of the preventive and ameliorative measures being taken to address these impacts. At this stage it may even be necessary to redesign the project, if environmental, social, or economic imperatives demand it.

Environmental Movements: - An environmental movement can be defined as a social or political movement, for the conservation of environment or for the improvement of the state of the environment. The terms 'green movement' or 'conservation movement' is alternatively used to denote the same. The environmental movements favor the sustainable management of natural resources. The movements often stress the protection of the environment through changes in public policy. Many movements are centered on ecology, health and human rights. Environmental movements range from the highly organized and formally institutionalized ones to the radically informal activities. The spatial scope of various environmental movements ranges from being local to the global. Guha and Gadgil (1989) defined the environmental movements as 'organized social activity consciously directed towards promoting sustainable use of natural resources halting environmental degradation or bringing about environmental restoration' Yanki Tong defined environmental movement as a type of "social movement that involves an array of individuals, groups and coalitions that perceive a common interest in environmental protection and act to bring about changes in environmental policies and practices".

"The environmental movements are conceived as broad networks of people and organizations engaged in collective action in the pursuit of environmental benefits. Environmental movements are understood to be very diverse and complex, their organizational forms ranging from the highly organized and formally institutionalized to the radically informal, the spatial scope of their activities ranging from the local to the almost global, the nature of their concerns ranging from single issue to the full panoply of global environmental concerns. Such an inclusive conception is consistent with the usage of the term amongst environmental activists themselves and enables us to consider the linkages between the several levels and forms of what activists call 'the environmental movement (Singh, 1973).

Environmental Movements in India: - The concern for environmental protection in India can be traced back to the beginning of twentieth century when people demonstrated against the commercialization of forest resources during the Colonial period (Sahu, Geetanjoy 2007). In Indian context, large number of environmental movements has emerged especially after 1970s and 1980s. In this framework Sahu, Geetanjoy (2007) stated that: "In India, the environmental movement has grown rapidly over the last three to four decades. It has played a key role in three areas such i.e.

1. Creating public awareness about the importance of bringing about a balance between environment and development.

2. Opposing developmental projects that are inimical to social and environmental concerns.

3. Organizing model projects that show the way forward towards non-bureaucratic and participatory, community-based natural resource management systems.

As per Sharma, Aviram (2007) major reasons of the emergence of environmental movements in India are

1. Control over natural resources

2. False developmental policies of the government

3. Socioeconomic reasons

4. Environmental degradation/ destruction and lastly spread of environmental awareness and media.

Narmada dispute with special reference to environmental movement: - While the Narmada Bachao Andolan is believed to be the most talked about resistance movement challenging the large dam, it would be wrong to assume that large dams in India were always celebrated as 'modern temples of India' and had not met with protests. McCully (2001: 299) states that, "Harakud, the first huge multi-purpose dam project completed in independent India, provoked opposition from local politicians and bureaucrats as well as the people to be evicted". McCully's brief narrative on resistance movements against large dams in India, in his book Silenced Rivers, informs readers that around 30,000 people marched in protest against Hirakud Dam in 1946. Mentioning another incident, McCully reports that "in 1970, some 4000 peope occupied the Pong dam construction site to demand resettlement land, and the work was stopped for more than two weeks". McCully narrates to us the widespread popular resistance by people affected from large dams in the state of Bihar in late 1970s, on the banks of Subarnarekha river. He refers to a protest march by around 1 lakh people to the site of Chandil dam. A month after this spectacular mobilisation, police had opened fire at a demonstration by around 8000 affected people killing three protestors. In the decade of 1970s, there arose protests against the proposed Tehri dam on Bhagirathi and from the people affected by Chandil and Icha dams on Subarnarekha. There were also movements by downstream people affected by construction of Sipu and Dantiwada dam, led by Gandhian activists, raising concerns about water security.

Narmada Bachao Andolan: - Considered to be one of the most powerful mass movements started way back in 1985 it was against the construction of a dam on the river Narmada. The dam named Sardar Sarovar Dam and Narmada Sagar would have displaced close to 250000 people once it was erected. The river Narmada, which is the largest flowing river in the west, would have been reduced to nothing but a small lake and destroy the biodiversity of the entire Narmada Valley, once the dam would have been erected. The government aimed to build close to 3000 big and small dams along the river to help in the irrigation process and also bring revenue for the government. It was at this juncture that Medha Patkar along with other environmentalists and non-government organizations started protesting against this dam project as it would destroy thousands of acres of forest and agricultural land in the area. Supported by Baba Amte, another respected social and model reader in the Indian landscape, the movement gained a lot of popularity and support from all major sectors in the Indian industry. The Andolan had specifically targeted the Sardar Sarovar project Dam, considered to be the second largest of the massive dams the government intended to build, as it would completely alter the biodiversity of the area. Despite the protests, the government promised that it would help in providing irrigation and drinking water to the farmers in the area and also help in bringing hydroelectric power. However, what the government failed to understand was it would lead to a large amount of displacement of the people in the area and also cause a major loss to their current livelihoods. Hence, the Narmada Bachao Andolan was a voice against the effective-decision taken by the government by environmentalists in India and even abroad.

Impact of the Andolan: - The Narmada Bachao Andolan plays an important role in the political history of India as it highlighted one of the biggest mass movements against the government to save nature. Mainly led by the native tribes, along with farmers, Human Rights activists, and environmentalists the movement gained a lot of popularity and support from all corners of the country. The multi-crore project gained financial assistance from even the World Bank which was largely frowned upon and protested against forcing them to withdraw their support in 1992. The people took this matter to the court where the Supreme Court ordered the height of the Dam to be brought down to 90 as a post to 130m. The withdrawal of the support of the World bank has left the state government and market borrowings to finance the current project.

Immediate effect: - The immediate effect that was witnessed post the start of the Narmada Bachao Andolan was the case being dragged to the Supreme Court by the people of India. The intervention from the Supreme Court outlined that there was several corruption present in the entire development of the project plan. The Supreme Court ordered the World Bank to review the loan provided for the Sardar Sarovar project. The exposition of fraud and corruption concerning the rehabilitation of the people highlighted the ill effect that the dam may bring to the people in Narmada Valley. Moreover, it Was also highlighted that it could lead to significant submergence of the area around the dam and lead to a suspension in agricultural and horticultural activities along with disrupting the community life in the area (https://unacademy.com/content/mppsc/study-material/environment-and-ecology/narmada-bachao-andolan/).

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UNIT: - 11

Environmental Performance Index

Introduction: - Careful measurement of environmental trends and progress provides a foundation for effective policymaking. The 2018 Environmental Performance Index (EPI) ranks 180 countries on 24 performance indicators across ten issue categories covering environmental health and ecosystem vitality. These metrics provide a gauge at a national scale of how close countries are to established environmental policy goals. The EPI thus offers a scorecard that highlights leaders and laggards in environmental performance, gives insight on best practices, and provides guidance for countries that aspire to be leaders in sustainability.

The Environmental Performance Index (EPI) is a joint research project of two prominent US American Universities (Yale Centre for Environmental Policy and Law, New Haven and Centre for International Earth Science Information Network (CIESIN)/Columbia University, New York) and commissioned by the World Economic Forum/ Davos, with the objective to establish a scientifically sound international composite environment index, which would allow for a sound measurement of quantitative cross-country comparison of environmental performances. The research project further aims at enhancing the analysis with respect to conditions of success for environmental policies. The EPI identifies scores for several core environmental policy categories and measures how close countries come to meet them. The index is constructed as a composite index, based on sixteen highly aggregated indicators which are weighted differently and which are assessed against absolute targets. In addition to publishing the composite index and individual country scores, a comparative country ranking is released (Haberland, 2008).

Data-driven environmental insights: - Scientific progress and evolving technologies offer the prospect of moving the world toward a more sustainable future, but a persistent disconnect between research findings and actionable policy insights continues to hold back environmental progress. World leaders need more refined tools that allow them to better understand sustainability challenges, data, and trends — and which provide a firmer foundation for policy choices. By carefully measuring environmental performance, highlighting critical results, identifying leaders and laggards, and spotlighting best practices in the policy domain, carefully constructed metrics can support transformative change and signal the path toward sustainable development. The Environmental Performance Index (EPI) gives countries the information and tools they need to track progress toward meeting the UN sustainable development goals (SDGs) and other critical policy targets, adopt policies and programs that improve the environmental well-being of their citizens and the health of the ecosystems on which all life depends, identify top-performing peers to whom they might look for guidance, and ensure maximum returns on environmental investments. Using comprehensive and accessible metrics, the EPI captures country-level performance and historical trends in climate change, ecosystem vitality, and environmental public health. The 2022 EPI ranks 180 countries based on 40 performance indicators across 11 environmental issue categories. As the most comprehensive environmental analysis ever compiled, the 2022

EPI empowers policymakers, researchers, engaged citizens, business leaders, non-governmental organization officials, and the media to track trends in sustainability and enhance environmental decision-making.

Measuring Climate Performance: - Recognizing the urgency of the threat of climate change, world leaders pledged at the 26th Conference of Parties in November 2021 to put their countries on track for netzero greenhouse gas (GHG) emissions by mid-century. To achieve this goal, nations will need to redouble their efforts to reduce emissions, expand carbon sinks, improve energy efficiency, and invest in clean energy infrastructure. While some nations have spelled out their plans for the transformative change required to get to net-zero emissions by 2050, far fewer have put their emissions on the downward trajectory that will be required to hit the net-zero GHG target. Success in this endeavor is essential to the global response to climate change. The 2022 EPI therefore includes a new metric based on recent GHG emissions trends to project how close countries will be to the netzero target in 2050. Leveraging the latest data, this major methodological advancement in the EPI framework provides critical new tools for tracking country-by-country and global progress on climate change. The EPI's groundbreaking findings show that only a handful of countries — including Denmark and the United Kingdom — are currently slated to meet the net-zero GHG commitment, while many others are headed in the wrong direction.

New Insights for Improving Air Quality: - Air pollution remains a critical public health challenge in many nations. Reimagining how policymakers can use metrics to improve air quality, the 2022 EPI introduces several new indicators that more acutely emphasize trends in environmental health. Existing metrics insufficiently monitor exposure to a broad suite of air pollutants, hindering the ability of decision-makers to holistically address the public health impacts of poor air quality. To support new emissions control policies and ensure implemented solutions realize meaningful gains in environmental health, the 2022 EPI tracks exposure to four additional air pollutants: nitrogen oxides, sulfur dioxide, carbon monoxide, and volatile organic compounds. These innovative metrics demonstrate that most of the world's population breathes unsafe air. Although air quality in many countries continues to deteriorate, this new framework of indicators offers policymakers a toolkit to reverse unsustainable trends (Wolf et al., 2022).

The Need for Environmental Performance Indicators: - Environmental policymaking is difficult under the best of circumstances. Decision-makers must address a wide range of pollution control and natural resource management challenges in the face of incomplete or conflicting data, causal complexity, divergent values and preferences, and myriad uncertainties. Insufficient facts and lack of careful analysis makes each step of the process more difficult—problems are harder to see, trends are not identified, policy goals become more difficult to set, regulatory efforts may be misdirected, and investments in environmental protection may be wasted – ultimately resulting in suboptimum environmental performance. Shifting environmental policymaking onto firmer analytic foundations, based on carefully constructed data and indicators, therefore emerges as a matter of considerable urgency. The commitment to empirical data is just a first step. Identifying an appropriate set of metrics is equally important. Some indicator initiatives have been too broad to be of great value. In

covering sustainable development or sustainability in a "triple bottom line" with environmental, social, and economic factors, as well as underlying endowments, accumulated harms, current policy efforts, and the prospect for changing future trajectories, these efforts lost coherence and therefore policy relevance. Other efforts have been too narrow to cover the full spectrum of environmental challenges. In addressing only a subset of issues that policymakers and members of the scientific community identify as fundamental to meeting society's environmental challenges,these indices have limited value (Esty et al., 2008).

Drivers of Environmental Performance Index: The major drivers of EPI are as given beliow (kaufmann et al. 2007) : -

a. GDP Per capita: - Not surprisingly, per capita GDP is correlated with higher performance on the EPI. In particular, overall EPI scores are higher in countries that have a per capita GDP of $10,000 or higher. Performance below this threshold is variable, and the higher scores associated with countries above this threshold are driven predominantly by high performances in the environmental health category. Within the environmental health category per capita GDP shows a strong positive correlation with performance on the urban particulates, environmental burden of disease, water supply, and adequate sanitation indicators. Per capita GDP also positively correlates to performance on the water quality and supply, pesticide regulation, forest growth, burned land area, and ecological and health ozone indicators. A strong negative relationship exists between per capita GDP and performance on the agricultural subsidies indicator, and per capita GDP is also slightly negatively correlated with performance on the agricultural intensity, marine protected areas, sulfur dioxide, and GHG emissions per capita indicators.

b. Corruption: - The control of corruption measure is aggregated from a number of indicators gauging perceptions of corruption, conventionally defined as the exercise of public power for private gain. Environmental performance appears to be correlated with corruption. Countries with high levels of corruption tend to have low levels of environmental performance, whereas countries with low levels of corruption perform better on the EPI. This relationship is true particularly for the marine protected areas and greenhouse gas emissions per GDP indicators. Countries with low levels of corruption also correlated with lower performance on the greenhouse gas emissions per capita and water quality indicators.

c. Government Effectiveness: - Government effectiveness measures the competence of the bureaucracy, the quality of policymaking, and public service delivery. A slight positive relationship exists between government effectiveness and EPI performance. Particularly, government effectiveness positively correlates with performance on the greenhouse gas emissions per capita, health ozone, growing stock, and water quality indicators. Government effectiveness shows a slight negative correlation with performance on the sulfur dioxide indicator.

d. Voice and Accountability: - Voice and Accountability measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. There appears to be a positive

correlation between environmental performance and the level of Voice and Accountability. This trend is equally strong for both Environmental Health and Ecosystem Vitality suggesting that increased public awareness and public involvement in government have positive effects on all national environmental objectives.

e. Competitiveness (From World Economic Forum): - Competitiveness is a comprehensive measurement of the comparative strengths and weakness of major and emerging national economies. The Competitiveness rankings of 131 countries are calculated in a Global Competitiveness Report (GCR) from both publicly available data and the Executive Opinion Survey, a comprehensive annual survey conducted by the World Economic Forum together with its network of Partner Institutes. There is a strong positive relationship between competitiveness and environmental performance. Switzerland, Norway, Sweden, and Finland -- the four top-ranked countries in the 2008 EPI -- also receive superior Competitiveness scores (ranked second, sixteenth, fourth, and sixth respectively). It should be noted that although this correlation exists, competitiveness does not solely predict environmental performance. For example, even though the United States is the leader in Global Competitiveness, they are ranked thirty-ninth in the 2008 Environmental Performance Index, and perform very poorly within many aspects of the Ecosystem Vitality objective.

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UNIT 12

Environmental Audit

Introduction: - Environmental auditing is a management tool which simply inspects the environmental management activities performed by the industries or organizations and makes them aware of new cleaner technology. For the impact of industries and their product on natural resources and environmental quality it is necessary to have "Environmental Audit" to ensure sustainable industrial developments. Objectives need and advantages are focused in this paper. Moreover, audit scheme, approach, characteristics, case studies in India are also enumerated. For more implementation and popularization of environmental audit in India are conducted to review existing management systems and internal controls. To gather appropriate information to provide a basis for evaluating the reliability of internal controls in achieving desired environmental results. Suggestive measures are also suggested for the improvement of companies and industries. Pollution now is an inevitable consequence of modern industrial technology, rapid and convenient transport and comfortable housing, but excessive pollution may interfere with man's health and his mental, social and economic wellbeing. There is now a clarion call from every nook and corner of the society that "save the nation from this menace the pollution". Governments, all over the world, have formulated laws and regulations to correct and cure the past violations of good environmental practices.

Environmental audit is a general term that reflects various kinds of evaluations intended to identify environmental compliance and management system, implementation gaps, along with related corrective actions. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambience. Environment audit is a useful tool to determine how and where the most natural resources are being used; and can then considerations be given on how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can create health consciousness and promote environmental awareness, values and ethics.

The term auditing is known to us in financial accounts and records are examined. Environmental audit is for the impact of the industries and their products on natural resources and environmental quality. It is necessary to have 'Environmental Audit' to ensure sustainable industrial developments. Environmental Audit is a pragmatic management tool, which addresses itself to help an industry or operation, to verify compliance with environmental requirements, to evaluate the effectiveness of the environmental management system, to assess risks and to identify and correct environmental hazards. It is the examination of accounts of revenues and costs of environmental and natural resources, their estimation, depreciations and natural resources, their estimation depreciations and values recorded in the books of accounts (Jariwala, 2003).

Environmental organization management systems and equipment are performing with the aims of:

i. Facilitating management control of environmental practices.

ii. Assessing compliance with company policies.

iii. Facilitating professional competence

Objectives of Environmental Auditing: - The major objectives of Environmental Auditing are (Anjaneyulu, 2002; Dash, 2004)

1. An environmental audit program which is designed and implemented properly can enhance an industry 's environmental performance.

2. Monitoring the scale of optimum utilization of the resources and evaluating the company at national & international level.

3. To suggest for using alternative energy for the conservation of energy resources.

4. Evaluation of waste water quality and determination of waste water characteristic s & their effects on the living system.

5. Classification of the categories of solid waste hazardous waste their sources, quantities & characteristics.

6. Introduction and implementation of time saving technologies in production.

7. Maintains of Labour / Occupational health & medicine.

8. Proper documentation of environmental compliance status.

9. To help in minimizing the wastes through modern cleaner technologies.

10. Regular environmental auditing once in a year will help in producing environmentally educated & technically sound personnels.

Differing Types of Environmental Audits: -

a. Environmental Management Audits: - These are audits which are specifically designed to check and evaluate the effectiveness of environmental management systems. Sound environmental management at a site or in an operation depends upon procedures, work instructions, guidelines, specification, training programs and monitoring systems being implemented by the employees of the organization operating on the site. If these employees are not given the right instructions, training and procedures within the system, they cannot be expected to carry out their work effectively. Thus, the first stage in auditing an operation is to check the presence, absence and functioning of the environmental management system (which could be formal or informal). This then creates a baseline against which one can check the environmental functioning of an organization more effectively and objectively.

b. Environmental Compliance Audits: - Environmental compliance (or performance) audits are specifically designed to test compliance (which covers both legal compliance and corporate compliance) to environmental policies, objectives, laws, by-laws, ordinances,

regulations and standards. These types of audits will often also include more numerical testing and specific checks on, for example, compliance with requirements in water and air permits and licences.

c. Environmental Assessment Audit: - An environmental assessment audit is an instrument used to check that an Environmental Impact Assessment complies with the minimum legal requirements and also checks to ensure that due legal process has been followed. This particular audit is not common in South Africa but is used elsewhere in the world to assist in EIA quality control and to reduce unnecessary costs and inconvenience should the EIA be appealed against.

d. Waste Audits: - Waste audits are environmental audits which specifically look at the waste management component of an operation or site. In such audits, the various aspects of waste management would be reviewed and the methods, procedures and systems checked and verified. In cases where site management are reluctant to undertake full site environmental audits, it is often easier to motivate for a specialized waste audit because the results of this will often more readily generate data and actions which can save money.

e. Environmental Due Diligence Audits: - Environmental due diligence audits are described in different ways but are essentially audits which look at the actual and potential environmental liabilities of a site or operation. They are most commonly carried out as a precursor to the purchase of property which has been or is likely to be used for industrial or commercial purposes. Often, they form a part of a wider financial due diligence audit which looks at the various business risks associated with the purchase of property. The kind of issues that can emerge from environmental due diligence audits include past dumping or burying of hazardous waste which may result in pollutants contaminating the groundwater. In such circumstances, the owner of the land where the waste was buried could be held liable for the clean-up costs. It is important, when purchasing property, to ensure that the new owner is not taking over someone else's hidden environmental liabilities.

f. Supplier Audits: - A supplier audit is an audit carried out by a client to test the environmental compliance of a contractor or supplier. It should be an audit using the environmental conditions included in the contract document. In the absence of any specific conditions, it could be an audit of the supplier's environmental management system with special reference to the client's business. It is often said that in any organization, one's contractors are the weakest link in the chain of operation. This is not necessarily a reflection on the quality of the contractor's service but acknowledgement of the fact that the contractor will not necessarily have the same goals and objectives as the client organization. The contractor and client will have a contractual relationship which is often based upon the supply of a specific product or service. If the client wishes a contractor to have exactly the same approach to environmental policy and systems as his own, then this needs to be included in the contract. Furthermore, the compliance with such policies and systems need to be regularly audited. Thus a supplier or contractor audit is one where the contractor is audited against the environmental requirements of the contract.

Advantages of Environmental Audit: -

- Preparation of Environmental management plan.
- Assessment of environmental input and risks.
- Identifying areas of strength and weakness for improvements.
- Evaluation of pollution control.
- Verification of compliance with laws.
- Assuring safety of plant, environment & human beings.
- Enhancement of loss prevention, manpower development and marketing.
- Budgeting for pollution control, waste prevention, reduction, recycling and reuse.
- Providing an opportunity for management to give credit for good environmental performance.
- As a whole environmental audit plays an important role in minimizing the environmental problem locally, regionally, nationally and internationally.

Environmental Auditing and Decision-making: -

a. Transparency: - An environmental audit report is one of the useful means of demonstrating an organisation's commitment to openness and transparency. If an organization believes it has nothing to hide from its stakeholders, then it should feel confident enough to make its environmental audit reports freely available to those who request them.

b. Audit report distribution: - As a basic rule, environmental audit reports should be made available to all stakeholders. In such circumstances, the information contained within the report should be written in such a manner that all stakeholders are able to understand it. Should the report be excessively technical, there should be non-technical summaries or appendices included. Some reports are specifically written for internal organisational consumption and for use as baseline information and guidance for the purpose of continuous improvement. At the commencement of the audit process, it is advisable to ascertain who the potential audience of the audit report will be and to get consensus on the format, content, circulation and status.

c. Confidentiality: - The external auditor is an "outsider" and, as such, must be given access to strategic, sensitive and proprietary company information in order to be able to carry out the audit. In order to protect proprietary company secrets and information that ensures a company's competitive advantage, an external auditor may be required to sign some form of secrecy agreement to reinforce the need to safely manage information during the course of the audit. As a basic principle of professionalism, the auditor should keep all information gathered confidential, unless given permission to release information by the client.

d. Participation of Stakeholders on Audits: - Stakeholders such as neighboring communities are often very suspicious of the industrial operations that they live next to. This suspicion often stems from a lack of knowledge and understanding of what goes on inside the factories and sites. Inviting representatives of these neighboring communities to participate in

the routine internal audits, and even the less frequent external audits, is a means of demonstrating good faith and openness.

e. Audit Follow-up: - Audits are exercises which generate considerable quantities of valuable management information. The time and effort and cost involved in this exercise is often considerable and in order to be able to justify this expenditure, it is important to ensure that the findings and recommendations of the audit are considered at the correct level within the organization and that action plans and implementation programs result from the findings. Audit follow up is part of the wider process of continuous improvement. Without follow-up, the audit becomes an isolated event which soon becomes forgotten in the pressures of organizational priorities and the passing of time.

f. Auditing and Formal Systems: - Many companies are taking the route of establishing environmental management systems which are based upon the ISO 14001 standard for EMS. The choice of whether to actually certify the system formally is dependent upon cost benefit and associated demand from customers and clients. Whilst it may be seen to be desirable to certify, many organizations will align their internal environmental management systems to ISO 14001 and delay the formal certification until there is a business motivation to certify.

Environmental audits can "add value" to the management approaches being taken by companies and organizations and is a way of identifying, evaluating and managing environmental risks (known and unknown). It can be undertaken at various levels of sophistication and detail which can be tailored to the needs of the client organization. The current focus on shifting business priorities from just a financial profit bottom line to a broader "Triple Bottom Line". This means that organizations need to collect more data and evaluate performance on a wider and more diverse basis. The environmental audit assists in the process of testing performance in the environmental arena and is fast becoming an indispensable aid to business decision making.

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1.7 Self-Assessment Test: -

How environment, population and development are linked with each other?

What is IPAT model and PDF model?

What do you mean by the tragedy of commons?

Discuss different earth summits with their principles.

What are the aspects of Montreal and Kyoto Protocol?

Explain the different country of parties.

What are the key issues and challenges of agriculture?

Briefly discuss the concept of alternative agriculture.

Discuss the causes and consequences of forest depletion.

What are the environmental impacts of tourism industry?

What are the purposes and stages of Environmental Impact Assessment?

Discuss about Narmada dispute with special reference to environmental movement.

How do you measure the climate performance?

What are the drivers of EPI?

Discuss differing Types of Environmental Audits.

1.8 Summaries and Key Points: -

The entire volume may be summaries with emphasizing some important key points:

The concept and definition of environment and development with special reference to IPAT and PDF model;

The Tragedy of commons and their review;

The highlights and principles of earth summit;

The Montreal Protocol and Its Implications for Climate Change and the key issues of Kyoto Protocol;

Discussions of different conferences of parties;

Discussion of the concept of alternative agriculture and the necessity;

Define forest resources and its use and misuse;

Challenge of tourism industry, special focus in India;

Concept and purpose of Environmental Impact Assessment.

Environment and Narmada dispute

Concept of Environmental Audit and Environmental performance index.

Disclaimer: This self-learning material is based on different books, journals and web-sources.