Preface

With its grounding in the "guiding pillars of Access, Equity, Equality, Affordability and Accountability," the New Education Policy (NEP 2020) envisions flexible curricular structures and creative combinations for studies across disciplines. Accordingly, the UGC has revised the CBCS with a new Curriculum and Credit Framework for Undergraduate Programmes (CCFUP) to further empower the flexible choice based credit system with a multidisciplinary approach and multiple/ lateral entry-exit options. It is held that this entire exercise shall leverage the potential of higher education in three-fold ways - learner's personal enlightenment; her/his constructive public engagement; productive social contribution. Cumulatively therefore, all academic endeavours taken up under the NEP 2020 framework are aimed at synergising individual attainments towards the enhancement of our national goals.

In this epochal moment of a paradigmatic transformation in the higher education scenario, the role of an Open University is crucial, not just in terms of improving the Gross Enrolment Ratio (GER) but also in upholding the qualitative parameters. It is time to acknowledge that the implementation of the National Higher Education Qualifications Framework (NHEQF), National Credit Framework (NCrF)and its syncing with the National Skills Qualification Framework (NSQF) are best optimised in the arena of Open and Distance Learning that is truly seamless in its horizons. As one of the largest Open Universities in Eastern India that has been accredited with 'A' grade by NAAC in 2021, has ranked second among Open Universities in the NIRF in 2024, and attained the much required UGC 12B status, Netaji Subhas Open University is committed to both quantity and quality in its mission to spread higher education. It was therefore imperative upon us to embrace NEP 2020, bring in dynamic revisions to our Undergraduate syllabi, and formulate these Self Learning Materials anew. Our new offering is synchronised with the CCFUP in integrating domain specific knowledge with multidisciplinary fields, honing of skills that are relevant to each domain, enhancement of abilities, and of course deep-diving into Indian Knowledge Systems.

Self Learning Materials (SLM's) are the mainstay of Student Support Services (SSS) of an Open University. It is with a futuristic thought that we now offer our learners the choice of print or e-slm's. From our mandate of offering quality higher education in the mother tongue, and from the logistic viewpoint of balancing scholastic needs, we strive to bring out learning materials in Bengali and English. All our faculty members are constantly engaged in this academic exercise that combines subject specific academic research with educational pedagogy.We are privileged in that the expertise of academics across institutions on a national level also comes together to augment our own faculty strength in developing these learning materials. We look forward to proactive feedback from all stakeholders whose participatory zeal in the teaching-learning process based on these study materials will enable us to only get better. On the whole it has been a very challenging task, and I congratulate everyone in the preparation of these SLM's.

I wish the venture all success.

Professor Indrajit Lahiri
Vice Chancellor

Netaji Subhas Open University

Under Graduate Degree Programme

Bachelor of Arts (Honours) SOCIOLOGY (DSE)

Paper : NCE-SO-02 Environmental Sociology

Subject : Environmental Sociology

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UG: Environmental Sociology
NCE-SO-02

Course Title : Environmental Sociology
Course Code : NCE-SO-02

Module – I : Envisioning Environmental Sociology

Unit – 1	:	Environment Sociology: Definition and Meaning	7
Unit – 2	:	The Realist-Constructivist Debate	47

Module – II : Different Aproaches

Unit – 3	:	Treadmill of Production	55
Unit – 4	:	Ecological Modernisation	64
Unit – 5	:	Risk	77
Unit – 6	:	Eco-feminism and feminist environmentalism	96
Unit – 7	:	Political Ecology	111

Module – III : Environmental Moments in India

Unit – 8	:	History of Environmental Movements in India	123
Unit – 9	:	Recent Trends in Environmental Movements in India: Issues and Challenges	140
Unit – 10	:	Forest Based Movement—Chipko	160
Unit – 11	:	Water-based Movements—Narmada	174
Unit – 12	:	Land Based Movements (Anti-mining and Seed)	189
Unit – 13	:	Global Warming, Policy Making & Sustainable Development in India	211
Unit – 14	:	Major Environmental Issues in India	
	i)	Air Pollution	240
	ii)	Water Pollution and Ground Water Depletion	261
	iii)	Deforestation	304
	iv)	Plastic and E-Waste	339
	v)	Medical Waste, Pollution and Health Risk	369

MODULE – I
ENVISIONING ENVIRONMENTAL SOCIOLOGY

UNIT–1 : ENVIRONMENT SOCIOLOGY : DEFINITION AND MEANING

Structure

1.0. Objectives
1.1 Introduction
1.2 Definition
1.3 Meaning and Nature
1.4 Emergence of Environment Sociology
1.5 Scope of Environmental Sociology
1.6 Conclusion
1.7 Summary
1.8 Model questions
1.9 Suggested Readings and References

1.0 Objectives

The objectives of this unit are :

- To give the learners a brief idea about the newly emerged sub-area of sociology.
- To find an appropriate definition of the sub-area of Environmental Sociology.
- To explain the meaning of Environmental Sociology.
- To examine its nature and scope.
- To give learners an idea about why environment has emerged as a sociological issue.

1.1 Introduction

Environmental Sociology, a relatively new sub-area of sociology, has started to gain recognition in about the past five or six decades and it is concerned with the intimate relationship between man and nature. Each leaves deep impact on the other; and nature teaches people why and how it is important for the healthy survival of mankind. This branch of study uses mainstream sociological theories and concepts

to examine different environmental issues like environmental conflict, politics, movements, etc. Issues associated with environment involve all the forces and materials surrounding all living beings; it is consisted of multiple mutually related, interacting systems of physical, biological and cultural kind. Thus the living, thriving elements around human beings comprise the environment and each and every element interacts with each other and shapes the human lives. Looking at the concept of environment it can be said that environmental sociology is an interdisciplinary subject that involves the knowledge of subjects like biology, chemistry, physics, statistics, geography, geology, economics, law, micro-biology, bio-chemistry, sociology, politics, international relations and many such disciplines. The knowledge and techniques of all these disciplines are often used in different combinations in the understanding of environmental issues and also in the solution of environment related problems.

Due to various natural and man-made events the environment is , for long, undergoing changes, resulting in pollution and severe climatic conditions. As awareness regarding those conditions started to emerge, ideas for damage control also started to emerge. All these led to the birth of the sub-discipline of environmental sociology. It examines the ecology of different areas and understands how developments in one corner of the globe may affect the natural environment of other areas.

Inclusion of environment and ecology in the understanding of human society, as it has already been mentioned, has happened late. The classical western sociologists like Durkheim, Weber and Marx were well aware of the role of the Nature on human life; but they have never extended their ideas of man-nature relationship into full-fledged theories. Therefore, the study of environment or ecology could not develop in their writings. However, Indian sociologist Radha Kamal Mukherjee developed some ideas regarding man-nature proximity; but his ideas have little impact on the contemporary study of sociology in general and environmental sociology in particular.

1.2 Definition

To understand the meaning and importance of Sociology of Environment we need to understand the meaning of its key terms; these are Sociology and Environment. From these two, we need to come to the meaning of sociology of environment.

Sociology: Sociology is the systematic study of human social life, groups, societies, processes, causes and consequences of social change and nature and significance of human social behaviour.

Environment: Environment is the sum total of a living organism, including natural forces and other living things, which provide conditions for development and growth as well as of danger and damage.

Environmental Sociology: Environmental sociology, as a subarea of sociology is the study of relations between human societies and their physical environments; or to put it more simply, its subjec-tmatter is societal-environmental interactions. Such interactions include the ways humans influence the environment and also the ways environmental conditions influence the human world. The manners in which man-nature interactions are socially interpreted and acted upon are also taken into consideration.In short we can say, environmental sociology is defined as the study of interactions among the physical environment, social behaviour and social institutions.

Generally speaking, environmental sociology explores the close relationship between and interdependence of environment and human society. Though it may appear to be similar to sociology of environment, there are some differences between the two. Environmental sociology questions and reformulates many of the existing theories and methods; as a sub-area of sociology it studies the inter-relationship and interactions between human societies and their natural surroundings. To understand the nature of this reciprocal relationship it examines the social factors that impact environmental issues, the process of natural resource management, environmental crises, etc. It also tries to understand the society's response to various environmental problems and how these problems are socially created.

An awareness regarding the impending hazards of environment, mostly created by human intervention in nature, had started to emerge in the 1960s and the sub-area of Environmental Sociology had started to make its presence felt. There is a general belief that on the 'Earth Day 1970', i.e., on 22.04.1970 the environmental movement took its first step forward; it was also the day when new environmentalism started its journey to be embraced by thousands of supporters, giving the environmental issues a quick acceptance in a short period. For sociologists this recognition to environmental issues was significant, because so far there was barely any presence of comprehensive discussions on environment within the discipline. Classical sociological thinkers like Durkheim, Weber and Karl Marx were concerned with environment and its changes caused by human intervention, yet they never developed these ideas into full-fledged theories and for this and many other reasons environmental sociology did not develop earlier.

The sub-area of environmental sociology has developed with components from many divergent disciplines like biology, geology,chemistry, physics, engineering, sociology, health sciences, anthropology, economics, statistics and philosophy and thus has acquired a multi-disciplinary approach. Its integration with a wide array of subjects has led to deep understanding of the intricacies of man-environment relationship, of the problems of environment and their solutions. The sociological enquiries regarding environmental issues was the outcome of rising public awareness

about the complex environmental conditions and problems associated with them. Scientists and other experts could understand that the devastation of nature was the product of its abuse and exploitation by men, governed by the need, greed and demands of mankind. The experts who rang the alarm bell in the 1960s, were also the persons who started to examine the issues from both macro and micro angles.With their efforts people now gradually became aware of the role played by all the macro and micro elements that surround the ecology.

Environmental sociology, as a specialised sub-discipline, minutely examines the role and impact of environment on human society. A detailed knowledge about this is very useful because environment plays a number of significant roles for mankind. Firstly, it supports and regulates everything that a person needs; for example, air,water, soil, food, residence, transport system, agriculture, trade and commerce, health and mortality, life style and every other thing.

Secondly, it prevents pollution emerging out of natural causes by absorbing the pollutants in the atmosphere. For example, trees and plants, during day time, absorb, carbon-dioxide and releases oxygen to keep the environment healthy and livable.

Thirdly, environment determines the food chain, the shelter for every living creature, the purpose of life for all creatures on earth, their techniques of survival and entertainment as well. This shows that every living being including the human kinds, plants, animals and insects can survive on the earth because of the support they receive from the eco-system itself.

As the human society is so much dependent on the ecosystem, it becomes essential to learn about its different aspects and to understand the nature of this dependence . For all these reasons the study of different aspects of environment has become an integral part of the discipline of sociology.

1.3 Meaning and Nature

Environmental sociology is generally defined as the sociological study of socio-environmental interactions.

It is also defined as a field of sociology that deals with the interactions of societies and their built and natural environments.

According to Stewart Lockie, environmental sociology is concerned with the reciprocal relationship between environment and society.

According to Gisbert, environment means "anything immediately surrounding an object and exerting a direct influence on it." It is the sum total of conditions that surrounds us at a given point of time and space.

The word environment has been derived from the French verb 'environer' meaning

'to encircle or surround'. Thus environment includes physical, chemical, biological worlds and their social and cultural impacts on material life.

As we have come to know, environmental sociology is the study of the mutual interactions between the physical environment or the ecosystem, social organisation and social behaviour. Environment is the system that encompasses all physical and material elements of life starting from the tiniest of being reaching up to the largest of elements at the biosphere and also the non-living elements that affect the natural world. It also examines the social factors behind environmental resource management, leading to various environmental conditions that determine how the environmental issues are socially viewed and the approaches nurtured by the society towards these issues. On the basis of all these and many others, environmental sociology took its baby steps in the late 1970s as a response to the environmental movements that took shape in the 1960s. As a new and vibrant subfield of sociology it started to examine the physical contexts of environment and their associated social factors as well. Environmental problems , movements and public-private initiatives to solve the problems have become integral parts of this particular subfield. It has a multi-disciplinary approach and its subject matter includes biology, geology, geography, chemistry, physics, botany, zoology, health science, anthropology, economics, statistics, culture studies and sociology. The main focus of this branch of knowledge remains on the issues and problems of contemporary societies and presently it is counted as one of the well respected, interdisciplinary field of study.Dunlap and Catton have observed "elements of societal-environmental interactions within the discipline." (1979).

1.4 Emergence of Environmental Sociology

Despite the close, reciprocal relationship between nature and human society , for a long time, environment was not considered a part of sociology's subject matter. Eminent thinkers have pointed out that problems of water and air pollution and concern for their evil effects on human health date back to the Roman period, if not earlier. In between the late 14th and mid-16th century pollution had caused spread of diseases in Europe. Ancient civilisations like China, India and Peru used to practice soil conservation even 2000 years ago. But such concerns did not give rise to any activism. It came much later in the late 19th century out of the need to protect the countryside in Europe and wilderness in the United States. Pollution caused by unregulated growth of industries as an aftermath of the Industrial Revolution in Europe also raised concern over the matter. Some American thinkers like the utilitarian Gifford Pinchot (1865-1946) and conservationist John Muir (1838-1914) were among the first advocates of environment during the late 19th-early 20th century period. Pinchot felt that the bounties of nature should be protected for ensuring their use in

future; whereas conservationists like Muir used to believe that nature should be protected so that its beauty could be enjoyed for ever and ever. Though there were differences between these two schools of thought, their arguments led to the establishment of a number of National Parks, Sierra Club, opening of US Forest Service and many such other organisations for the careful protection of environment in the USA. Aldo Leopold (1887-1948), a professor of wild life management played an important role in designating Gila National Forest in New Mexico in 1924 as America's first wilderness area.

Environmental organizations established during the late 19th century-early 20th century period were primarily middle-class lobbying groups concerned with nature conservation, wildlife protection and industrial pollution caused under the impact of industrial pollution and unplanned urbanisation. However, in Europe and Oceania notable conservation developments had taken place since the beginning of the 20th century. For example, Sweden and Switzerland established National Parks and in New Zealand, a Native Bird Protection Society was established during that time. But these efforts did not create any well-organized movement, neither any move towards sociology of environment was noticed during that period.Sir Patrick Geddes (1854-1932), known as the ‘father of town-planning’, used biological concepts to develop a holistic view of people and where they live, to find both of them organic and how any discrepancy between the two could affect their health and well-being.Geddes encouraged people to become actively involved in the betterment of their surroundings. For this purpose, in 1884, he established the Environment Society (later renamed as the Edinburgh Social Union) to encourage local residents to survey, plan and improve the local environment. For his contributions towards environmental improvement many consider him the 'father of environmental sociology'.

Much later, in the 1960s, modern environmentalism arose as a consumer movement when people in America started to demand clean water, air and cleaner surroundings as their rights, it contributed towards the development of the study of environmental problems within the arena of sociology. It gradually became clear that the environment was incapable of absorbing the whole amount of human waste products, at the same time there was the need to protect the areas of natural beauty. In the 1970s, due to the outcome of various environmental movements, sociologists, like experts from other disciplines, started to include various issues and problems of environment within the academic arena of sociology. By the end of that decade thinkers like William R. Catton, Jr., Riley Dunlap and others favoured the application of a holistic Systems Approach to interlink elements of environment with social issues as they wanted to view society as a complete system in its totality. Apart from Catton and Dunlap, Leopold and Muir, other important contributors to environmental sociology

are George Perkins Marsh, Kari Marie Norgaard, John Bellamy Foster, and Dr. William Freudenburg.An important development of this subdiscipline is the shift from 'sociology of environment' to an environmental sociology; the former refers to the study of environmental issues following the approaches of traditional sociology, the latter encompasses the societal-environmental relations. (Dunlap and Catton, 1980; 1978).

By the early 1970s a large number of sociologists had come to understand from the growing literature contributed by the likes of Rachel Carson, Hardin, Ehrlich and Ehrlich and Commoner that environmental problems and ecological constraints were real and could pose serious problems for the human society in the near future. Knowledge based on personal experiences and media-accounts of many alarming situations also contributed to the growth of concern for the environment and future of mankind. Rachel Carson's best-selling book, 'Silent Spring' (1962), exposing the level of ecological devastation caused by agricultural pesticide use, had already triggered serious concern for protection of natural environment from human intervention and modern technology. Then in the early 1970s came The Limits of Growth predictions of the environmental catastrophe and energy crisis in the USA. All these created a serious concern and brought the future of environment and human society to the forefront.

After its emergence in the 1970s, a sharp decline of interest in was noticed in the early 1980s, and was revitalised again in the late1980s. The American psycheas more in favour of the prospect of unlimited and endless growth; hence any possibility of limit for the sake of protection of environment did not appeal to them for long. Environmental sociology courses lost their popularity, job prospects also suffered a set back and the discipline's emphasis on the eco-system dependence of the modern, industrialised societies did not match the pulse of the time. Then, again, in the latter half of the '80s renewal of interests in the subject could be felt when there emerged a rising concern over human exposure to before toxic and other hazardous wastes. A growing recognition of the global environmental change calls for examination of societal-environmental interactions and thus offers an opportunity for strengthening sociological interests in environment.

At present, environmental sociology is considered a very important interdisciplinary study by eminent scholars and its subject matter is composed of issues from demography, public health, ecology, environmentalism, environmental problems and many other related things. For researches, enquiries and analyses it involves thoughts and theories to explain environment, surveys and field researches, enquiries and analyses, interviews of experts, activists and victims of environmental disasters, observations on various environmental conditions, reviews and reassessment of old documents and reports to draw new conclusions regarding them. Environmental

sociologists need to depend on the works of anthropologists, climate scientists, economists, geographers, urban planners and even legal experts to gain a deep understanding on the matter and this gives environmental sociology a multi-disciplinary character in true sense.

In short, we can conclude that the emergence of environmental sociology has been the result of two primary factors like firstly, the assessment of the impact of nature on human society and secondly, the evaluation of the impact of man's negative or destructive behaviour towards his environment. The discourses in environmental sociology have made us more concerned about the dangers associated with the human devastation of nature in future.

1.5 Scope of Environmental Sociology

The scope of environmental sociology revolves around four primary areas of study; these are:

a) empirical research and theory Building,

b) analysis of the reciprocal relations between the society and its surrounding natural environment,

c) assessment of society's role regarding environment, and

d) search for a sustainable solution for the problems associated with environment.

Each of these four broad areas involves several important issues and this has widened the scope of the subject to a large extent. It is also essential to note down that in the recent years the scope of this sub-discipline of sociology has broadened further with inclusion of several other matters within its fold. We need to discuss these areas one by one.

a) Empirical Research and Theory Building

One important task of environmental sociology is to look into the social factors that may cause mild to severe problems for the environment. It has been found that demographical, political, cultural and economic factors may lead to degeneration of ecology and environment.Environmentalists and other experts do explain how human interventions negatively impact environmental condition; they also offer suggestions for its remedy and restoration. To do this the environmental sociologists do researches, often taking help from researches in other disciplines, and build theories to explain the social impacts of drastic environmental change. The theories, in turn, help examine and understand the prevalent conditions, the future trends and the prognosis of the situation; they also encourage further researches based on facts and scientific information.

b) Analyses of Man-Nature Reciprocity

Both environmentalists and environmental sociologists discuss the reciprocal relations between the society and the natural environment to understand how man's activities and the process for development scar and damage the natural environment and ecology as well as how nature impacts human life and social environment in all the ages. The scholars from both the fields examine the impacts of natural calamities and devastations in the light of environmental equity. Since the past one century researches have been increasingly drawing towards the man-nature relationship. These researches have revealed the multiple ways humans are linked to natural elements like the sustainability of natural resources, physical and mental health benefits associated with one's engagement with nature. In short, man needs nature more than nature needs man. Man has the capacity to change the nature and alter the climate by exploiting it relentlessly, by spending enormous energy and time. But this is no one sided affair as nature has also fought back with climatic changes and thus devastating the lives of not only humans but also millions of species, and with disease outbreaks. The more we harm the nature, the more we expose ourselves to diseases.

Environmental sociologists try to understand and explain the reciprocity of natural and human worlds with the help of scientific research findings in other disciplines, government documents, media reports and interviews of the environmental disaster victims. Having a multi-disciplinary perspective helps environmental sociology to look at the relevant issues from multiple points of view.

c) Assessment of Society's Role Regarding Environment

Environmental sociology examines specifically the role of the society in relation to environment and puts emphasis on the views of the society on issues like global climate change.

There are various human activities that cause global warming, like use of transports that get power through fossil fuel; burning of such fuels releases pollutants like carbon, raises temperature of the earth and hampers air and water quality. Rapid, unregulated industrialisation accompanied by unplanned urbanisation, deforestation, livestock production, commercial farming, overuse of electricity, etc. are all handiworks of humans in civilised societies. Whenever the state of environment is examined, these activities of men should be assessed and evaluated in an honest manner.

d) Search for a Sustainable Solution for Environmental Problems.

Environmental Sociology explores the roads to permanently salvage the damages caused to the environment due to various factors. It also tries to understand the measures for maintaining sustainable environment. Sustainable development means development that allows all future generations to have a potential average quality of life as high as being enjoyed by the present generation. The concept of sustainable development was developed by the United Nations Conference on Environment and

Development (UNCED) by defining it as "Development that meets the need of the present generation without compromising the ability of the future generation to meet their own needs."(1992, Rio de Janeiro). By adopting the principles of sustainable development environmental sociology tries to create a roadmap for regenerating a healthy natural environment.

The new millennium has extended the discipline's horizon by adding some more areas to the subject; these are the problems of global climatic change, use of fossil fuel and nuclear power, problems of poverty, inequality, deprivation and exploitation, etc. Some important theories have also been included within its subject matter. Let us discuss the matters one by one.

e) Global Climatic Change

The whole world today is quite apprehensive about the grim prospect of global climatic change. This problem is intricately associated with several serious political and economic issues covering the whole world. Environment experts have noticed that the impacts of human interventions like warfare, political turmoil at national and international level causing floods, famines, droughts etc. remain at play behind climatic changes. It is a proved scientific fact today that global warming is nothing but the inevitable outcome of large scale deforestation for the purpose of industrialisation over a prolonged period of time. Environmental sociology covers all small and large areas affected by such problems; examines the regular occurrences of joblessness, poverty, hunger and displacement triggered by climatic changes caused by human intervention. Political crises like civil war may also break out, as we often have witnessed in many countries of Africa.

f) Use of Fossil Fuel

Fossil fuels are sources of severe damages to the environment and such damages had started to take place since the prehistoric ages when people used to live inside caves and had to depend on fire to drive away wild animals. At that time less environmental damages had occurred because the earth used to be inhabited by very few people. With rapid increase in population and industrial activities since the industrial revolution in Europe, fossil fuel turned into a great natural resource destroyer causing damage to both human and natural health. Environmental sociology explores the relationship between fossil fuel and human society vigorously.

g) Nuclear Power Disaster

Nuclear power has become a great source of energy for modern industries , at the same time this also may cause large scale devastation to the environment. The explosions in nuclear plants at Chernobyle (Ukraine, April, 1996) and Fukushima (Japan, March, 2011) are important indicators of that danger.The whole world has become aware of the possibilities of such disasters since the 1970s.

h) Environment and Social Problems

Environmental sociology also acknowledges the fact that the problems of poverty, inequality, deprivation and exploitation are closely linked with the issues of ecology and environment. Throughout the world the deprived, marginalised sections, especially the ethnic communities have to bear the brunt of poor environmental conditions ; women, more than men, become the victims of environmental crises. The American Sociological Association has once pointed out that the inclusion of analysis of inequality and deprivation in environmental sociology indicates how much importance is allocated to the study of social inequality in sociology itself.

i) Environmental Theories

Apart from all these, environmental sociology also includes a good number of theories to examine and explain the issues it deals with; these are theories like critical theory, eco-feminism, ecological modernisation, political ecology, cultural sociology, environmental justice, post-colonial studies, risk theory etc. It also has several approaches like eco-Marxism, neo-Malthusianism, ecological modernisation and reform, cultural -environmental sociology, realism and the social constructivism.

Environmental sociology examines both environmental and social processes, incorporates theoretical and practical considerations. Thus, it goes beyond traditional sociological research by entailing indepth understanding of the environment and also by adhering to its empirical measurements and theoretical conceptualisation. As a branch of sociology it focuses on the relationship between societal well-being and environmental quality. In the 1970s ,it came to be dominated by the study of the green movement, energy issues, disaster risks, public attitude towards environment, environmental policies and environmental quality as a social issue. It looks into the human causes and social determinants of environmental pollution, natural resource depletion, inequitable social distribution, vulnerability of disadvantaged populations and their chances of survival during the time of natural disasters, public sentiments regarding environmental issues and policies and the impact of green movements over these issues.

j) Politics, Law and Public Policy

Politics, law, public policies and their relationship to environmental conditions and problems are areas that have attracted the attention of environmental sociologists. They examine these areas to understand the extent to which and through what mechanism laws regarding emissions and pollutions are enforced and how people collectively react to them, the stand the government and other agencies of power might take towards environment, pollution, displacement and many other related issues.

1.6 Conclusion

The progression of civilisation, technological advancement and the march of industrialisation – all have forced major ruination of natural environment; escalation of such damages have given birth to man's urge for the protection of ecology and environment. Advancement of civilisation has led to the increase in environmental pollution and industrial revolution has ignited the scale of environmental destruction in the name of rapid and large scale industrial development.Though the natural world has experienced multiple levels of destruction of ecology and environment like depletion of ozone layer, soil erosion, air pollution, deforestation, ecological imbalance, water pollution and many other related problems for the past two hundred years , there was not much consciousness regarding their long term impact. The natural world has experienced too much toxic elements firstly due to the wars including the two world wars, and secondly due to the unrestrained growth of modern industry in all corners of the globe. Use of strong chemical pesticides and insecticides, uncontrolled use of plastic, rapid deforestation, overcrowding of the earth and many such hazards have endangered both the human and the natural world. If such activities continue without restraint, the future of the earth and life on it will perish, for sure. Environmental sociology not only tries to understand the immediate problems but also tries to build awareness regarding the problems that may erupt in future; it also tries to find a way out for the human world.

Though environmental sociology ,as a sub-area of sociology first earned popularity in the more advanced America and several European countries, since the 1990s it also became popular in other corners of the globe like in Japan, Korea, India. In India there already was a tradition of concerns with environment in the writings of Rabindranath Tagore, Mahatma Gandhi and Radha Kamal Mukhopadhyay. Unfortunately, no sociology of environment emerged from this though in developing countries like India environmental degradation under the impact of colonial rule, industrialization , unplanned urban growth, role of environment movements, gender inequality, steady depletion of natural resources remain integrated, hence need equal attention.

1.7 Summary

The term 'environmental sociology' was used by Samuel Klausner in 1971 for the first time in his book ‘One Man and His Environment’. The first words of caution were uttered by Rachel Carson in 1962 when she narrated how excessive use of chemical pesticides in agriculture was harming the ecology in her book ‘Silent Spring’. Since then, like experts from other fields, sociologists, too, started to present their

observations on ecology and environment with reference to human society.

One of the early environmental sociologists was William Catton who made extensive research on the problems of population density and increasing use of fossil fuel in 1972. By 1980 his path-breaking book 'Overshoot: The Ecological Basis of Revolutionary Social Change' was published.

The main objectives of environmental sociology also include discussion and understanding of problems affecting natural environment and their solutions, human ecology, sustainable development, conflicts over environmental issues, ecological modernisation, treadmill of production, risk society, environmental laws and policies, etc. This sub-area of sociology studies both social and environmental problems that are interrelated; for this, it wants to understand the environmental implications of behaviours like waste disposal and recycling. Another objective of its area of inquiry is to examine the environmental conditions that affect everyday lives, economic livelihood and public health of populations.

1.8 Model Questions

All Queations are 5 Marks each.

i) What is environmental sociology?

ii) Why has environmental sociology developed only in the second half of the last century?

iii) What is meant by research and theory building in environmental sociology?

All Queations are 10 Marks each.

i) Discuss the emergence of environmental sociology in the west.

ii) Discuss the meaning of environmental sociology and give a denition.

iii) Examine the nature and scope of environmental sociology.

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UNIT–2 : THE REALIST-CONSTRUCTIVIST DEBATE

Structure

2.0 Objectives

2.1 Introduction

2.2 Why Debate?

2.2.1 Approaches to Environmental Sociology

2.2.2. Realist Theory in Environmental Sociology

2.2.3 Meaning of Social Constructivism

2.2.3.1 Essense of the Theory

2.2.3.2 Radical Constructionism versus Moderate Constructionism

2.2.3.2 Science and the Constructionism of Environmental Problems

2.3 The Debate between the Realist and Constructivist Approach

2.4 Conclusion

2.5 Summary

2.6 Model Questions

2.7 Suggested Readings/References

2.0 Objectives

This Unit will help the learners to understand

- The differences between the two dominating approaches of environmental sociology.
- The moot point of debate over the state of global environment.

2.1 Introduction

Learners have already acquired some primary ideas about the subdiscipline of environmental sociology and its two approaches with contrasting views about exploring environmental problems. These two approaches, namely the realist and the constructivist (also known as constructionist) approaches present two completely different notions

regarding environment. The realist approach, the older of the two approaches, has its roots in the writings of ancient Greek scholar Thucydides, Machiavelli of the medieval period , and of Hobbes and Rousseau of England and France respectively; but it has been formally nurtured in the 1940s by thinkers like Reinold Neibuhr, Hans J. Morgenthau, Kenneth Waltz and Robert Gilpin. They argue that the international system is composed of equally sovereign, independent states and there is no authority superior to them. As all the states are always guided by their own self-interests amidst cut-throat competition over power and supremacy, the threat of war always looms large. For the protection of their own interests the states are required to remain ever vigilant and upgrade their military capabilities to deter and defeat potential adversaries. International cooperation, under such circumstances, remain fragile and transitory. The main concern of the states become relative benefits or benefits greater than what others can get. This stand of traditional political realism fails to address the global environmental crisis which requires long-term sustenance of healthy ecology based on peaceful cooperation of states. However, environmental realism has shifted its stance and does not dwell on the anarchy of the nation-states but on scientific evidence of the grievous damage to the biosphere caused by the human inhabitants of the earth. The ecological realists assume that the earth needs a healthy biosphere for getting innumerable, invaluable 'ecosystem services'. Traditional political realism suggests that the prospect for drastic improvement in natural resources, arresting climate change , biodiversity loss and ocean degradation is remote because states prioritise their national interests, independence and power more than anything else. Ecological realists, on the other hand, focus on the cooperation and coordination between states for survival. The realist -constructionist debate in environmental sociology is characterised by the differences between materialist versus idealist explanations of social life. While the realists sound the alarm bell for the impending global ecological devastation, the constructionists do not believe in the existence of any serious environmental problem; they assume that all the concerns over environment and its decay have, in fact, been constructed by alarmists only without looking at the realities of the situation.

Realism is based on the perception of a world, full of sovereign states, each competing with the others for the fulfilment of their narrow national interests in terms of economic and military gain. Therefore, realists like Frederick Schuman stated that ‘‘all politics is a struggle for power’’ Hans J. Mogenthau has once claimed (1948) that the desire to dominate is a part of human nature; for this, stronger nations dominate and weaker states surrender. As , according to the realists, states are not necessarily predisposed to cooperate and look for relative gains in all their interactions with other states, climate negotiations often fail. The constructivist perspective covers the interplay of the elements of agency and structure within global climate change politics. This

perspective is, to some extent, shaped by the domestic political context and also by the actual negotiating process on climate change issues. The dominance of the realist approach has been challenged by social constructivism. While realists believe that because of constant competition amongst nations over power and dominance states should rely on self-help, constructivists believe that national security should be envisioned as food security, human rights and cleaner environment.

Regarding social constructionism(or constructivism, as it is also known) there exists some confusion over its definition, application and value with respect to environment despite the existence of some scholarly pieces of writing on the subject. The constructivist perspective recognises that knowledge cannot be divorced from social experience, that there are multiple realities and that it is necessary to understand the plurality of ideational constructions and how these are related to different stakeholders' groups, their interests as well as the influence of power relations. In short, this approach looks into a particular environmental issues that has a certain social, political and economic impetus; its concern is the influence of these fields and their relevant actors on the construction of a certain 'environmental claim' as an actual problem.

Constructivism argues that the material and ideational are completely interwoven and interdependent; whereas realism gives primacy to material factors. In the opinion of constructivists the nature of any structure is sociallydefined and has intersubjective meanings. Keeping this point in view Adler (1997) has said that human agencies create a social context in which the meaning of structure is continuously defined and redefined.

2.2 Why Debate?

The relative merits of realist versus social constructivist approaches for studying environmental issues have become topics for a heated debate. Many believe that the scholars of both the approaches are capable of having a stand-up row over this issue.

The stand of traditional political realism fails to address the global environmental crisis which requires long-term sustenance of healthy ecology. It cannot be denied that healthy ecology requires a healthy biosphere for getting innumerable, invaluable ecosystem services; at the same time, traditional political realism suggests that the prospect for drastic improvement in natural resources, arresting climate change, biodiversity loss and ocean degradation is remote because states put their national interests , independence and power first. Cooperation and coordination between states can only be possible when there looms serious threats to survival or gaining more power for the states. For example, in 2015, under the leadership of President Barrack

Obama, the USA adopted a pioneering role in creating international cooperation to prevent further environmental damage. Social constructionists , however, view the world and its environment from an altogether different point. They believe that issues that are accepted as normal or natural in society are, in fact, socially constructed. Therefore, the perception of environmental doom is also a mental construct and do not always project a true to life picture. This difference in perception has prepared the ground for debate.

The term social constructionism covers a variety of distinct approaches. One of them questions the goal of contributing to the management of environmental problems by refraining from making political or moral claims and acceptance . Realists , however, believe this is nothing short of political quietism. Constructivists are of the opinion that taking a step back from environmental disputes does not imply irrelevance.

2.2.1 Approaches to Environmental Sociology

There are basically three approaches to Environmental Sociology-

1. The constructionist approach: It argues that there is no one 'reality' of environmental problems. Different people have their own differently constructed and equally valid interpretations of the environment. In this view social and other realities do not exist independently of the meanings people create about them. Applied to environmental issues, this approach maintains that “there is no singular 'nature' as such, only a diversity of contested natures; and that each such nature is constituted through a variety of socio-cultural processes from which such natures cannot be plausibly separated". So sociologists should investigate how the environment is understood by different sections of the population, how environmental issues are constituted as social problems and how people respond to these discourses on environmental trouble. It is hard to deny the force of the constructivist claim that our understanding of environmental problems is constructed in specific social contexts. So they admit that society influences the way we look at the natural world but they insist that there is a reality out there(8).

2. The reformist approach: It aims to make small reforms to the economic and political structures of current society to deal with environmental problems. A much-read book with this approach is 'Natural Capitalism'. Within this approach markets are the main means to distribute products-products are bought and sold for money. According to Hawken and colleagues, "Natural capitalism does not aim to discard market economics". Instead what is necessary is the steering of markets 'in more creative and constructive directions'. Other aspects of the capitalist economy such as money, private ownership of the means of production (factories and farms, and so on)

and wage labour are also retained.““In the reformist model economic growth continues. It is argued that this can take place at the same time as environmental damage is cut back. For example, according to Hawken et al., "even if the global economy expanded by 6- to 8-fold, the rate of releasing carbon by burning fossil fuel could simultaneously decrease". In fact, new environmental technology is a growth industry in this account and stimulates growth "reducing the economy's dependence on fossil fuels can be seen as an investment and job creation opportunity". Environmental reforms come about because people lobby politicians for changes with the threat of voters turning away from parties that do not enact environmental reforms. Markets "demand responsible citizenship to keep them functioning properly". This is what is expected to take place in rich countries; proponents of the reformist model never consider how the model could possibly work in poor and undemocratic countries. Environmental reforms also come about partly through lifestyle changes by ordinary citizens who make different market decisions. But a central aspect of change is various kinds of government intervention-for example, regulations to prevent environmentally damaging practices, taxes such as a carbon tax on the use of fossil fuels, incentives and subsidies for new technologies such as solar hot water services or wind power, and international agreements like the Kyoto Protocol designed to get countries to agree to environmental reforms. One idea is to replace all taxation based on income with environmental taxes-governments would be totally funded by taxes on harmful environmental activities. According to the reformist account, all these environmental reforms benefit the economy, first, because energy efficiency is cheaper; you are not wasting money on energy you don't need. Second, environmental reforms create new industries and new jobs-, for example new energy infrastructure such as wind energy plants or energy-efficient double- glazed windows.(9)

3. The realist approach: They are of the opinion that the problems of the environment are quite real. Inevitably, social scientists will follow the lead of the natural sciences in identifying the problems. The task of sociology is to explain the social causes of environmental problems. Also, what social alternatives could produce a better environmental outcome? In this approach, sociologists are in the same boat as most other commentators on environmental problems. Academics in many disciplines-for example, environmental scientists, economists, and psychologists-argue about what the problems are and what can be done. If sociology has anything special to offer, it is a deeper and more systematic understanding of the social roots of environmental problems and the processes of social change. (10)

The realist approach comprehends "risks" as objective elements of interaction between nature and society. It explains the “increase of environmental and technological

risks" through the intensification and extensiveness of nature's utilisation. According to Dunlap-one representative of this approach, who has been selected here in order to exemplify some crucial points while reporting and considering his theses-the environment has to fulfill three essential functions for society, namely a to provide it with resources ('supply-depot'), b) to absorb its refuse ('waste-repository') and c to serve as 'living-space' and habitat of man. If now an environment is used by one function, the other two are impaired. Given this setting there emerges a twofold 'Gestalt' of human societies' ecological problematic. As a social effect of this interaction utilization competition and usufructuary conflicts ensue. The ecological systems-on the other side of the coin-are affected by pressures, which in the extreme disrupt their capacity to regenerate. If during the progression of industrialisation the ecosystem 'Earth' is increasingly utilized, the following ensues:

- The three utilisation circles overlap more and more and an aggravation of negative interactions among them ensues.
- The simultaneous expansion of all three functions leads to a transgression of the global carrying capacity or the environment's 'ability to withstand' the stress.

This problem will remain incomprehensible, if it is understood reclusively in the framework of the 'construction of social problems' as a genuine phenomenon of social cognition and communication. The growing social attention towards environmental and technological risks is therefore in essence a responsive reaction to their actual increase.

2.2.2 Realist Theory in Environmental Sociology

The realist approach comprehends "risks" as objective elements of interaction between nature and society. It explains the "increase of environmental and technological risks" through the intensification and extensiveness of nature's utilization. According to Dunlap [50] - one representative of this approach, who has been selected here in order to exemplify some crucial points while reporting and considering his theses the environment has to fulfill three essential functions for society, namely a) to provide it with resources ("supply-depot"), b) to absorb its refuse ("waste-repository") and c) to serve as "living-space" and habitat of man. If now an environment is used by one function, the other two are impaired. Given this setting there emerges a twofold "Gestalt" of human societies' ecological problematic. As a social effect of this interaction utilization competition and usufructuary conflicts ensue. The ecological systems on the other side of the coin are affected by pressures, which in the extreme disrupt their capacity to regenerate (15).““All realist theories, irrespective of the sub strand, view international relations as composed of states existing in anarchy. A state's main

concern is to ensure its own survival within the system. This realist security paradigm is the traditional agenda of states. However, the threat of climate change is part of a new agenda of international politics and security threats. The effects of climate change do not discriminate between state borders, and if allowed to continue at the present increased rate, will inflict severe environmental catastrophes on people across the globe. This is not a typical threat confronting states. Thus improved military capabilities will not render states secure from climate change, although these may assist in responding to emergency situations caused by severe floods or storms, for example. Realists claim that states will seek to gain power at the expense of other states, and that self-interest is the most prudent foreign policy. However, it is impossible to ignore the multilateral environmental agreements, protocols and domestic environmental legislation, as well as the growth of international environmental organisations and institutions, in bringing together states to cooperate against climate change. During Chinese President Xi Jinping's recent visit to the United States, he and his American counterpart issued a joint statement on climate change with "new domestic policy commitments and a common vision for an ambitious global climate agreement in Paris". The US Clean Power Plan will aim to "reduce emissions in the US power sector by 32% by 2030". Beijing has just announced its "plans to launch in 2017 a national emission trading system covering power generation, steel, cement, and carbon sources in the electric grid".“Offensive realism argues that one of the inevitable outcomes of states existing in a self-dependent and anarchic world is the "tragedy of the commons", a term coined by the American ecologist Garrett Hardin. The global commons are "areas and resources that do not fall under sovereign jurisdiction" such as the high seas, deep ocean floor and global atmosphere".

According to an offensive realist approach to climate change, when you combine the fact that states seek to gain power at the expense of other states, with the knowledge that an infinite amount of resources are available around the globe, you are left with a world where states will use up as much easy and cheap energy as possible (for example, oil, gas, and coal) to maximise their gains. Rather than coopering to protect the planet and to avoid potential catastrophic climate change, states will seek to maximise their energy security at the expense of other states and the environment. The tragedy of the global commons is the outcome. Thus, climate change issues are condemned "to the periphery of international relations". An offensive realist approach suggests that in a world where all states are seeking to become more powerful and secure than their rivals, climate change would be viewed as an external factor that could allow for the gap between secure states and insecure states to widen. As the stronger and richer states better secure themselves, the weaker and poorer states are

left more vulnerable. Heywood highlights an important reason why realists, especially offensive realists, will argue for states to continue plunging the earth's fossil fuel resources. According to Heywood, the reason why states prize energy from oil and gas, for example, so highly is that it furnishes them "with a means of gaining from, and exercising influence over other countries". Offensive realists view a state's ability to exert influence over other states and regions as a key strategy in increasing its own power and security.““Defensive realism, in particular, Stephen Walt's Balance of Threat theory, however, offers an angle that in fact urges states to take the climate change threat seriously, and to act to mitigate it. Walt's theory of balancing describes two different state behaviours: firstly, when states form alliances to collectively balance against a threat, and secondly, when states align themselves with the threat (for example, a great power) in order to increase their security in the system. As Robert Kaplan argues, the changing of the earth's climate is "the national security issue of the early twenty-first century". That is, climate change arguably is the greatest threat to states today. Writing from a geo-political perspective, Kaplan asserts that the "political and strategical impact of surging populations, spreading disease, deforestation and soil erosion, water depletion, air pollution and, possibly, rising sea levels in critical, overcrowded regions such as the Nile Delta and Bangladesh-developments that will prompt mass migrations and, in turn, incite group conflicts-will be the core foreign policy challenge". The climate change threat is real, and as any realist foreign policy dictates, every potential threat must be taken seriously and reduced. Whilst realists contend that the international system of states is constant, Kaplan has warned that climate change has the potential to change the state system, thus altering the conduct of power politics. It is here that Walt's first state behaviour can help discern a realist approach to climate change. Facing the external threat of climate change, which does not discriminate between states and their borders, will prompt states to align themselves to collectively balance against this danger. Whilst this may involve some degree of interstate cooperation, something of which all realists are skeptical, the danger posed by the climate change threat will outweigh concerns of cooperation. For example, even though the regularities of the Kyoto Protocol were not ratified by countries who has 55% of global emission, but it did provided platform for the states to come together on a single issue of world importance. Stephen Walt argue that such alliances were usually narrow and short-lived, lasting until the threat-whether it is a Napoleonic France or the Islamic State of Iraq and al- Sham. It is politics of a two-way relation of politics between Environment and State politics.

2.2.3 Meaning of Social Constructivism

Social constructivist approach in environmental sociology has emerged from a

sociological tradition that argues that society is not a real thing, it is socially constructed. Applied to the understanding of environment, it maintains that there is no one single 'nature', but a diversity of contested natures, each composed of a variety of socio-cultural processes. With time this approach became institutionalised and then internalised as more cultural and interpretative orientations started to enter the field. A good number of European scholars were of the opinion that claims about environmental conditions and problems are not only socially constructed but also these are subjects of societal conflict. They have further argued that as there is no reason for privileging the claims of one party over the others, the multiplicity of reality should be accepted. With this support the constructivist approach has thrown a challenge to the traditionally popular objectivist/ realist interpretation of nature. While the realist approach views the environment as a biophysical entity that persists independent of human society; the social constructivist approach accepts that the existence of nature depends on its various coexisting interpretations. It also specifies the uncertainties that surround the issues related to global environmental change and other associated issues. In spite of facing many criticisms from the Realist thinkers, Constructivists have often spoken about the positive aspects of their own approach. In the opinion of John Hannigan (Environmental Sociology, 1995) the social construction of environmental issues and problems revolves around the belief that important social actors like scientists, industrialists, politicians, civil servants, journalists and environmental activists endorse certain claims successfully and on the basis of those claims perceptions about the environment's reality are formed.

Social constructionism started to enter into sociological discources when the process of claims making became more important than the task of determining the validity of claims. The approach created a stir among the scholars of the early-970s when it was applied first to understand the issues related to social problems and then to all other areas of sociology in general. By 1989 it was noted by some scholars that constructivism can be helpful both as a theoretical approach and an analytical tool. For example, from a social constructionist point there are three primary points to encounter: the claims regarding problems, the claim-makers or people who establish their claims and the process through which claims are raised. The principle of constructionism has primarily emerged as a challenge to conventional international relations scholarship and later it entered the critical sphere of environmental sociology. Going against the realist and neo-realist emphasis on the role of the principal actors-the national gov governments in international relations, constructivism shows how global climate politics is influenced. Hoffman has shown, in the context of America, (2012) that climate change is not only an environmental issue, it has deep political undertones and involvement of political

ideologies too. For this reason, concern over climate change and/or environmental crises has become more about political affiliation at the cost of scientific knowledge as there is a significant tendency to ignore the scientific causes behind climatic change and express bias in favour of certain ideologies. Not only isolated climate advocates, national governments, too, being swayed by certain ideologies, adopt policies, tweak laws and prepare short and long term programs to regulate climate and environmental changes. Thus, the constructivist perspective of environmental sociology discusses the elements of agency and structure on one hand, and their roles in the global climate change politics, on the other. The main thing regarding environmental issues is how these are perceived because the perception depends, to some extent, on the domestic political scenario of a country. That determines what can be held as progress or development. A large section of contemporary thinkers believe that anthropogenic causes are largely responsible for environmental degradation. For this reason, human, social and economic relations are believed to play important roles in the environmental field.““It has been noted often that the same environmental issue may generate varied responses from different sections of the society depending on the political and ideological stand of the actors. The same event may be framed as a serious issue or a non-issue in different contexts. For example, in the case of a nuclear accident at the nuclear power ¦plant at Chernobyl in 1986, different social, institutional, economic and political agencies handled the matter in different ways. For example, in Germany and Italy, influential actors emphasised the uncertainties and demanded precautionary action; but in France those same uncertainties were either downplayed were had used to criticise the countermeasures adapted in other countries. Thus, the Chernobyl fallout proved to be a social construct as well as an actual dramatic event.

2.2.3.1 Essence of the Theory

The emergence of the primary notions about social construction of real-life situation began when, in the early 1960s, certain dissatisfaction over the manner science was being conducted in higher research institutions was raging the academic world. The more traditionalists were treating science as an objective pursuit of knowledge with the belief that it should strictly adhere to the scientific method for acquiring positive, objective knowledge of the real world. With this kind of arguments one could count only physical and natural sciences as objective, factual and therefore, true sciences. However, criticisms evolving from a number of sources against the dominant understanding of science started to appear in the 1960s. Scientists, historians, philosophers and scholars from other disciplines had, by then, expressed doubts regarding the possibility of attaining objectivity in the perception and interpretation of reality. Thomas Kuhn, a very popular historian of science in the 1960s, was of the opinion that scientists observe reality with the help of their own world views. Their

scientific perceptions help them construct their own 'reality' even though that remains far removed from the actual reality. Sociologists, with their long association with the notion of reality have come up with the idea that reality is different for each, person and for that reason social construction of reality takes place. That happens because every person's life experiences are different, impacting each person's visions, thought processes and interactions with others in different ways. The process of socialisation or how one is raised determines how one perceives others and presents oneself in public. That means, one's perception of reality is shaped by one's presentation of self-perception of others along with one's image in the eyes of others. Kuhn has aptly summed up the situation by saying that scientists, being humans, are guided by their own personal world views to construct their own images of reality; this lessens the chances of reckoning one üniform or universal reality - the reality that is acceptable to all. Furthermore, the scientists are trained to see the reality in a particular, consciously assumed manner. For this, the critics have often argued that there can be no science without human interpretation of the reality.“By the 1960s the till then existing methods of science came under heavy criticism and several soft or social sciences became recognised as ideological and non-scientific, hence less helpful to understand the real world. It has also been suggested that science actually depends on some social consensus among scientists over the nature of reality. Out of all these criticisms it was clearly established that science with all its theories and practices is nothing but a social construction; and there can be no science without human interpretation of reality. It should be remembered that not all environmental problems attract the same public reaction; some assessed as minor may remain out of public attention and clandestinely may increase in severity. But some other specially the ones known as the new 'global environmental problems' like bio-diversity loss, global warming, ozone depletion, acid rain, tropical deforestation may acquire serious international attention despite having conflicting scientific evidence to support them. Which issue will be recognised at the national and or international level and which one will not, despite having propensity to more serious danger, rests primarily upon the claim-making activities of issue-entrepreneurs in science, mass media and politics. It also depends a lot on the cross-cultural influences. Having said all these, it should also be remembered that besides human constructions nature retains certain autonomy.

From the above discussions learners can understand how and when positivist concepts have been challenged in the field of science and it took some more years for the challenge to impact the field of environmental sociology. In the 1980s when post modernism attained popularity, a trend among sociologists to treat environmental claims as a form of social construction had started to emerge. One of the most prominent advocates of this view is John A. Hannigan. Social Construction of

environmental reality during that period followed two distinctly different versions known as 'soft constructionism' and 'hard constructionism'. Soft or moderate constructionism holds that environmental problems are real but they require social construction for being noticed. On the other hand, the supporters of 'hard or radical' constructionism argue that the environmental problems are social constructs in their entirety. The constructivists argue that the concept of nature is constructed socially through language and culture; one cannot know nature by itself, but only through the lens of society people come to understand it.

Many argue that the social constructivist account of nature is rooted in the Marxist sociology of knowledge; it has also been nurtured by scholars like Peter Burger and Thomas Luckman who have examined the hows and whys of social construction of reality. Constructivists seek to understand how preferences are formed and knowledge is generated; however, they do not emphasise misperception, cognitive or emotional biases that distort rationality.

The origin of social constructionism lies in the belief that reality can never be realised objectively; it can only be learnt through observation and experience of social categories. Individual's own observation, classification and experience of reality give it such a unique quality that it appears to be a social creation. However, rather than one single reality, there exist multiple realities-each subjected to different cultural or linguistic influences. The positivists have failed to understand reality from this angle.

As reality is a social construction, nature is another one because, being intimately connected with the different nuances of the human world, nature manifests itself in myriad ways. Therefore, there cannot be one single universal nature, it holds different meanings based on different contexts of culture, social positions and historical moments. The different socio-cultural processes exist side by side, so do the different versions of nature. From this brief discussion it can be understood that nature cannot have any single fixed meaning because there is no fixed reality. The idea is, truth is not found, but it is made and making truth means exercising power.

Social constructivist analysis of environment and nature is the product of multiple intellectual influences and each influence has its own merit. In the 19th century, when Darwinism became quite popular and everything was being explained in terms of biological thinking, early sociologists had drawn two conclusions about firstly, the separation of the social from the natural; and secondly, about man's distinct identity beyond the simple sum total of the nature's features. But in the discipline of Geography, the original environmental science, environmental issues are always combining social and natural phenomena, and neither is free from the other in origin or substance.

2.2.3.2 Radical Constructionism versus Moderate Constructionism

As it has already been pointed out social constructionism can be of two types-hard or radical type and soft or moderate type.

a) Radical Type of Social Constructionism: The radical type of social constructionism does not accept the independent existence of a natural world. It holds that natural world exists only within the social discourse as being socially set up it cannot have any external existence. It can be understood only through language with which we express and exchange our ideas of nature. Thus, radical constructionists believe that to understand nature we must know its socially constructed form/s.

b) Moderate/Soft constructionism: Moderate or soft constructionism does not put emphasis on the social and historical context of the natural world though it is true that we can know the natural world only through several social mediations and cultural filters. There can never be any universal nature, but only disparate constructions of it. We build up our own ideas on what we designate as nature. The object remains real, but its knowledge gets constructed.“Environmental issues and problems are not merely constructed by scholars and experts, media too plays conflicting role by either supporting or rejecting the technological progresses, fabricating stories and endowing issues and events with symbolic meaning.““In the past, the events, be it related to nature, politics, wars and discoveries, or anything else, used to be verifiable and were thought to have a more or less truthful existence beyond the newsroom. But in the 1970s a new model replaced this older one and transformed the whole process by conceptualising news as a 'constructed reality'. News making now became a collaborative effort in which journalists and their sources work in tandem.Environment, today, with its multiple ideologies and political movements, has emerged as a political subject. Modern environmentalism has given birth to many views that add upto the global environmentál political agenda. The government and policy-makers all over the world are motivated and guided by one or the other of these concepts. Being parts of regional and global politics, environmental issues have grabbed the attention of both print and visual media increasingly in the last fifty years.““Construction of news is generally influenced by cultural or political factors; aided by organisational routines of the newsroom itself. Presentation of news is not caused by any accident, it is created with careful attention to build order and predictability among the chaotic combination of unrelated events or issues. These news items are mostly routine, yet crucial in meeting deadlines and story quotas. To make these items more attractive and attention-grabbing 'news angles' are used; the additions of these angles determines the 'spin' that makes a story interesting enough for wide media coverage. Environmental issues have emerged as the play fields for media-constructed angles and spins.

Schoenfeld et al. have pointed out that prior to 1969 environmentalism as such was not treated as worthy of any news value; it used to be discussed only with reference to conservation which was quite well known to all since the 1880s in the USA. In Britain certain environmental issues were quite well known like preservation of countryside, the national heritage and the protection of flora and fauna of the country but many of the contemporary environmental problems, such as, air pollution, oil spills etc. were not known to many till late 1960s-early 1970s period. Only after that period environmental issues turned into major news categories and the process of news-making of environmental issues started in full swing. Three major types of environmental events started to draw everyone's attention; these included mile stone events like the Earth day, the Rio Summit etc., catastrophes like oil spills, nuclear accidents, toxic fires, etc. and legal-administrative occurrences like parliamentary hearings, trials of environment related cases, release of environmental white papers etc.““Mile stone events are often marked by the presence of celebrities and symbolism. The Earth Summit at Rio de Janeiro in Brazil in 1992 and the 2005 Summit of G8 leaders in Scotland were attended by prominent global political leaders, thousands of NGO representatives, celebrity actors, musicians and media barons. Both the summits offered ample scope to highlight environmental ideological issues. It was only natural that media interests too would be centered around those issues.

Catastrophes offer the media its means to sustain; these are also the prime attractions of environmental news coverage. Natural catastrophes and their devastating after-effects seem to be more newsworthy because these also involve many human interest stories of courage, self-sacrifice and resilience. On the other hand, the more serious slow-onset environmental hazards like ozone depletion, acid rain etc. require better packaging as the most recent outcomes of an event and not as an inevitable outcome of a series of societal and political decisions (Hannigan). This proves that to be presentable and attractive for the common people a piece of information should be selected and constructed carefully. Often there occurs a tension between objective analysis of risk and image-building for the media; as a consequence, some media accounts of environmental problems are ignored and soon forgotten while some others earn applauds and acceptance. Event-centered news coverage has the capacity to build public awareness over some crucial yet much ignored environmental topics while it has some disadvantages as well. Media tends to focus on some events without relating it to the proper political and social developmental contexts and this may give the news consumers some wrong ideas about the role of individuals or corporations behind resource depletion and pollution. Media may also be reluctant about exposing the damaging roles of powerful institutional actors as contributors to environmental problems. Even when the intention of the media is honest they may face difficulties

in publishing an honest story about the existing environmental conditions and other issues like economic recession may steal the limelight. Schoenfeld (1980) mentions that categorisation of an environmental story is not easy as the classic environmental story may be labelled as nothing less than 'business-medical-scientific-economic-political-social-pollution story'. For this editors and producers often get confused over environmental issues. Claim makers should know how to keep environmental stories fresh and compelling.For good marketing of any contemporary event or problem, media can unduly highlight the not so imponant aspect or may ignore a significant part of the issue. This kind of misrepresentation of environmental information has become a regular occurrence nowadays. Media or the business press in particular often presents the environment as an economic opportunity by indicating that environmental adversity can be turned into a profit with human. perseverance and ingenuity.

2.2.3.3 Science and the Construction of Environmental Problems

Science always searches for the truth and so any conclusion arrived at after gruelling, in-depth scientific research are taken as valid. Claims based on such valid conclusions are accepted as the only truth of the matter. Most of the environmental issues and caims are backed by scientific research and are prioritised over most other social problems. Scientific researchers often encounter incredible claims made by other scientific research findings. These claims may be of two kinds-cognitive claims and interpretative claims. Cognitive claims are made to convert scientific observations, hypotheses and theories into factual knowledge by involving novel scientific claims within an established research tradition. But interpretative claims are made to find the greater significance for non- specialist common public and the content of the claim suggests what they should do. Hannigan has clarified the point with an example based on the claim of global warming. There is a cognitive claim that emissions from sources like cars, factories, power plants, etc. are creating greenhouse effect that will lead to significant temperature rise over the next several decades. Responding to that the interpretative claim states that so much global warming will drastically impact the earth by flooding many low-lying countries like the Netherlands on one hand, and by bringing draught to crop-rich areas like American Midwest on the other. When Hurricane Katrina struck New Orleons and the Gulf coast, this claim seemed to be true.

Scientists also routinely construct 'Ignorance Claims' by citing gaps in available scientific knowledge. This happens either in the hope of getting research funding from the appropriate authority or to reject any recent data or fact claim by citing insufficiency of proof. Aronson has spoken of three types of claims: technical, cultural and social problem interpretative claims.

Technical Interpretative Claims: Such claims are usually made when scientific advisers to industry and administration assess the risks involved in the use of controversial technologies similar to genetic engineering, nuclear power etc. and toxic pollutants like mercury or global hazards of the stature of ozone depletion, global warming, etc. While making assessment of risks, scientists infuse their own political agendas and knowledge claims, preferred ideologies and moral standards into their suggestions and recommendations by going against the notion that such recommendations should remain politically neutral.

Cultural Interpretative Claims: This type of claim is presented through public““speeches, popular science journals and other publications and influential newspaper articles for garnering ideological support in favour of scientific research.

Social Problem Interpretative Claims: Scientists may claim scientific speciality for solving a social problem. Such claims are usually made under three specific conditions like (a) when a new discipline requires research funding and political support for its field; (b) when scientists try to show the importance of their research work in solving recognised and unrecognised social problems, for example, in cancerre search in the 1970s and AIDS research in the 1980s. (c) Scientific claim making also occurs when social movements restrict scientific research and scientists become compelled to explain and justify the utility of their research.

Environmental problems are often constructed scientifically when science fails to ensure absolute safety for the environment. Scientists then try to create a buzz around some supposedly high-risk situation and the urgent need to protect the society from that imminent danger. While green activists strongly feel that early human intervention is the need of the day for protection from future environmental doom, scientists with decades long experience in the field reject those precautionary notions on the ground that those are based on wrong approach guided by administrative and political matters.

Though all parties present their arguments built on scientific evidence, environmentalists, scientists, regulators and legal experts disagree over what constitutes solid evidence.

2.3 The Debate between the Realist and the Constructivist Approach.

As it appears from the above discussionm the realist and the constructivist approaches have two completely opposite outlooks to environment and its protection leading to a debate over the perception of the problems concerning environment. The sides taken by these two debating approaches will be easy to understand if we consider their points of difference first.

1) The realist approach in environmental sociology has focused on the material aspects like national interests, economic and military power and gain only; while the constructivist approach takes both the materialist and ideational aspects into consideration.

2) While the realist approach takes cognizance of the role of the state actors only in the global political-environmental circle, the constructivist approach takes into account the roles of both the state and non-state actors because the non-state actors act as climate policy entrepreneurs and contribute significantly towards the preparation of the environmental policies. Constructivists have expressed concern over all the aspects that have been ignored by the realists, for example, the man-nature reciprocity or the social-historical contexts of environment.

3) The constructivist perspective in environment is a social process which explores different explanations of the same situation and carefully considers one of them while rejecting others for understanding the situation. For example, the concept of sustainable development has multiple meanings, but all the meanings may not carry equal weightage for all the parties concerned.

4) While the realists have placed emphasis on the advancement of national interests in all spheres of state affairs including environment, constructivists have included many other aspects within its scope of analysis to give us a deeper insight into the role of the state and other agencies in environment oriented politics. It also takes into account the role of the state and other agencies in environment oriented politics and the role of the common people as actors. It has been noticed that people in different communities in different stages of history have developed different approaches towards environment owing to the different levels of socialisation into matters of ecology and environment. Those who are more environmentally socialised, behave more responsibly and take care of the environment in a more sincere fashion; but if their socialisation lags in creating environment sensitivity then people behave in a selfish and destructive manner. Constructivists take into account all these aspects concerning environment. It also looks deep into the colonial history of plunder and devastation of natural resources of colonized states by their colonial, capitalist masters to understand the full extent of exploitation and domination of weaker, technologically backward countries by the superpowers of the west.

As the concept of globalised world economy, international cooperation etc. has acquired importance in the recent times, the realist perception with its priority over national interest fulfilment has faced many challenges from many quarters. Today it has widely been accepted that environmental protection and development can best be served through interstate cooperation and coordination. Peter Haas has aptly commented

that globalisation has not occurred in trade and commerce alone, environmental problems have also become globalised. One such problem is transborder pollution or environmental conditions generated in one country polluting the natural environment of another country. Marine pollution involving many nation-states and innumerable source points of pollution can be cited as an example of transborder pollution.This happens because ships use the ocean as a very convenient sewerage system and also because seepage from oil drilling processes often enter the sea water at the shore of one country and may be carried to the shores of many other countries. Transboundary air pollution, too, is generated in one country and often affects one or more countries, especially the neighbouring countries. It causes acidification and summer smog, pollutes soil and water by dispersing hazardous substances to near and far lands. Use of energy and transport including international shipping is impacting the air quality of countries through which the ships pass. To stop all these, international understanding and cooperation are extremely needed.

Now, the moot point of debate between these two schools over environmental crises is that whether the ecological problems are real or all socially constructed. The constructivists believe that the real issues are not as grave as they are presented to be to serve the interests of the superpowers. The similar kind of arguments have also been raised by many during the recent pandemic conditions. Many people, including experts, questioned the widespread caution measures prescribed by doctors and other experts. In a similar fashion, the supporters of environmental constructivists often believe that even though there may be some dangers from excessive, erratic and irresponsible use of natural resources, the future may not be as bleak as it appears to be. Big superpower states project the danger as real and the smaller, not-so-resourceful states tow the line. Ecological realists, on the other hand, believe that ecology and environment do matter in a state's national interest , therefore, cooperation between states to protect the natural resources of each of them is extremely needed. Ecological realists argue that protection of ecology is needed in the interests of all states. Environmental issues have global consequences; pollution and deterioration in the ecology of one country may easily affect the environment of many other countries. For example, the ocean carries all the polluting elements deposited in the river water of one country to the far and distant shores of many other countries. As environmental issues have global consequences, these cannot be the private concern of any single state. It requires global cooperation and so, cannot be the private concern of any single state. For this reason, in 2015 under the leadership of President Barrack Obama, the USA adopted a pioneering role in creating international cooperation to prevent further environmental damage.The global environmental crisis , encompassing climate change, collapsing biodiversity and the slow death of the world's oceans and glaciers, has

exposed the limitations of traditional political realism. Today the time is ripe for the nations to embrace a new approach to world politics policythat treats the preservation of the biosphere as a core national interest and a security objective of national security. Drawing on hundreds of rigorous scientific studies, environmental realists deals with the sources and physical effects of global warming. They also believe that all these problems are due to human activity like burning of fossil fuels and not due to natural causes. Realists believe and that has also been accepted worldwide that we are currently losing the battle against the catastrophic human-made changes to the environment. Not only humans but all lives depend on a healthy environment.

2.4 Conclusion

Realists see the world as literally real and believe that we come to gain our knowledge about it from our realistic understanding of the world. On the other hand, a constructivist approach sees reality as a social construction 'we know what we know' because of prevalent social practice. Thus, realism would say that we recognise a rock as a rock because of its inherent properties, whereas constructivism would say we recognise it as such because we have learnt to do so.

Realism is one of the oldest theories of international relations to explain why states go to war and how they react to potential threats. Initially though only political and economic issues were the reasons behind war, the threat of climate change is relatively new. Only since the 1970s climate change has become a major talking point on the international political agenda.Climate change does not discriminate between states and state borders. It affects the way ordinary people live and the way states operate in the international system. Since the 1970s the climate change has gradually ascended the international political agenda, starting with the establishment of the United Nations Environmental Programme (UNEP) in 1972 and the signature of the first treaty on climate change at the UN Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro. By that time nations across the globe began to feel the effects of climate change; this threat is unlike any other kind of threat the nations had faced so far. There are many variations of realism and not all of these can offer any solution to combat climate changes, a defensive realist approach can rationalise state alliance to balance against the threat.

Climate change is an inherently political issue, it revolves around the themes of power, morality and interests. Constructivists argue that some of the perspective's arguments can unlock some of the aspects shaping global climate politics that have not been addressed by the conventional international relations theories. Realists argue that states are not necessarily predisposed to cooperation. For this reason frequent

lack of cooperative behaviour among nations are quite common. Hoffman (2012) has pointed out that in the United States, climate change has become an issue that is associated with a particular political ideology. Large parts of the public disregard the scientific basis of climate change and instead view the issue from an ideological perspective. Within this context, climate change has become associated with big government supposedly influencing the private market through climate related regulations and additional taxation.

In the opinion of the constructivists climate change is an objective phenomenon no doubt, but how subjects perceive it also do matter.This perception is partly shaped by the domestic political context in which subjects have been socialised. Socially constructed perceptions then filter down into the actual negotiating process that may, to a large extent, cause the frequent impasses on climate change issues. The advocates of the constructivist approach admit that one situation may be explained in many ways in different cultural and historical contexts.

2.5 Summary

Understanding that there are some inherent differences between the two approaches this unit has tried to identify the points of difference.

It is quite clear that issues involving climate change have emerged as crucial for both national interests and international politics between states. With the help of their core principles this unit has located the ground for debate between these approaches.

2.6 Model Questions

All queations are 5 marks each.

i) What is transborder pollution?

ii) What do you mean by transboundary air pollution?

iii) Mention two differences between Realist and Constructivist approaches.

All queations are 10 marks each.

i) Examine the differences between the approaches to study environment and climate change.

ii) Make an assessment of the debate between the realist and constructivist approaches in environmental sociology.

2.7 Suggested Readings

1. Patrick M. Steward. 20.7.2020. The Case for Ecological Realisms https://www.worldpoliticsreview.com
2. Cockriel, K. et al., Environmental Realism. DOI 10.1007/978-3-319-52824-3_1
3. (Palgrave Macmillan) Environmental Realism Challenging Solutions.
4. Social Constructivism and Environmental Problems–Epistemological Challenges.
5. Jorgen Klein. Norwegian University of Science and Technology. ResearchGate Uploaded by Jorgen Klein on 20 November 2015.

MODULE – II
DIFFERENT APPROACHES

UNIT–3 : TREADMILL OF PRODUCTION

Structure

3.0 Objectives
3.1 Introduction
3.2 Social vs. Ecological Elements of the Treadmill
3.3 The 'Only' Perspective of the Treadmill versus the 'Fully' Perspective of Ecological Modernisation
3.4 Assessing Ecological Change from within the Economic State
3.5 Conclusion
3.6 Model Questions
3.7 Suggested Readings

3.0 Objectives

The Unit aspires to enlighten the learners about:

- The meaning and importance of ecological elements of the treadmill.
- Different perspectives of ecological modernization.
- The state of ecological change within a certain economic condition.

3.1 Introduction

The treadmill of production (TOP), a concept first introduced in 1980 by Schnaiberg (1980), arose from two observations. First, a major change appeared in the impact of production processes upon ecosystems in the last half of the 20th century. Second, social and political responses to these production processes were quite variable and volatile. While some people rebelled against this modern production system, others embraced these new technologies as their best hope for solving environmental problems. Ironically, we have returned to this theoretical dual valence at the end of the twentieth century. Among environmental sociologists, proponents of ecological modernisation (EM) have postulated that there is a growing independence or 'emancipation' of the ecological sphere from the political and economic spheres in state and industry policy-making. Within each of these spheres there are significant institutional

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transformations stimulated by leading firms, who have been driven by the pressures to reduce the environmental impacts of their past production processes.

Schnaiberg (1980) argued that one major change in the U.S. production system during the post-1945 era was a rising status of workers, moving from a working to a middle class, albeit within a society still marked by considerable poverty. Workers gained new income and occupational opportunities through the post-1945 expansion of production and trade, but at the expense of new ecological disruptions. In three books, Schnaiberg and his collaborators outlined the new production system that had changed its relation to the environment in two fundamental respects :

- First, modern factories needed greater material inputs. The modern factory was capital-intense, and hence, more energy was needed to run machinery. Likewise, the machinery was designed to vastly increase production levels, thus requiring far more raw materials. This feature of this new production system helped explain why ever greater levels of withdrawals from ecosystems were required. These ecological withdrawals led to one set of environmental problems, natural resource depletion.
- Second, modern factories used many more chemicals in the new production processes. The modern factory used new ‘efficient’ energy/chemical intensive technologies to transform raw materials into finished products. Thus, workers were increasingly engaged in managing energy and chemical flows, and directing their flows through the complex machinery, to create marketable products. This feature led to a second set of environmental problems, pollution -- which Schnaiberg termed ‘additions’ to the ecosystem.

After 1996, different workers further elaborated the concept of treadmill of "production theory". Environmental impacts of production were viewed in these analyses as outcomes derived from changing relationships between capital owners, workers, and the state. The five axes of such changes outlined below differ markedly from ecological modernisation principles:

1. **Economic expansion:** Economic expansion was generally viewed as the core of any viable social, economic, or environmental policy. Economic expansion was thought to increase the profits that corporate managers and their investors require for capital outlays. Workers were also believed to benefit from these outlays because investments lead to increased production, creating new local employment.Capital outlays also led to higher levels of productivity, a precondition for rising wages. Government agencies needed to ensure that national production generates sufficient profitability to: (a) induce investments by capital owners; (b) provide enough additional market values to maintain

a level of wages adequate to sustain consumer demand; and (c) generate enough tax revenue to cover the state's social expenditures. Governments believed that tax revenues from the accelerating treadmill would rise more rapidly than citizen demands. Thus, government officials and agencies increasingly shared a stake in the economic expansion with the private sector.

2. **Increased consumption:** If economic growth were to come about through increased production of the amount of goods, consumers needed to have the disposable income to purchase the goods. Therefore the state, along with private capital, worked to make low-interest loans available to consumers for the purchase of homes and other items. This would ensure a continued cycle of production and consumption.
3. **Solving social and ecological problems by speeding up the treadmill:** Social and ecological problems were thought to be best solved ‘‘through the market.’’ Thus, there arose an untenable, almost magical sense that any type of economic expansion will reduce social and ecological problems. Poverty would be reduced by a growing economy because there was an expanded job base and increased wages at the bottom. A growing economy also supported government social expenditures (for education, housing, and other needs of the poor), and provided the source of funding for technological development that could address environmental ills.
4. **Economic expansion via large firms:** Economic expansion was seen as fostered primarily through the growth of large firms, ‘core firms.’ Large firms were thought to be the driving engine of the economy. Their growth created the primary demand for jobs and secondary demand for supplies, which fuelled the growth of smaller entrepreneurial firms. The wages paid to the large labour pools provided consumption capacity among consumers, who kept mainstreet American merchants in business. The earlier popular slogan ‘‘What's good for General Motors is Good for America’’ captured this thinking.
5. **Alliances among capital, labor, and governments:** The post-1945 political economy was largely held together by an implicit contract. Private capital's need for a reliable labour force permitted the development of strong trade unions, which could also collectively bargain for wage increases and safer working conditions. Workers' need for jobs and their general satisfaction with unprecedented material gains led to a ‘no strike’ pledge with management. The state played its part by expanding public education in order to produce a higher quality labour force, while also expanding consumer credit to make sure that domestic demand for goods kept pace with the increase in production.

3.2 Social vs. Ecological Elements of the Treadmill

Two forms of a 'treadmill' emerged in this new system. As firms made more products using more efficient technologies, they also garnered rising profits, which could be invested in still more productive technologies. This suggested a kind of ecological treadmill. This expansion required greater inputs (raw materials and energy) and hence greater withdrawals of natural resources. It also led to greater additions (toxic chemical pollution and other forms of liquid and solid waste). The implications of this model were that ecosystems were increasingly becoming used as sources of raw materials and as 'sinks' for toxic wastes, degrading ecosystems while enhancing profit levels.

A second form of the treadmill was social. After each cycle of production, a growing share of profits was allocated to upgrading the technological "efficiencies" of the firm. Analogously to ecosystems, workers were helping to sow the seeds of their own degradation. By generating profits in one cycle, they would help set in motion a new level of investment in labour-saving technology, ultimately leading to their removal from the production process. Despite these trends, some workers did indeed gain opportunities in this process as skilled technological workers, while others lost such opportunities. Moreover, as this treadmill expanded, it created new sources of revenue for governments. Some of this revenue was used to give displaced workers social and economic compensation (e.g., income supplements and alternative employment). There were thus some losses and some gains as the treadmill expanded, replacing earlier forms of production, natural resource utilisation and employment.

In its initial formulation, therefore, the treadmill was more than a model for ecological impacts of production. Inherent in its logic was a necessary and simultaneous shift in social relations within production, and social relations between producers and other institutions. From its inception, then, the treadmill's dual focus has been within the firm and within the society in which the firm is embedded. This is a primary distinction between the theory of the treadmill of production and the theory of ecological modernisation.

In recent decades, the rising tide of global investments and geographic shifting of production has intensified competitive pressures on ever more workers in industrial societies, leading to downsizing and increasing bifurcation of global labour forces, outsourcing of production, and a decline in real wages for more workers. Furthermore, ecological risks within communities and workplaces have increased markedly, while nation-states have ceded significant policy making authority to corporate-run global trade organisations.

For recycling programs in the U.S., it became clear how the practice of substituting larger forms of physical capital for human labour had permeated every aspect of this industry. From billing and accounting to collection, processing, labelling and shipping, the recycling industry has wholeheartedly adopted labour-saving technologies,robotics, and expert systems. The commodification of recycling also fundamentally represented a displacement of the environmental movement, which had earlier emphasised recyclings use-value potential. Additionally, the much-anticipated employment and revenue gains for communities and governments never materialised, either when communities did recycling directly, or when they contracted out with private industry. Furthermore, despite recycling's local image, markets for post-consumer waste were much more volatile and global in scope than previously expected. To understand why this outcome occurred, we believe a more general dynamics of the treadmill needs to be studied, as outlined in the next section.

3.3 The 'Only' Perspective of the Treadmill,versus the 'Fully' Perspective of Ecological Modernization

In a 1994 book Schnaiberg & Gould had outlined an evaluation problem that is inherently political, and one that will perhaps help us understand the differences between the treadmill and ecological modernisation theories in viewing the modern "environmental state". Briefly put, our argument was that there are two ways of evaluating any change in state (or firm) actions. One uses the past as a guide, and sees any positive change as 'fully' moving from a negative past to a more-positive present. The other sees 'only' alimited amount of change, comparing the present status to a future goal to be desired.From the latter perspective, the state has actively or passively permitted the treadmill to achieve its current practices, which are inherently unsustainable on both ecological and social dimensions.

Conversely, from the standpoint of some ecological modernisation theorists, firms(under pressures or encouragements from their states and NGOs) have moved 'fully' beyond their earlier dismissal of ecological costs of their profitable activities. The firms now take some ecological factors into account in some of their planning and activities.Moreover, since the state has, over the past 25 years, incorporated some consideration of ecological outcomes for some economic policies, there has been "fully" some movement away from a strictly economic synthesis of the societal-environmental dialectic.

Tacitly or explicitly, some of these arguments by ecological modernisation theorists seem to suggest that, if this ecological modernisation is permitted to continue, we will achieve some ideal sustainable end-state. But, they argue, this will occur through

processes of supra-industrialisation, not through processes of de-industrialisation (as some environmental movements share with treadmill analysts such as us). Ecological modernist theorists argue that states should encourage these forms of super-industrialisation, to delink natural resources form economic development. We think this is an unlikely trajectory, as we argue in the closing section.

3.4 Assessing Ecological Change from within the Economic State

This analysis of the role of the state within the treadmill stresses the typical practices of economic organisations, their autonomy relative to the state, and their regulation by the state. Governments have (until the recent growth spurt) been increasingly restricted by policies promulgated by coalitions driven by reproducing the treadmill. As a result, ever more profitable corporations are now 'generously' endowing local governments, schools and universities, and public broadcasting with 'public support' ranging from motor vehicles to environmental curriculum. And also as a result, government regulation is increasingly curtailed around many environmental policies.Poor environmental quality affects the economic well-being, health and the state of resources. In fact, economy and environment remain entangled in multiple ways.

3.5 Conclusion

Treadmill of production theory was introduced by Allan Schnaiberg in his 1980 book named 'The Environment: From Surplus to Scarcity'. It is a political economic approach for understanding environmental ecological disorganization, environmental destruction and harm in the Posts World War II era. It is now considered a specialized approach within environmental sociology. To begin to understand the basic assumptions of Treadmill of Productions theory (ToP), it is necessary to begin by defining some of that approaches' key terms. At the core of ToP is the idea that capitalism is an ecological destructive means of production, and that the processes of producing and consuming goods generates ecological disorganisation.

Buttel (2004) calls 'treadmill of production theory' the single most important sociological concept and theory to have emerged within North American environmental sociology." Burkett (2006) expand on in ecological Marxism when they describe the inherent contradiction between capitalism and the ecosystem consisting of ecological destruction, and the fact that capitalism must destroy the ecosystem to expand and grow. Capitalism's ecologically destructive tendencies are seen in the processes of ecological withdrawals and ecological additions. Ecological withdrawals are defined as the resource harms capitalism produces in the process of extracting raw materials.

In the post-World War II era, these resource withdrawal processes have been driven by a chemically intensive segment of the treadmill of production along with intensive mechanisation of ecological withdrawals. These chemical and technological innovations in the withdrawal portion of the treadmill of production process intensify the withdrawal process or speed it up while requiring reduced labour input, thus accelerating the potential for capital accumulation. Moreover, this intensification of the ecological withdrawal process accelerates ecological disorganisation by increasing the destruction of nature. Thus, there is a contradiction between capital accumulation and ecological destruction under capitalism. Ecological additions consist of the emission of pollutants into the ecosystem. Over time as the treadmill of production accelerates, it generates larger quantities of ecological additions, and emits increased quantities of pollution which may also be more concentrated with respect to toxicity. These ecological additions also produce ecological disorganisation by changing nature and accelerating other ecologically destructive tendencies (e.g., the acceleration of climate change in response to ecological additions).

Treadmill of Production theory (ToP theory) also draws attention to the ways in which the state, the private sector and labour interact to facilitate ecological disorganisation under post-World War II capitalism. Schnaiberg argued that each of these sectors has an interest in increasing ecological disorganisation for its own benefit. In short, ToP explains how the political economic organisation of capitalism and the chemical/technological innovations in the post-World War II capitalist treadmill of production accelerates ecological disorganization. Theoretically, as the treadmill of production expands and ecological withdrawals and ecological additions accelerate, so too does ecological disorganisation. More recent applications of this view, however, have incorporated treadmill of production theory more directly into ecological Marxism.

The Treadmill of Production theory offers a sharp critique against the dominant capitalistic mode of production in modern industrialised societies The advocates of this theory believe that higher capital investment is essential for high profit aided by high level of resource extraction. As per their explanation, as yield and profit increase, scopes for new investment and employment will surely increase; but aided by more advanced technology, this will lead to greater uncontrollable depletion of natural resources and higher rate of environmental pollution.For the workers, there will be neither any corresponding increase in wages nor in social expenditures for their benefit under such circumstances. The common people including the workers are lured to dream about the new and better opportunities as a natural consequence of the increase in investment; but it always remains elusive.

The treadmill of production has generated excessive environmental risk, especially climate risk in rich and poor countries alike throughout the world.The treadmill theory

analyses the close relations between advanced economy and environmental damage and the perception of economic development was blurred by the lure of higher growth only. Schnaiberg has shown that in the modern world where the corporation, the state and labour-all cherish the concept of economic growth as economic development. is believed to be the only path to social progress. Therefore, the pursuit of economic growth and development has led to ever deepening capital intensity and environmental crises. With this view, the treadmill theory seeks to examine the social roots of expanded production. The system of treadmill production is kept in force by three important agents, namely, the corporations, workers and the state; however, the corporations are its primary driving force. It is interesting to note that the workers, both as consumers and citizens, also support the process though they remain at the receiving end of the system. On the one hand,they are laid off by increasing mechanisation of the production; on other, they face most of the negative consequences of the treadmill system, yet they continue to believe that this is immensely beneficial for their job opportunities in particular and for social progress in general.

However, the theory of treadmill production has not only won appreciation, but has also earned flaks from many quarters, especially from Erik Olin Wright, a Marxist scholar. Though he accepts the core point of the theory he has also criticised it on multiple grounds. Firstly, he criticises the way the words 'treadmill' and 'producer' camouflage the true character of capitalism and owner-capitalist respectively. Secondly, Write argues that just because production takes place before consumption that does not mean that the former is more important than the latter.Capitalist production depends on maximisation of profit, private ownership and free competition and that explains how and why this kind of production becomes harmful for the environment.Thirdly, Wright further observes that in treadmill theory ecological sustainability actually means ‘no growth’ economy; though there may not always be any connection between the growth of output and growth of physical output in general. Improvement in quality of product may be possible without an increase in the quantity of raw material; economic growth, too, is possible with certain kind of service,Wright has also noticed that treadmill theory does not take the possibility of green economy or green capital into account. He finds that capitalist economy puts emphasis on service and quality of the produce among other things.

Some other treadmill theorists like Gould have spoken of 'ecological synthesis' or state's control over the ecosystem without any consideration of profit, wages and employment as the treadmill theorists look for alternatives. However, Wright is doubtful about its possibility in a capitalist system as this system often brings in its own destruction even when there is centralised planning for cutting the damage caused by the system of production. Therefore, he argues that the alternative model needs to

be detailed well. He is also critical of the use of the imagery of 'treadmill' to describe a society that is running in place, but not moving forward. The whole picture, he believes, evokes the sense of a society that is actually moving backward with decreasing social efficiency of natural resource utilisation and increasing the rate of resource extraction and ecosystem pollution. Wright believes, this is a genuine sign of moving backward.

3.6 Model Questions

A. Answer in brief: 5 marks

i) What is treadmill of production?

ii) What are the two important aspects that changed the relations between environment and production systems?

iii) What are the two forms of treadmill in the new ecological system?

B. Answer in detail: 10 marks

iv) Make a critical assessment of the environmental impacts of treadmill production.

v) Make a comparative assessment of the social and ecological elements of the treadmill.

vi) Critically examine the ecological changes caused by the economic state.

3.7 Suggested Readings

1. Gould, Kenneth, Pellow, D. N., Schnaiberg A. 2008. The Treadmill of Production. Routledge.
2. Islam, S. 2015. The Global Treadmill of Production and the Environment. Springdale.
3. Schnaiberg A., Pellow, D. N., & Weinberg A. (2002). The treadmill of production and the environmental state. In The environmental state under pressure (pp. 15-32). Emerald Group Publishing Limited.
4. U.N. Environmental Yearbooks / Global Environmental Outlook Yearbooks - UNEP 2014 Year Book.

UNIT–4 : ECOLOGICAL MODERNISATION

Structure

4.0 Objectives.
4.1 Introduction
4.2 The Theory and its Critics.
4.3 The Emergence of Ecological Modernisation Theory
6.3.1 Core Themes of Ecological Modernisation Theory
4.4 The Key Features of Ecological Modernisation
4.5 Case Study of Ecological Modernisation-Ecological Modernisation and Restructuring in Australia
6.5.1 Ecological Modernisation in Some Other Countries.
4.6 Conclusion.
4.7 Model Questions.
4.8 Suggested Readings.

4.0 Objectives

This Unit helps the Learners in many ways, like:

- To know about the importance of ecological modernisation.
- To examine the theory of ecological modernisation.
- To understand the key features of ecological modernisation.
- To assess the impacts of ecological modernisation with the help of case-studies.

4.1 Introduction

Ecological modernisation is a school of thought in the social sciences that argues that the economy benefits from moves towards environmentalism. This has gained increasing attention among policy makers in the last several decades. It is an analytical approach as well as a policy strategy and environmental discourse.The last few decades have seen the rise of 'ecological modernisation theory' (EMT) as a "green capitalist" tradition extending modernisation theory into environmental sociology. This article uses a synthesis of political economy, world-systems theory, and political, economic, and environmental sociology to demonstrate that the EMT presumption of growth and profit as economic priorities (alongside its neglect of core-periphery relations) produces many feedback loops which fatally undermine the viability of EMT's own political,

technological, and social prescriptions, alongside creating problems for the fundamental EMT concept of 'ecological rationality'. Ecological modernization theory is a fundamentally representative 'green capitalist' approach to environmental sociology (Mol 2002), presuming the central features of the CWS and adopting many core elements of traditional 'modernisation theory'.

Many contemporary environmental social scientists and commentators suggest that a major turn occurred in the 1980s with regard to the continuing undermining of sustenance bases of western industrial societies. The Brundtland report [WCED, 1987] is often denoted as the codification of that transformation, which was marked by other historical events as well, including the 1992 United Nations Conference on Environment and Development (UNCED). Beyond this common understanding, divergent interpretations have developed on (i) the nature of that transformation, (ii) the actors and actions which have triggered innovations in societies' interactions with external nature, (iii) the extent to which such environmental improvements have reflected changing environmental ideologies and discourses, and (iv) the social and geographical distribution of those changes.

Numerous social scientists have analysed aspects of this turn, looking at, for example, the changing role of the nation-state in safeguarding the environment [cf. Jänicke, 1993], and the role of social movements in representing environmental interests vis-à-vis economic agents [cf. Rawcliffe, 1998]. Few attempts have been made to formulate more general explanations of current transformations of environmental practices, discourses and institutions. One of the more sustained efforts to do so has been a growing number of publications which can be brought together under the label, 'ecological modernisation'. Scholars in different disciplines from around the world have been developing and 'testing' this body of work for nearly two decades. The fundamental issues of ecological modernisation started to appear in Berlin, Germany in the early 1980s in the writings of a number of scholars like Joseph Huber, Martin Janicke and Udo E. Simonis. But they were not alone, many others also had been thinking on the same line at that time. Their main objective was to readapt economic growth and industrial development for the protection and rejuvenation of environment. For this reason, this theory campaigns in favour of compatible combination of economy and ecology; it also supports productive use of natural resources like air, water, soil etc. to booster future growth and development; to increase energy and resource efficiency, product and process innovations with better environmental management, clean technology, substitution of hazardous substances. Ecological modernisation gives people ample scope to act in nurturing the environment, but it may also lead to conflicts with the principles of the conservationists.

The theory of ecological modernisation has a wide scope covering techno-industrial

progress, policy and economy, and even cultural aspects like ecological modernisation of mind, value orientations, attitudes, behaviours and lifestyles. It also recommends innovative structural changes and researchers of this specialised area are currently aiming at eco-innovations. Another important aspect of this theory is that it shares many concepts with other neighbouring approaches like sustainable development, industrial ecology, industrial metabolism etc. The economic benefits of ecological modernization are immense, such as determination of the role of the governments in speeding up technological progress and adaptation of good environmental regulation.

4.2 The Theory and Its Critics

Ecological modernisation was originally presented in the German language by Huber. Many of the debates surrounding the theory, however, have been in response to English language treatments, particularly those by Mol and Spaargaren. This discussion focuses on the work in the English language, paying special attention to the publications that have focused on clarifying key issues. Although the theory of ecological modernisation presents a complex understanding of posts-industrial society, the core issue of the argument involves technological innovation. One of the key characteristics of the theory is that the authors see continued industrial development as offering the best option for escaping from the ecological crises of the developed world. Unlike theorists who see technological development as being generally problematic–pointing to a potential need to stop capitalism and or the process of industrialisation to deal with ecological crises, spaargaren and Mol argue that environmental problems can best be solved through further advancement of technology and industrialisation. More specifically, there are two main ways that the expectations of ecological modernisation differ from those of most of the past works on society-environment relationships. First, the theory explicitly describes environmental improvements as being economically feasible; indeed, entrepreneurial agents and economic/market dynamics are seen as playing leading roles in bringing about needed ecological changes. Second, in the context of the expectation for continued economic development, ecological modernisation depicts political actors as building new and different coalitions to make environmental protection politically feasible. The theory has developed with considerable diversity and debate. But the applicability of the theory to different cultural, social, economic, political-institutional settings and locations around the world cannot be ascertained so soon;it needs to get further expanded to include various dimensions of contemporary life. This theory has got its strength from classical European social theories to address the issues of consumption practices and consumer behaviour, development of cultural institutions and practices and also of national cultural orientations.

The theory of ecological modernisation analyses how contemporary industrially advanced societies deal with environmental crises. Its subject matter has been developed to examine environmental problems as challenges for social, technical and economic reform, to consider the transformation of core social institutions of modernity like capital and industry on local, national and global scales. Therefore, its primary objective is to analyse the ways the contemporary industrialised societies deal with environmental crises.

4.3 The Emergence of Ecological Modernisation Theory

Ecological Modernisation Theory was first developed in the early 1980s primarily in a small group of western European countries, notably Germany, the Netherlands and the United Kingdom (UK). Social scientists such as Martin Jänicke, Volker von Prittwitz, Udo Simonis and Klaus Zimmermann (Germany), Gert Spaargaren, Maarten Hajer, and Arthur P.J. Mol (the Netherlands) and Albert Weale, Maurie Cohen and Joseph Murphy (UK) made substantial contributions to this scholarship even in its relatively short existence. In the 1980s the environmental depletion and hazards caused by the western industrial societies gave birth to newer ideas regarding conservation of nature and environmental resources. Ecological Modernisation theory has developed with considerable diversity and debate, not only by national background and theoretical foundation, but also chronologically. We can distinguish at least three stages in the development and maturation of this school-of-thought.

The first contributions, especially those by Joseph Huber, were characterised by heavy emphasis on the role of technological innovations in environmental reform, especially in the sphere of industrial production; a critical attitude towards the (bureaucratic) state; a favourable attitude towards the role of market actors and dynamics in environmental reforms; a systems' theoretical and rather evolutionary perspective with a limited notion of human agency and social struggles; and an orientation towards analyses at the level of the nation-state.

The second period, from the late 1980s to the mid-1990s, showed less emphasis on technological innovation as the key motor of ecological modernisation; a more balanced view on the respective roles of states and 'the market' in ecological transformation and more attention to institutional and cultural dynamics of ecological modernisation. During this period, scholarship on ecological modernisation continued to emphasise national and comparative studies of industrial production in the Organisation for Economic Co-operation and Development (OECD) countries. The environmental depletion and hazards caused by the western industrial societies gave birth to newer ideas regarding conservation of nature and environmental resources

during this period. The Brundtland Report (WCED,1987) and the United Nations Conference on Environmental Development (1992) report had prompted the international society to take cognisance of the role of the nation-state in safeguarding the environment. Soon the topic of 'ecological modernisation' emerged as a new area of interest among social scientists.

Since the mid-1990s, the frontier of Ecological Modernisation Theory has broadened theoretically and geographically to include studies on the ecological transformation of consumption; ecological modernisation in non-European countries (newly industrializing countries, less developed countries, the transitional economies in Central and Eastern Europe, but also OECD countries such as the USA and Canada); and global processes. Works in the present volume fit squarely in this third phase of Ecological Modernization Theory.

Notwithstanding their temporal, national, and theoretical differences, one can gather this scholarship together under the aegis of Ecological Modernisation Theory. Such studies arguably have three broad perspectives in common : (i) moving beyond apocalyptic orientations to see environmental problems as challenges for social, technical and economic reform, rather than as immutable consequences of industrialisation; (ii) emphasising transformation of core social institutions of modernity — be it not beyond recognition — including science and technology, production and consumption, politics and governance, and the 'market', on multiple scales (local, national, and global); and (iii) positioning in the academic field distinct from counter-productivity/ de-industrialisation, postmodernist/strong social constructionist, and many neo-Marxist analyses.

4.3.1 Core Themes of Ecological Modernisation Theory

From the initial contributions onwards, the aim of Ecological Modernisation Theory has been to analyse how contemporary industrialised societies deal with environmental crises. The core of all studies in the tradition of Ecological Modernisation focuses on (existing and programmed) environmental reforms in social practices, institutional designs and societal and policy discourses to safeguard societies' sustenance bases.

Some authors emphasise that these social transformations in institutions, practices and discourses are paralleled by physical changes in tendencies of environmental disruptions and material flows.From the mid-1980s onwards, a process of decoupling or delinking of material from economic flows emerged in ecological front-runner nations such as Germany, Japan, the Netherlands, Sweden, and Denmark. In a number of cases (countries, industrial sectors, issues), environmental reforms arguably even resulted in an absolute decline of natural resources used and emissions produced, regardless of economic growth in monetary or material terms (amount of products).

Considerable debate has emerged about whether these improvements have actually taken place and to what extent any such improvements are structural or incidental.

It is not physical improvements, however, but rather social and institutional transformations which have been and still are at the core of much current scholarship on ecological modernisation. These transformations can be grouped in five clusters:

1. **Changing role of science and technology:** Science and technology not only are judged for their role in the emergence of environmental problems but also valued for their actual and potential role in curing and preventing them. Traditional curative and repair options are replaced by preventive socio-technological approaches incorporating environmental considerations from the design stage of technological and organisational innovations. Science and technology are not marginalised despite an apparent growing uncertainty of expert knowledge regarding definitions and causes of, and solutions for, environmental problems.
2. **Increasing importance of market dynamics and economic agents:** The producers, customers, consumers, credit institutions, insurance companies etc act as carriers of ecological restructuring and reform in addition to the more conventional categories of state agencies and new social movements that prevail in all most all social theories on the environment.
3. **Transformations in the role of the nation-state:** More decentralised, flexible and consensual styles of governance emerge, with less top-down, national command-and-control environmental regulation – often referred to as political modernisation. More opportunities for non-state actors to assume traditional administrative, regulatory, managerial, corporate, and mediating functions of the nation-states, referred to by some as subpolitical arrangements.
4. **Modifications in the position, role and ideology of social movements:** Increasingly, social movements are involved in public and private decision-making institutions regarding environmental reforms, in contrast to having been limited to the periphery or even outside of such processes and institutions in the 1970s and '80s. Along with this is a partial shift from anti-systemic, de-modernisation to reform ideologies. These changes, in turn, have led to debates within social movement organisations regarding tensions of dualistic strategies and ideologies.
5. **Changing discursive practices and emerging new ideologies:** Complete neglect of the environment and the fundamental counter positioning of economic and environmental interests are no longer accepted as legitimate positions. Intergenerational solidarity in dealing with the sustenance base has emerged as an undisputed core principle.

Such social transformations feature as central topics of scholarship on ecological modernisation in western industrialised countries, and increasingly elsewhere as well.

4.4 The Key Features of Ecological Modernisation.

By summarising the literature on ecological modernization, one can identify four key features that distinguish it from other theoretical approaches.

A. **Ecological modernization as technological adjustment:** Ecological modernization is concerned with technological developments with environmentally beneficial outcomes. These outcomes are specifically aimed at reducingemissions at source and fostering greater resource efficiency. Ecological modernisation is primarily a strategy intended to maintain or improve market competitiveness, in which the environmental benefits of technological change are related to companies' cost minimising responses to new pressures from the market itself and broader society.

B. **Ecological modernisation as belief system:** The concept of ecological modernization reflects an ideology based on the understanding that environmental protection is a precondition of long-term economic development. It emphasises the achievement of the highest possible environmental standards as a means for developing market advantage through the integration of anticipatory mechanisms into the production process, the recognition of actual and anticipated costs of environmental externalities in economic planning, and the economic importance of strengthening consumer preferences for cleaner or 'green' products.

C. **Ecological modernisation as policy discourse:** Internalising care for the environment into existing patterns of economic production and consumption or, in other words, facilitating change in environmental policy within the broad framework of modernity, also determines the discourse about 'the environment'. So far, this discourse has been largely economistic–framing environmental problems in monetary terms, portraying environmental protection as a matter of good management and potential cost savings. At the core of ecological modernisation is the idea that ‘pollution prevention pays’, thus it is essentially an efficiency-oriented approach to the environment.

D. **Ecological modernisation and environmental policy making:** One of the most important aspects in analysing the theory of ecological modernisation is how it relates to the process of environmental policy making. What policies are formulated within the discourse of ecological modernisation? Which societal actors play an important role in the formulation and implementation of those

policies? Usually, ecological modernisation favours a style of environmental policy making within which nation-state intervention moves away from a mere hierarchical command and control policy-style and towards a more decentralized policy-style, consensual negotiations, partial self-regulation (with legal boundaries), and the use of market mechanisms and instruments. This suggests that ecological modernisation as defined within environmental policy making largely excludes the social dimension which is one of the three defining features of the concept of sustainable development.

Categories of ecological modernisation:

Weak ecological modernisation	Strong ecological modernisation
Economistic	Ecological
Technological (narrow)	Institutional/systemic (broad)
Instrumental	Communicative
Technocratic/neo-corporatist/closed	Deliberative democratic/open
National	International
Unitary (hegemonic)	Diversifying

Source : Christoff, 1996

4.5 Case Study of Ecological Modernization-Ecological Modernisation and Restructuring in Australia.

Ecological restructuring, which includes industrial and technological modernisation, also goes beyond it by seeking significant change to the sectoral mix. Australia finds itself in a structural quandary. Its climate policy is conditioned by the economic fact of its abundance of fossil fuel resources and hence its status as a producer and net exporter of energy. The comparative advantage of cheap energy in turn fuels its economic and trade performance, and its relatively low energy prices act to attract business investment and underpin economic prosperity. In 2005-06, coal exports were Australia's highest export earner, contributing $AU24 billion to the economy; coal also provided 80% of Australia's electricity. Key energy intensive industries, such as aluminium smelting and refining, coal and steel, cement and liquefied natural gas production rely on cheap energy. Like most other countries, Australia has designed a suite of climate policies that complement its economic circumstances and support its national interest. This helps explain the readier 'availability' of ecological modernisation (EM) proposals in some states than in others. Countries that rely on energy imports will tend to generate strong climate policies while those that export

fossil fuels tend to generate weaker ones. Other factors are also important to a country's environmental policy decisions, but countries with abundant coal and gas deposits and substantial carbon exports have boosted the power of the fossil fuel energy lobby, hindered the development of energy efficiency, and affected perceptions of the economic costs of reducing emissions. This describes the Australian climate scenario well.

The concentration of 'dirty' industries, and their centrality to Australia's sectoral strengths, thus makes its climate policy response problematic. There are basically two options for 'cleaning' these industries. The first involves technological innovation of the particular industry along EM lines. The second necessarily goes further, requiring 'inter-sectoral structural change' to reduce or even phase out these industries. Since 'dirty industries' present a 'structural problem' that is not solvable 'only by means of ecological modernisation', the 'solution can only be found in a sectoral strategy beyond technological improvements'. The first option is the more acceptable, while it may require significant technological investment, a sector's identity and longevity remains intact. Clean coal technologies (CCTs) such as carbon capture and storage represent the main technological solutions to greening the coal industry. Many of these technologies seek to capture carbon emissions from fossil fuel production and then bury them underground; others involve the transformation of carbon dioxide into solids that do not require burial. At their heart sits an 'end-of-pipe', or very weak EM logic. Through technological innovation, they promise to retain and increase the coal sector while eliminating its greenhouse emissions. This technological first option is not, however, without economic and political risks, not least in its capacity to trigger sectoral restructuring by fiat rather than intention. CCTs serve two important functions in the Australian case.

4.5.1. Ecological Modernisation in Some Other Countries

Solid steps for ecological modernization have been undertaken in many other countries across the globe, though not always with the same amount of success. We will examine the ecological modernisation experiences of three countries, namely, Japan, Germany and Netherland.

a) **Japan:** Japan's ecological modernisation experiences are path breaking and interesting in many ways. The country is not only one of the first countries to adopt measures for ecological modernisation, it is also the first non-western democratic country with post-industrial economy. As per the IMF Assessment Report (2003) it is the world's second largest economy with one of the most affluent and sophisticated consumer and industrial markets and its post-war economic growth and the associated 'pollution debacle' have impacted the global environment enormously.To improve its environmental condition, Japan

had started to take up various measures since the 1970s and thus earned global recognition as a front-runner and leader in the field of ecology and environment.

In the post-world war era Japan started to experience high population density and rapid industrial growth accompanied by fast urbanisation. All these caused severe air and water pollution and related health hazards. The environmental problems further magnified there because residential areas were often situated quite near to the industrial zones. Japan's environmental policies had to change when a number of environmental scandals and protests jolted the country out of its stupor. In 1993, the Basic Environment Law was made to serve certain essential purposes like implementation of direct regulation over industries, speedy adoption and implementation of cleaner technologies, etc. Being a strongly centralised country, Japan's central government has the sole authority to set environmental standards and uniform regulations across the country. A number of regional governments have also come forward to make agreements with local polluting firms to set more stringent environmental regulations without obstructing the jurisdictions of the national legislations. Cities and national groups enjoy supervisory power over the firms' behaviour. Firms also voluntarily become party to such arrangements as they also wanted to give the impression of being green and eco-friendly. Such efforts had started much earlier when the city of Yokohama signed an agreement with Electric Power Co. in 1964 and with Tokyo Denryoku (TEPCO) in 1965. Such agreements became popular in the 1970s and the 1980s amidst public hue and cry over the rising level of pollution and the threats of more stringent government regulations. The innovative strategy of reduced interest rate subsidies for firms that employ clean and green technologies is also a small but sure step towards lesser pollution in Japan's environment. The country is also a forerunner in rare earth policy and electrification of automobiles.

b) **Germany:** Though Germany has joined less in the challenges of ecological modernisation, it has gradually emerged as a pioneer in climate and energy, especially in the field of renewable energy policy and has earned global recognition for its role in society-nature relationships in matters of energy and transportation for its proactive stance in developing ambitious environmental policies since the beginning of the new millennium. With this, it has emerged as a fine example of coexistence of healthy growth and low-carbon economy.The Federal Environmental Agency of the country has addressed the key environmental policy challenges of the 21st century through ecological modernisation of economy by identifying suitable modernisation strategies

and also by developing proposals for policy implementation. The country has prepared guidelines for an environmentally sound, reliable and affordable energy supply with increasing use of renewable energies and greater energy efficiency. In electricity production, Germany's target is to improve the share of renewables from 17% today to more than 80% in 2050 in addition to complete phasing out of electricity production from nuclear power plants by 2022. Greenhouse gas emissions has been cut by 40% in 2020 and is aimed to cut at least by 80% within the next three decades. Such ambitious environmental programmes have made Germany increase its energy resource and carbon efficiency. The OECD Environmental Performance Review has reported in as early as 2012 that Germany has both the highest level of resource productivity in the world with absolute reduction in Green House Gas emissions and continuously growing GDP. Germany's green growth policies have stood out not only as important models for environmental innovation, but also to be considered good enough to promote a globally competitive environmental goods and services sector.

c) **Netherlands :** Netherlands is situated on the delta of multiple major European rivers, with about one-fourth part of its land lying below sea level. It is a small country with only 17 million people. Its unique geographical position has given it a solid knowledge and skill of water management that has been recognised throughout the world.The Dutch state and its people look at the environmental problem as technological challenges to be fixed by inventing new technologies and implementing right emission standards. The country, therefore, while accepting the principles of ecological modernization based on economic growth and sustainability, suggests that environmental and climatic change problems are nothing but technical problems and therefore can be fixed with technical help and also can be economically profitable. Critics point out that, though the problems of emissions and pollutions can be sorted with technocratic sustainability, it has no room for social aspects like concern for low-income groups and minority communities.

4.5 Conclusion

The concept of ecological modernisation has gained ground in the last few decades in social sciences. Emerging in Berlin in the early 1980s it has gradually stressed on productive use of natural resources like air, water, soil and ecosystems for increased energy and resource efficiency. The increasing support in favour of ecological modernisation has brought in pertinent questions regarding the role of modern industries. It is still a very young but quite mature concept that is growing at a regular pace. The

theory is based primarily in the political and policy debates rooted in the north-western corner of Europe, though its influence has expanded quite rapidly across the globe. It explores different aspects of people's life that remain unexamined and, therefore, unanswered by other environment approaches. As it addresses complex issues related to consumption behaviour, consumption practices and matters of national cultural orientations, it contributes generously to environmental social science and policy and strengthens the bonds between social science and other disciplines.

There is no doubt that discussions and debates over ecological modernisation have given rise to a number of understandings regarding the matter-ranging from ecological modernisation of mind, value orientations, attitudes, behaviour and lifestyles with sustainable household. Sustainable household signifies environment-friendly lifestyles, consumer patterns and demand-pull control of supply chains. The fashion and textile industries, too, are facing numerous criticisms for the negative impact they leave on the earth. Not merely individual operators are facing the backlashes from the conservationists, the state too is being seen as one of the facilitators of environmental damage. However, many believe that ecological modernisation movement is nothing but 'green washing'. Positive transformation of ecology can be achieved with resource conservation and not simply with upgradation of technology. It has also been pointed out that ecological modernisation does not address issues like environmental racism or asymmetric distribution of environment resources. In spite of such and many other criticism, ecological modernisation has, of late, emerged as dynamic and contentious area of environmental social science research and policy discourse. However, we have not yet reached the end of Ecological Modernisation Theory and much is yet to be done in developing, testing and critiquing it.

4.7 Model Questions

A. Answer in brief : 5 marks.

1. What is meant by Ecological Modernisation?
2. What are the key features of ecological modernisation?
3. What are the core themes of Ecological modernisation?
4. How has Japan improved her environmental conditions?
5. Why is Germany considered one of the leaders in ecological modernisation?

B. Answer in detail. 10 Marks

7. Examine, in detail, the key features of Ecological Modernisation Theory.
8. What do you mean by ecological modernisation? Examine its key features.
9. Make an assessment of Australia's experiments with ecological modernisation.

10. Make a comparative analysis of the ecological modernisation processes adopted in Japan, Germany and Netherlands.

4.8 Suggested Readings

1. Arthur, P.J.Mol and Sonnenfield, D.A. (Eds.) 2000 Ecological Modernisation Around the World: Prospectives and Critical Debates.(Environmental Politics) Routledge.
2. Barett, Brendan F.D.2005. Ecological modernisation and Japan. Routledge.
3. Curran, G. (2009). Ecological modernisation and climate change in Australia. Environmental politics, 18(2), 201-217.www.tandofline.com>ab
4. Mez, Lutz. Okamura, Lila, Widner,Helmut.(Eds.) 2019. The Ecological Modernisation Capacity of Japan and Germany, Springerlink.
5. Mol, A.P.J., Sonnenfield, D.A.2000. Ecological Modernisation around the World: Perspectives and Critical Debates. Routledge.
6. Mol, A.P.J, Sonnenfield and Spaargaren (eds.) 2009.The Ecological Modernisation Reader: Environmental Reform in Theory and Practice. Routledge.

UNIT–5 : RISK

Structure

5.0 Objectives.
5.1 Introduction.
5.2 Types of Risks.
  7.2.1 Air Emissions and Air Quality.
  7.2.2 Hazardous Materials Use.
  7.2.3 Occupational Health and Safety.
5.3 Risks for Indigenous People.
5.4 Social Impact Assessment.
5.5 The Nature of SIA in an International Context.
  7.5.1 Definition of SIA.
5.6 Principles Specific to SIA Practice.
5.7 Conclusion.
5.8 Model Questions.
5.9 Suggested Readings.

5.0 Objectives

The objectives of this Unit is to enrich the learners about:

- The nature and types of environmental risks.
- The perils of occupational health hazards and the measures for their remedy.
- Environmental damages and the threats on the life and livelihood of indigenous people.
- The importance of social impact assessment to reduce ecological damages.

5.1 Introduction

Climate change, ozone depletion, and other environmental ills are widely discussed effects of air pollution. Less well-known, at least in the developed world, are the lethal short-term public health impacts of breathing polluted air. In fact, up to 6.5 million deaths globally every year may be attributed to air pollution.

Too much pollution can pose a health risk to anyone, but whether it is lethal or not mostly depends on the person's underlying health status. The highest rates of mortality are among the elderly, or those who for whatever reason are susceptible to cardiovascular damage. Existing heart or breathing conditions can increase risk. High

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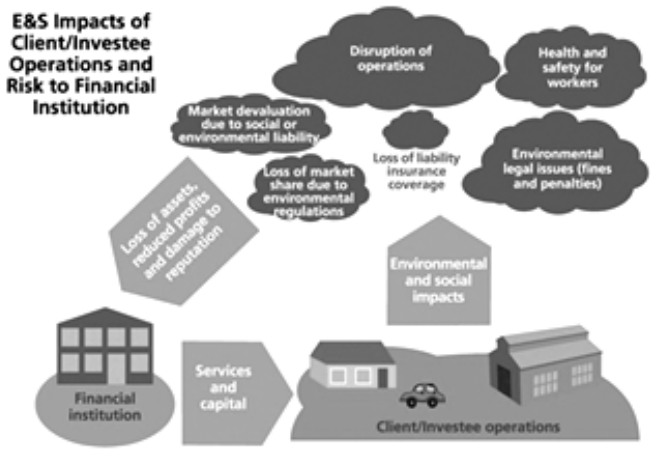
concentrations of single pollutants, e.g. particulate material or ozone, are more deadly compared to smaller simultaneous concentrations of many different pollutants. For vulnerable populations, even short-term exposure can be lethal; one exceptionally polluted day can kill a vulnerable person. However, even low-level chronic exposure over prolonged periods can reduce life expectancy.Poverty exposes people to various stressors, such as polluted water, that increase pollution susceptibility.

On the other end of the age scale, infants under the age of one year are also extra susceptible. Studies on the subject found that both respiratory disease and Sudden Infant Death Syndrome (SIDS) are associated with higher rates of particulate air pollution. The exact reason remains unclear. In adults excessive particulates can stimulate dangerous allergic reactions, inflammation, or changes in heart rhythm, and it could be that these problems are difficult for an infant's immature system to tolerate. As with adults, socioeconomic factors play a major role. All of the studies of infant deaths control for socio-economic factors, the recent research finds that pollution kills the most infants in poorer and developing countries. For children, SIDS risk increases when there is a smoker in the household, and more affluent or more educated people are less likely to smoke.

Socioeconomic factors affect adults as well. Deaths proximally caused by air pollution are more common on hot days that already stress an older or younger body. So economically disadvantaged people who cannot afford air conditioning, for instance, are more vulnerable. They may be exposed to more heat or even more pollution if they open a window to cool off. In general, poverty exposes people to various stressors, such as polluted water, that increase pollution susceptibility.

In other words, it is not so much that air pollution kills people directly, it's that more people would be alive without it.



Sources : firstforsustainability.org

5.2 Types of Risks

Environmental issues may present themselves as temporary or permanent changes to the atmosphere, water, and land due to human activities, which can result in impacts that may be either reversible or irreversible. Social issues may emerge in the workplace of a client's/investee's operations and may also impact surrounding communities. A client's/investee's performance in the areas listed below can represent environmental and social risks to the operation:

5.2.1. Air Emissions and Air Quality

Emissions of air pollutants can occur from a wide variety of activities during construction, operation and decommissioning of a client's/investee's operations.

Air emissions are typically associated with processes such as combustion, storage of materials or other industry-sector specific processes and can be:

- **Point sources :** These are discrete, stationary, identifiable sources of emissions (such as a specific stack, vent or other discrete point of emission) that release pollutants to the atmosphere. They are typically located in manufacturing or production plants. Point sources are characterised by the release of air pollutants typically associated with the combustion of fossil fuels, such as nitrogen oxides (NOx), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM), as well as other air pollutants including certain volatile organic compounds (VOCs) and metals that may also be associated with a wide range of industrial activities.
- **Fugitive sources :** These are emissions that are distributed spatially over a wide area and originate in operations where exhausts are not captured and released through a stack. Fugitive emissions have the potential for much greater ground-level impacts than stationary source emissions, since they are discharged and dispersed close to the ground. The two main types of fugitive emissions are volatile organic compounds (VOCs) and particulate matter (PM). Other contaminants (NOx, SO_2 and CO) are mainly associated with combustion processes designed to deliver electrical or mechanical power, steam and heat.
- **Mobile sources :** These are emissions associated with vehicle use and include CO, NOx, SO_2, PM and VOCs. Emissions can be reduced by implementing a regular vehicle maintenance and repair program, instructing drivers on better driving practices that reduce both the risk of accidents and fuel consumption, replacing older vehicles with newer, more fuel efficient alternatives, converting to cleaner fuels and installing emission control devices such as catalytic converters.

A client/investee should estimate and monitor air emissions associated with operations through qualitative or quantitative assessments and atmospheric dispersion models to assess potential ground level concentrations and environmental impacts. At a facility level, air emissions should not result in pollutant concentrations that exceed the ambient air quality standards set by national authorities, which would result in fines and/or penalties if concentrations are in violation of national legislation. Pollutant concentrations can also be compared to international best practice and standards to identify any deviations, which would indicate poor performance of an operation. Air emissions of concern typically include:

- **Volatile Organic Compounds (VOCs):** Emissions of VOCs are associated with industrial activities that produce, store and use VOC-containing liquids or gases in particular where the material is under pressure. Typical sources include equipment leaks (from valves, fittings and elbows), open vats and mixing tanks, storage tanks, unit operations in wastewater treatment systems and accidental releases. Emissions can be reduced by modifying equipment, regularly monitoring equipment to detect and repair leaks, using less volatile substances such as aqueous solvents and collecting vapours through air extractors.
- **Particulate Matter (PM):** Dust or particulate matter (PM) is released during certain operations such as the combustion of fossil fuels, open storage of solid materials, and from exposed soil surfaces, including unpaved roads. Emissions can be reduced through dust control methods such as covers, water suppression, or increased moisture content for open materials storage piles, or controls (such as a baghouse or cyclone).
- **Ozone Depleting Substances (ODS):** Ozone depleting substances (ODSs) include chemicals, which have been scheduled for phase-out under the Montreal Protocol on Substances that Deplete the Ozone Layer. Systems or processes using chlorofluorocarbons (CFCs), halons, 1,1,1-trichloroethane (methyl chloroform), carbon tetrachloride, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs), and methyl bromide should be gradually phased out or should not be used at all as determined by national regulations. These chemicals are typically used in a variety of applications including refrigeration, air conditioning, manufacturing foam products, solvent cleaning, aerosol propellants, fire protection systems and as crop fumigants.
- **Greenhouse Gases (GHGs):** Greenhouse Gases (GHGs), as defined under the Kyoto Protocol to the United Nations Framework Convention on Climate Change, include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride

(SF_6). GHGs can be generated by a facility's production processes as well as from the production of power (on-site or off-site) for use by the facility. Emissions can be reduced through mechanisms such as carbon financing, energy efficiency, sustainable forms of agriculture and forestry, use of renewable forms of energy, carbon capture and storage technologies, recovery and use of methane in waste management and energy distribution.

- **Sulfur dioxide (SO_2) :** Sulfur dioxide (SO_2) is mainly produced by the combustion of fuels such as oil and coal and as a by-product from some chemical production or wastewater treatment processes. Emissions can be reduced through the use of alternate fuels such as low sulfur coal, light diesel or natural gas, emission control technologies.
- **Toxics (mercury) :** Mercury exists as elemental mercury, inorganic mercury compounds (primarily mercuric chloride), and organic mercury compounds (primarily methyl mercury). All forms of mercury are toxic and each form exhibits different health effects. A major source of exposure to elemental mercury is through inhalation in the work place. Sources of inorganic mercury compounds are generally low as their use has mostly been banned but limited exposure can occur through the use of old cans of latex paint. Sources of methyl mercury include fungicide-treated grains and meat from animals fed with treated grain.

Where possible, a client's investee's operations should avoid, minimise and control adverse impacts on human health, safety and the environment from emissions to air. The generation and release of air emissions can be managed through a combination of energy use efficiency, process modification, selection of fuels or other materials and application of emission control techniques. A financial institution can help a client investee to identify areas for reductions in air emissions and to identify environmental business opportunities.

5.2.2 Hazardous Materials Use

A client's/investee's operations may require the use of materials that are hazardous. Hazardous materials are materials that represent a risk to human health, property, or the environment due to their physical or chemical characteristics.

These can be classified according to the hazard as explosives, compressed gases, including toxic or flammable gases, flammable liquids, flammable solids, oxidizing substances, toxic materials, radioactive material, and corrosive substances.

A client's/investee's operations may involve the production, handling, storage and use of large quantities of hazardous materials. This can result in uncontrolled releases of hazardous materials or accidents if the necessary measures to prevent accidents

such as fire and explosions or leaks and spills are not in place or the client/investee does not have procedures to respond to emergencies. The client/investee needs to ensure that prevention and control measures are in place to ensure the protection of the workforce and surrounding communities from hazardous materials used at a facility. Typically, prevention and control measures of hazardous materials include:

- **Non-hazardous substitutes.** Avoiding or minimising the use of hazardous materials in processes by using non-hazardous alternatives. For example, there are non-hazardous materials that can be used as substitutes for asbestos in building materials, PCBs in electrical equipment, persistent organic pollutants (POPs) in pesticides formulations, and ozone depleting substances in refrigeration systems.
- **Release prevention and control planning.** When handling hazardous materials, a client/investee needs to develop procedures and practices for quick and efficient responses to accidents. Where there is risk of a spill of hazardous materials, facilities should prepare a spill control, prevention and countermeasure plan, which would include training and drills of key staff on release prevention, inspection programs, and secondary containment structures.
- **Hazard communication and training programs.** Workers should be able to recognise and respond to workplace chemical hazards and have a clear understanding of hazard identification and safe operating and materials handling procedures. This also requires the need for suitable personal protection equipment (PPE includes footwear, masks, protective clothing and goggles), emergency eyewash and shower stations, ventilation systems and sanitary facilities.
- **Hazardous materials transfer.** Uncontrolled releases of hazardous materials may result from small cumulative events or from significant equipment failure associated with events such as manual or mechanical transfer between storage systems or process equipment. Hazardous material releases from processes can be prevented through the use of dedicated fittings, pipes, and hoses, regular inspection and maintenance of fittings, pipes, and hoses, and the use of secondary containment.
- **Overfill protection.** The overfilling of vessels and tanks is among the most common cause of spills resulting in soil and water contamination, and can easily be prevented.
- **Reaction, fire, and explosion prevention.** Reactive, flammable, and explosive materials should be managed to avoid uncontrolled reactions or conditions resulting in fire or explosion. Incompatible materials (acids, bases, flammables, oxidizers, reactive chemicals) should be stored in separate areas, and with

containment facilities separating material storage areas.

- **Secondary containment.** The use of secondary containment is a critical aspect for controlling accidental releases of liquid hazardous materials during storage and transfer. Appropriate secondary containment structures consist of berms, dikes, or walls, made of impervious, chemically resistant material, capable of containing the larger of 110 percent of the largest tank or 25% of the combined tank volumes in areas with above-ground storage tanks (ASTs) with a total storage volume equal or greater than 1,000 liters.
- **Underground Storage Tanks (USTs).** Although there are many environmental and safety advantages of underground storage of hazardous materials, including reduced risk of fire or explosion, and lower vapor losses into the atmosphere, leaks of hazardous materials can go undetected for long periods of time with potential for soil and groundwater contamination. The risk of leaks can be reduced by installing impermeable liners or structures such as concrete vaults under and around tanks, reconciling tank contents by measuring the volume and comparing it against the expected volume, regular testing of the integrity of the tank, and monitoring down-gradient groundwater quality for potential contamination.
- **Pesticide use.** When pest management activities include the use of pesticides, pesticides that are low in human toxicity and have minimal effects on non-target species and the environment should be used. Selected pesticides should be packaged in safe containers, clearly labeled for safe and proper use, and manufactured by a licensed entity. Pesticide should be handled, stored, applied, and disposed of in accordance with best international practice (Food and Agriculture Organization's International Code of Conduct on the Distribution and Use of Pesticides). Pesticides that are categorized as extremely hazardous, highly hazardous, and moderately hazardous by the World Health Organization Recommended Classification of Pesticides should not be used.
- **Where possible.** a client's/investee's operations should reduce the use and/or potential spills and releases of hazardous materials at the facility. A financial institution can help a client/investee to identify environmental business opportunities.

5.2.3 Occupational Health and Safety

Providing workers with a safe and healthy work environment, free from physical, chemical, biological, and radiological hazards inherent in a particular industry sector, is essential for ensuring the long-term sustainability of a client's/investee's operations.

A client/investee is required to implement all reasonable precautions to prevent accidents, injury, and illness of workers in the course of performing their duties. This includes following industry-specific worker's safety standards and implementing preventive and protective measures to :

- **Eliminate hazards** by removing an activity from the work process (such as substitution with less hazardous chemicals or use of different manufacturing processes);
- **Control the hazard** at its source through use of engineering controls (such as local exhaust ventilation, isolation rooms, machine guards, and acoustic insulation);
- **Minimise the hazard** through design of safe work systems and procedural control measures (such as job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, and limiting exposure or work duration);
- **Provide appropriate personal protective equipment (PPE)** in conjunction with training, use and maintenance of the PPE. PPE provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems.

A client's/investee's efforts to protect the health and safety of workers in the design and operation of facilities encompass the following aspects :

- **Integrity of workplace structures.** Facilities should be structurally safe and floors/surfaces should be free of accumulated material.
- **Severe weather and facility shutdown.** Facilities should be designed and constructed to withstand the expected elements for the region and have an area designated for safe refuge of workers.
- **Workspace and exit.** The workspace provided for each worker should be adequate for safe execution of all activities and passages to emergency exits should be unobstructed at all times.
- **Fire precautions.** The workplace should be designed to prevent the start of fires and the facility should be equipped with fire detectors, alarm systems, and fire-fighting equipment.
- **Lavatories and showers.** Adequate lavatory facilities (toilets and washing areas, including hot and cold running water, soap, and hand drying devices) should be provided for the number of people expected to work in the facility and segregated by gender, if necessary.

- **Potable water supply.** Adequate supplies of potable drinking water (meeting drinking water quality standards) should be provided and supplied to areas of food preparation or for the purpose of personal hygiene (washing or bathing).
- **Clean eating area.** A clean eating area needs to be designated within the facility, where workers are not exposed to hazardous or noxious substances.
- **Lighting.** Workplaces should receive natural light and be supplemented with sufficient artificial illumination to promote workers' safety and health, and enable safe equipment operation.
- **Safe access.** Passageways around the facility should be segregated for pedestrians and vehicles; hand, knee and foot railings should be installed on stairs, fixed ladders, and platforms; floor openings should be covered; covers to protect against falling items should be installed; and measures to prevent unauthorised access to dangerous areas should be in place.
- **First aid.** Appropriately equipped first-aid stations should be easily accessible throughout the place of work, including Eye-wash stations and/or emergency showers.
- **Air supply.** Sufficient fresh air should be supplied for indoor and confined work spaces, through appropriate air distribution systems, including heating, ventilation and air conditioning (HVAC).
- **Work environment temperature.** During hours of operation, the temperature in work, rest rooms and other welfare facilities should be maintained at an appropriate level.

Physical hazards in the workplace represent potential risks of accidents, injury or illness due to repetitive exposure to mechanical action or work activity. This may result in a wide range of injuries, from minor and medical aid only, to disabling, catastrophic, and/or fatal. Multiple exposures over prolonged periods can result in disabling injuries of comparable significance and consequence. Physical hazards in a client's/investee's operations stem from the following :

- **Rotating and moving equipment.** Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unexpected movement during operations.
- **Noise.** No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection.
- **Vibration.** Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation

of vibration dampening pads or devices, and limiting the duration of exposure.

- **Electrical.** Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact.
- **Eye hazards.** Solid particles from a wide variety of industrial operations, or a liquid chemical spray, may strike a worker in the eye causing an eye injury or permanent blindness.
- **Welding/hot work.** Welding creates an extremely bright and intense light that may seriously injuri a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases.
- **Industrial vehicle driving and site traffic.** Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios.
- **Working environment temperature.** Exposure to hot or cold working conditions in indoor or outdoor environments can result in temperature stress-related injury or death. Use of Personal Protective Equipment (PPE) to protect against other occupational hazards can accentuate and aggravate heat-related illnesses. Extreme temperatures in permanent work environments should be avoided through implementation of cooling and ventilation.
- **Ergonomics, repetitive motion, manual handling.** Injuries due to ergonomic factors, such as repetitive motion, overexertion, and manual handling, take prolonged and repeated exposures to develop, and typically require periods of weeks to months for recovery.
- **Working at heights.** Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters.
- **Illumination.** Work area light intensity should be adequate for the general purpose of the location and type of activity, and should be supplemented with dedicated work station illumination, as needed.

  Chemical hazards in the workplace represent potential risks for illness or injury due to single acute exposure or chronic repetitive exposure to toxic, corrosive,

sensitising or oxidative substances. They also represent a risk of uncontrolled reaction, including the risk of fire and explosion, if incompatible chemicals are inadvertently mixed. Chemical hazards in a client's/investee's operations stem from the following:

- **Air quality.** Poor air quality due to the release of contaminants into the work place can result in possible respiratory irritation, discomfort, or illness to workers.
- **Fire and explosions.** Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers.
- **Corrosive, oxidising, and reactive chemicals.** Corrosive, oxidising, and reactive chemicals present similar hazards as flammable materials. An additional hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions, which can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any mixing issues.
- **Asbestos containing materials.** The use of asbestos containing materials should be avoided in new buildings or as a new material in remodelling or renovation activities. If asbestos containing materials are present, particularly friable asbestos representing the potential to release fibers, the repair or removal and disposal should be performed according to internationally recognised procedures to prevent worker exposure.

Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. The use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents cannot be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognised exposure limits.

Radiation exposure can lead to potential discomfort, injury or serious illness to workers. Workplaces involving occupational and/or natural exposure to ionising radiation should be operated in accordance with recognised international safety standards and guidelines. Exposure to non-ionising radiation (including static magnetic fields, sub-radio frequency magnetic fields, static electric fields, radio frequency and microwave radiation, light and near-infrared radiation, and ultraviolet radiation) should be controlled according to international standards.

Additional precautions are required for workers in special hazard environments such as a confined space or an isolated workspace. A confined space is a wholly or

partially enclosed space, which is not designed or intended for human occupancy and in which a hazardous atmosphere could develop as a result of the contents, location or construction of the confined space or due to work done in or around the confined space. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. A worker in an isolated space is out of verbal communication and line of sight with a supervisor, other workers, or other persons capable of providing aid and assistance, for continuous periods (exceeding one hour). This puts a worker at increased risk should an accident or injury occur.

A client/investee should establish procedures and systems for monitoring and recording occupational accidents and diseases as well as dangerous occurrences and incidents, to verify the effectiveness of prevention and control strategies in their operations and monitor employee productivity against lost time injury. If a client/ investee does not adequately protect the health and safety of workers in the course of operations, leading to severe injuries, illnesses, and even fatalities, this represents a significant reputational risk and financial liability to the client/investee.

5.3 Risks for Indigenous People

Indigenous People (IP) are recognised as social groups with identities that are distinct from dominant groups in national societies and are often among vulnerable segments of the population.

Indigenous Peoples may be referred to in different countries by such terms as 'Indigenous ethnic minorities', 'aboriginals', 'hill tribes', 'minority nationalities', 'scheduled tribes', 'first nations', or 'tribal groups'.

IP typically self-identify as members of a distinct indigenous cultural group and are recognised as such by others; have a collective attachment to geographically distinct habitats or ancestral territories, making use of natural resources in these habitats and territories; have customary cultural, economic, social, or political institutions that are separate from those of the dominant society or culture; and communicate in an indigenous language, often different from the official language of the country or region.

Indigenous People are often closely tied to their traditional or customary lands and the natural resources on these lands. While these lands may not be under their legal ownership as defined under national law, the use of these lands by communities of IP for their livelihoods or for cultural purposes is often recognised under customary law. However, the economic, social and legal status of Indigenous People often limits their capacity to defend their interests and rights to lands and natural and cultural

resources. Indigenous People are particularly vulnerable if their lands and resources are transformed, encroached upon by outsiders, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also be under threat. These characteristics expose Indigenous People to different types of risks and severity of impacts, including loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and disease.

A client/investee should ensure that during the course of operations, the identity, culture and natural resource-based livelihoods of Indigenous People are respected and exposure to impoverishment and disease is prevented. This includes implementing the following actions :

- **Avoid or minimise adverse impacts.** When a client/investee cannot completely avoid impacts on Indigenous People, the client/investee needs to mitigate or compensate for these impacts in a culturally appropriate manner and with the informed participation of affected Indigenous People.
- **Consultation.** The client/investee needs to establish an ongoing relationship with the affected communities of Indigenous People, which should be culturally appropriate. If there are adverse impacts, the consultation process needs to ensure the free, prior, and informed consultation of the Indigenous People and facilitate their informed participation with respect to proposed mitigation measures and sharing development benefits.
- **Sharing development benefits.** The client/investee needs to identify opportunities for development benefits for affected Indigenous People. This should aim at improving their standard of living and livelihoods in a culturally appropriate manner, including the long-term sustainability of the natural resource on which they depend.
- **Impacts on traditional or customary lands.** If a client's/investee's operations are located within traditional or customary lands or involve the commercial use of natural resources located on these lands, this will generate adverse impacts on the livelihoods or cultural identity of the community of Indigenous People. The client/investee needs to inform affected communities of their rights under national laws, including the recognition of customary rights; make efforts to avoid or at least minimise the size of the impacted land; and offer land-based compensation as well as culturally appropriate development opportunities to affected communities.
- **Relocation of Indigenous People.** The client/investee should avoid the relocation of Indigenous People from their traditional lands. If relocation is unavoidable, the client/investee needs to enter into a good faith negotiation with the affected

communities and ensure that any relocation complies with best international standards.

If a client's/investee's operations are initiated and conducted without the involvement of Indigenous People, this can lead to misunderstanding and conflict. Given worldwide concern for the well-being of Indigenous People, there are significant reputational risks for a client/investee if Indigenous People issues are not managed appropriately.

5.4 Social Impact Assessment

Social Impact Assessment (SIA) includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.The important features of this definition are that :

1. The goal of impact assessment is to bring about a more ecologically, socio-culturally and economically sustainable and equitable environment. Impact assessment, therefore, promotes community development and empowerment, builds capacity, and develops social capital (social networks and trust).
2. The focus of concern of SIA is a proactive stance to development and better development outcomes, not just the identification or amelioration of negative or unintended outcomes. Assisting communities and other stakeholders to identify development goals, and ensuring that positive outcomes are maximised, can be more important than minimising harm from negative impacts.
3. The methodology of SIA can be applied to a wide range of planned interventions, and can be undertaken on behalf of a wide range of actors, and not just within a regulatory framework.
4. SIA contributes to the process of adaptive management of policies, programs, plans and projects, and therefore needs to inform the design and operation of the planned intervention.
5. SIA builds on local knowledge and utilises participatory processes to analyse the concerns of interested and affected parties. It involves stakeholders in the assessment of social impacts, the analysis of alternatives, and monitoring of the planned intervention.
6. The good practice of SIA accepts that social, economic and biophysical impacts are inherently and inextricably interconnected. Change in any of these domains will lead to changes in the other domains. SIA must, therefore, develop an

understanding of the impact pathways that are created when change in one domain triggers impacts across other domains, as well as the iterative or flow-on consequences within each domain. In other words, there must be consideration of the second and higher order impacts and of cumulative impacts.

7. In order for the discipline of SIA to learn and grow, there must be analysis of the impacts that occurred as a result of past activities. SIA must be reflexive and evaluative of its theoretical bases and of its practice.
8. While SIA is typically applied to planned interventions, the techniques of SIA can also be used to consider the social impacts that derive from other types of events, such as disasters, demographic change and epidemics.

SIA is best understood as an umbrella or overarching framework that embodies the evaluation of all impacts on humans and on all the ways in which people and communities interact with their socio-cultural, economic and biophysical surroundings. SIA thus has strong links with a wide range of specialist sub-fields involved in the assessment of areas such as: aesthetic impacts (landscape analysis); archaeological and cultural heritage impacts (both tangible and non-tangible); community impacts; cultural impacts; demographic impacts; development impacts; economic and fiscal impacts; gender impacts; health and mental health impacts; impacts on indigenous rights; infrastructural impacts, institutional impacts; leisure and tourism impacts; political impacts (human rights, governance, democratisation etc); poverty; psychological impacts; resource issues (access and ownership of resources); impacts on social and human capital; and other impacts on societies. As such, comprehensive SIA cannot normally be undertaken by a single person, but requires a team approach.

5.5 The Nature of SIA in an International Context.

The objective of SIA is to ensure that development maximises its benefits and minimises its costs, especially those costs borne by people (including those in other places and in the future). Costs and benefits may not be measurable or quantifiable and are often not adequately taken into account by decision-makers, regulatory authorities and developers. By identifying impacts in advance: (1) better decisions can be made about which interventions should proceed and how they should proceed; and (2) mitigation measures can be implemented to minimise the harm and maximise the benefits from a specific planned intervention or related activity.

An important feature of SIA is the professional value system held by its practitioners. In addition to a commitment to sustainability and to scientific integrity, such a value system includes an ethic that advocates openness and accountability, fairness and equity, and defends human rights. The role of SIA goes far beyond the ex-ante (in

advance) prediction of adverse impacts and the determination of who wins and who loses. SIA also encompasses: empowerment of local people; enhancement of the position of women, minority groups and other disadvantaged or marginalised members of society; development of capacity building; alleviation of all forms of dependency; increase in equity; and a focus on poverty reduction.

SIA complements the economic and technical models that characterise the thinking of many development professionals and agencies. SIA can be undertaken in different contexts and for different purposes. This creates difficulties in defining or evaluating it. The nature of an SIA done on behalf of a multinational corporation as part of that company's internal procedures may be very different to an SIA undertaken by a consultant in compliance with regulatory or funding agency requirements, or an SIA undertaken by a development agency interested in ensuring best value for their country's development assistance. These, in turn, may be very different an SIA undertaken by staff or students at a local university on behalf of the local community, from an SIA undertaken by the local community itself. Each of these applications of SIA is worthwhile, and none should pretend to be the definitive statement. Evaluation of an SIA needs to consider its intended purpose.

Some conceptualisations of SIA are related to protecting individual property rights, with-clear statements of adverse impacts required to ensure that individual rights are not transgressed. Where these rights are violated, SIA could be seen as contributing to mitigation and compensation mechanisms. In these situations, SIA tends to concentrate on the negative impacts. In other contexts, however, particularly in developing countries, there should be less emphasis on the negative impacts on small groups of individuals or on individual property rights. Rather, there should be greater concern with maximising social utility and development potential, while ensuring that such development is generally acceptable to the community, equitable and sustainable.

SIA should also focus on reconstruction of livelihoods. The improvement of social wellbeing of the wider community should be explicitly recognised as an objective of planned interventions, and as such should be an indicator considered by any form of assessment. However, awareness of the differential distribution of impacts among different groups in society, and particularly the impact burden experienced by vulnerable groups in the community should always be of prime concern.

5.5.1. Definition of SIA.

SIA is much more than the prediction step within an environmental assessment framework. Social impacts are much broader than the limited issues often considered in EIAs (such as demographic changes, job issues, financial security, and impacts on family life). A limited view of SIA creates demarcation problems about what are the

social impacts to be identified by SIA, versus what is considered by related fields such as health impact assessment, cultural impact assessment, heritage impact assessment, aesthetic impact assessment, or gender impact assessment. The SIA community of practitioners considers that all issues that affect people, directly or indirectly, are pertinent to social impact assessment. A convenient way of conceptualising social impacts is as changes to one or more of the following:

- People's way of life–that is, how they live, work, play and interact with one another on a day-to-day basis;
- Their culture–that is, their shared beliefs, customs, values and language or dialect;
- Their community–its cohesion, stability, character, services and facilities;
- Their political systems–the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose;
- Their environment–the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- Their health and wellbeing–health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity
- Their personal and property rights - particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties;
- Their fears and aspirations–their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

5.6 Principles Specific to SIA Practice

1. Equity considerations should be a fundamental element of impact assessment and of development planning.
2. Many of the social impacts of planned interventions can be predicted.
3. Planned interventions can be modified to reduce their negative social impacts and enhance their positive impacts.
4. SIA should be an integral part of the development process, involved in all stages from inception to follow-up audit.

5. There should be a focus on socially sustainable development, with SIA contributing to the determination of best development alternative(s)–SIA (and EIA) have more to offer than just being an arbiter between economic benefit and social cost.
6. In all planned interventions and their assessments, avenues should be developed to build the social and human capital of local communities and to strengthen democratic processes.
7. In all planned interventions, but especially where there are unavoidable impacts, ways to turn impacted people into beneficiaries should be investigated.
8. The SIA must give due consideration to the alternatives of any planned intervention, but especially in cases when there are likely to be unavoidable impacts.
9. Full consideration should be given to the potential mitigation measures of social and environmental impacts, even where impacted communities may approve the planned intervention and where they may be regarded as beneficiaries.
10. Local knowledge and experience and acknowledgment of different local cultural values should be incorporated in any assessment.
11. There should be no use of violence, harassment, intimidation or undue force in connection with the assessment or implementation of a planned intervention.
12. Developmental processes that infringe the human rights of any section of society should not be accepted.

5.7 Conclusion

The legal basis of SIA (and thereby increasing standing and public awareness) first emerged in 1969/1970 when the US National Environment Policy Act (NEPA) introduced a requirement to ensure that major federal actions significantly affecting the quality of the human environment were incorporated into a balanced and publicly available assessment of the likely impact of such actions. The inquiry into the proposed Mackenzie Valley gas pipeline from Yukon Territory to Alberta (1974-1978) was the first major EIA case which was overturned for social reasons, due to a failure to consider the impacts on a local tribe. Since then, SIA has been progressively introduced to many countries around the world.

The idea of risk has given birth to major debates among sociologists over two different approaches based on two distinctive conceptual frameworks like nation-state and modernity. Modern scholars like Ulrich Beck and Anthony Giddens, Mary Douglas

and Michel Foucault have examined the possibilities of risk from different angles. Foucault and Douglas view risk as a unreliable ally or potential antagonist; on the other hand Beck believes risk is a potential force and threat to both nation-state power and global capital.

5.8 Model Questions

A. Answer in brief: 5 marks.

1. What is meant by air quality?
2. What is meant by hazardous materials?
3. What do you mean by occupational health and safety?
4. Define SIA.
5. What is Greenhouse Gas?

B. Answer in detail: 10 marks.

6. Make a critical analysis of the types of risk that affect the environment.
7. How occupational health and safety may be secured?
8. Examine, in detail, the risks faced by indigenous people.
9. What is SIA? Discuss, in detail, its nature in an international context.

5.9 Suggested Readings

1. Bolin, Bert and others. 2001. Learning to Manage Global Environmental Risks - A Comparative History of Social Responses to Climate Change, Ozone Depletion and Acid Rain. Vol.I. MIT Press.
2. Cutter, Susan L. (ed.) 1993. Environmental Risks and Hazards. Pearson.
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UNIT–6 : ECO-FEMINISM AND FEMINIST ENVIRONMENTALISM

Structure

6.0 Objectives
6.1 Introduction
6.2 Background of Ecofeminism
6.3 Ecofeminism: An Intellectual History
  6.3.1 Socialist Ecofeminism
  6.3.2 The 1970s: Establishing Women's Relationship with Nature
  6.3.3 The 1980s: Gendering Sustainable Development
  6.3.4 Gender, Environment and Development on the International Agenda : the 1990s
6.4 Gender and Global Environmental Politics: Ecofeminist Contributions
  8.4.1 Liberal Ecofeminism
  8.4.2 Cultural Ecofeminism
6.5 Ecofeminist Perspectives on Environmental Ethics
6.6 Conclusion
6.7 Model Questions
6.8 Suggested Readings

6.0 Objectives

The Unit enlightens the learners about:

- The close relationship between women and gender.
- The core principles of ecofeminism and examines its significance.
- The interconnections and interplay between the different dimensions of ecofeminism.
- The emergence and development of ecofeminist perspective through different periods.

6.1 Introduction

■ **Ecofeminism** is both an ecological philosophy and a social movement that

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draws on environmental studies, critiques of modernity and science, and feminist critical analyses and activism to explicate connections between women and nature, and the implications of these relationships for environmental politics. Ecofeminists themselves embrace a wide range of views concerning the causal role of Western dualistic thinking, patriarchal structures of power, and capitalism in ecological degradation and the oppression of women and other subjugated people. Collectively, they find value in extending feminist analyses to the simultaneous interrogation of the domination of both nature and women. For most ecofeminists, ecological sustainability ultimately depends on elevating the economic and political roles that women play in society at all levels of organization. Thus the study of ecofeminism and ecofeminist movements can be briefly described as the following:

- **Ecofeminism** is an activist and academic movement that sees critical connections between the domination of nature and the exploitation of women. Ecofeminist activism grew during the 1980s and 1990s among women from the anti-nuclear, environmental, and lesbian-feminist movements. The 'Women and Life on Earth: Ecofeminism in the Eighties' conference held at Amherst (1980) was the first in a series of ecofeminist conferences, inspiring the growth of ecofeminist organizations and actions...'– Lois Ann Lorentzen, University of San Francisco, and Heather Eaton, Saint Paul University (2002).
- **Ecofeminism** is a movement that sees a connection between the exploitation and degradation of the natural world and the subordination and oppression of women. It emerged in the mid-1970s alongside second-wave feminism and the green movement. Ecofeminism brings together elements of the feminist and green movements, while at the same time offering a challenge to both. It takes from the green movement a concern about the impact of human activities on the non-human world and from feminism the view of humanity as gendered in ways that subordinate, exploit and oppress women."– From the introduction to 'Feminism & Ecology' by Mary Mellor, New York Univerity Press,1997, p.1.

6.2 Background of Ecofeminism

The major divisions within ecofeminism are liberal, cultural, socialist, and postmodern – as a basis for understanding the utility of gender analyses for global environmental politics (GEP). Specifically, ecofeminism has made critical and significant contributions to the discourses on environmental ethics and the interrelationships among gender, environment, and development. Hence the essay continues with a discussion of environmental ethics that distinguishes ecofeminist

approaches in terms of their appreciation for including care, connection, and responsibility as justifiable foundations for moral action. The essay's final section considers the shift in authority concerning sustainable practices from north to global south that characterises ecofeminism in the twenty-first century. Contemporary international and transnational institutions concerned with environment and development increasingly regard the daily practices of Third World women–many of whom maintain close, respectful, if not caring, relationships with the land–as beacons for sustainable, ecologically sound, economic development. This veritable transfer of power sheds light on the value of the moral commitments underlying relationships between women's socioeconomic political engagement and the ecological sustainability of their communities.

6.3 Ecofeminism: An Intellectual History

The development of ecofeminism as an intellectual thought within feminism and also many ecological fields of study which is closely tied to its history as a transnational social movement that increasingly seeks to improve women's socioeconomic and political opportunities as bases for environmental protection and overall better living conditions. Ecofeminist history may be divided, roughly, into four decade-long periods. Ecofeminism emerged in the early 1970s, coincident with a significant upturn in the contemporary women's and environmental movements. Ecofeminists initially recognised that women have historically–if not also naturally–been more interested in environmental issues than men, and women's activism has been a critical basis for environmental protection since, at least, the Industrial Revolution (Norwood 1993; Caiazza and Barrett 2003). Ecofeminism entered the academy in the 1980s. Ecofeminist activists and scholars focused their attention on the common exploitation of natural resources and women, particularly in the developing world (Shiva, 1993). They criticised governmental and cultural institutions that constrain women's reproductive and productive roles in society, and argued that environmental protection ultimately depends on increasing women's socioeconomic and political power. This moment of ecofeminist unity was mentioned in the Women's Action Agenda 21, presented at the United Nations Conference on Environment and Development (UNCED) in 1992. Ecofeminists in the current post-feminist (Clark-Flory, 2009) and post-environmentalist (Stein, 2008) world are not concerned with theoretical labels of this issue.

6.3.1 Socialist Ecofeminism

Socialist ecofeminism is the most recent iteration of social versions of ecofeminism. Early, Marxist ecofeminists argued that humans, socially constructed in terms of economic production, engaged with a scientifically and technically transformed nature.

They envisioned a socialist society in which the natural environment would be only minimally subjugated as the necessary side effect of providing adequate–never excessive–resources for all people, regardless of social class or gender. Later, social ecofeminists developed a feminist variation of social ecology. They distinguished themselves from cultural ecofeminists by recognizing a materialist connection between nature and all humans, in spite of obvious biological and significant cultural differences between men and women. Social ecofeminists followed suit, arguing that the devastating environmental harm associated with contemporary capitalist society could be remedied only by eliminating all systems of domination, not just the current and specific form of patriarchal domination of women by men that concerns cultural ecofeminists. Thus men and women alike are made responsible for establishing the institutional and behavioural changes necessary to ensure ecological sustainability.

Like their materialist compatriots, Socialist ecofeminists seek to distance themselves from cultural ecofeminists' essentialist stigma, yet attempt to acknowledge and include any number of women's particular lived experiences. As such, socialist ecofeminism provides an alternative, anti-essentialist or conceptual, ecofeminist standpoint emphasizing the social construction of human and non-human nature. This strand of ecofeminism regards nature–whether experienced or consumed directly or as the result of scientific and/or technological transformation–as the basis for all human life. Socialist ecofeminists critique modern capitalist, patriarchal institutions and culture for valuing production, which is associated with capital accumulation by working men, over reproduction, which is solidly within the domain of the world's women. They argue that nature, like women, has been devalued, exploited, and even destroyed by the entwined forces of capitalism and patriarchy. Yet the manner and extent to which this generalisation is true varies historically and geographically, making it theoretically possible for socialist ecofeminists to include the values and viewpoints of women of colour and Third World women in critical analyses of specific environmental problems and related social conflicts.

The politics of managing population growth is often cited as an illustrative case for the critical and explanatory power of socialist ecofeminism. Since the publication of Paul Erlich's ‘The Population Bomb’ in 1968, which restated Thomas Malthus's (1798) fears of social breakdown from overpopulation, environmentalists have regarded population control as essential to the planet's ecological health. Whether or not they are card-carrying members of Zero Population Growth (ZPG), many environmentalists continue to adhere to a two-child cap on family size, if they choose to reproduce at all. The adoption of such ethical restrictions on human reproduction has coincided with the development of ‘the pill’ and other means of family planning during a period of tremendous economic growth and related social mobility for women and minorities

in the world's most industrialised nations. Consequently, populations have remained steady or declined throughout Europe and North America, as well as parts of Latin American, Southeast Asia, and the Middle East (Central Intelligence Agency 2009; United Nations Population Division 2009). Seeking to extend these successes to all Third World nations, development agencies and non-governmental organizations (NGOs) established and supported–both financially and morally–population control measures in industrializing nations.

Socialist ecofeminists criticise their actions, and environmentalists' more general enthusiasm for the population control project for a handful of reasons. At the very least, universal population control strategies ignore the historical process by which family size typically declines with economic growth; thus reducing family size preemptively in agrarian societies that continue to require many hands to work on the land is culturally and ecologically indefensible. Second, governments, agencies, and NGOS have little control over how family planning technologies–from birth control pills and implanted devices, to prenatal testing, to sterilization–will ultimately be used. All are ecologically negative without even touching on questions of gendered human relationships to nature. Third, under conditions of extreme poverty, in places where women, children, and body parts are saleable, enabling desperate people to produce babies for either adoption or organ harvesting is, arguably, ethically reprehensible. Fourth, to the extent that experimental family planning technologies, or those known to be harmful, are 'dumped' into poorer societies, Third World women become 'mindless objects' for study. Finally, this whole discussion of what is good for industrializing societies borders on paternalism, even modern imperialism.

Socialist ecofeminists are on shaky ground. While their intention to interrogate ecological positions that may have been uncritically adopted by Western ecofeminists is admirable, even their empirical critiques cannot actually voice the experiences and viewpoints of 'other' women. Indeed, socialist ecofeminism is not as clearly identified with any faction of the ecofeminist movement as liberal and cultural ecofeminisms are. Socialist ecofeminism is thus promising with respect to its theoretical capacity to engage multiple feminist, ecological positions; however, we arguably have yet to see actual ecofeminist activists who share a socialist standpoint dialogue from multiple and potentially contradictory experiential locations.

6.3.2 The 1970s: Establishing Women's Relationship with Nature

Feminist writer Françoise d'Eaubonne is widely credited as the founder of ecofeminism as both an ecological philosophy and a social movement in the early 1970s. In 1972, d'Eaubonne established the Ecologie-Feminisme (Ecology-Feminism) Centre in Paris; 2 years later, she coined the term ecofeminisme ('ecofeminism') in

Feminism or Death (d'Eaubonne 1974), which blames masculinist culture for excessive population growth, pollution, and other sources of environmental degradation. D'Eaubonne cites the existence of a unique and significant relationship between women and nature and, on that basis, advocates specifically women's environmental activism to save the Earth.

A multidisciplinary collection of scholars echoed d'Eaubonne's recognition of the historical associations between women and nature. In 1974, cultural anthropologist Sherry Ortner (1974) published 'Is Female to Male as Nature is to Culture?' which argues that women's subordination to men is rooted in their symbolic connection to nature. A year later, Christian theologian Rosemary Radford Ruether was among the first ecofeminists to explore connections between sexism, racism, anti-Semitism, environmental destruction, and other forms of domination in 'New Woman, New Earth' (Ruether 1975). Susan Griffin, a poet, essayist, playwright, and screenwriter, completed the widely acclaimed 'Woman and Nature: The Roaring Insider Her' (1978) - an extended prose poem that pits scientific logic against women and life generally in 1978. Environmental historian and philosopher Carolyn Merchant followed this intellectual assault on scientism with a more academic treatise–'The Death of Nature: Women, Ecology, and the Scientific Revolution' (1980)–about how modern science's mechanistic worldview has enabled the simultaneous exploitation of nature and subordination of women.

6.3.3 The 1980s: Gendering Sustainable Development.

These early years of the expanding ecofeminism movement also coincided with the establishment of the United Nation's Decade for Women, (1975-85) during which UN-sponsored meetings brought hundreds of international and non-governmental organisations and tens of thousands of women–including some ecofeminists–together to consider issues associated with the status of women (Zinsser 1990). Notably, the relationship between women and the natural environment was among the "critical issues" discussed. Participants concluded that environmental degradation and pollution are destroying fragile ecosystems worldwide and displacing communities, which increasingly threatens the sustainability of safe and healthy environments, especially for (poor) women and their children. Women's actions are consequently essential to the institution of sustainable, ecologically sound patterns of production and consumption and approaches to natural resource management (United Nations Division for the Advancement of Women 1995).

Ecofeminist scholarship and activism had generated sufficient interest and discourse by the early 1980s to support the publication of a number of anthologies now regarded as central to the subfield, and indicative of ecofemimists' efforts to encourage inclusivity

and celebrate difference. The first of these was ‘Reclaim the Earth: Women Speak out for Life on Earth’, edited by activists Stephanie Leland and Leonie Caldecott (1983). Perhaps more characteristic of ecofeminism's second decade, which included both the movement of ‘global warming’ to centre stage internationally and the end of the Cold War, was ‘Healing the Wounds: The Promise of Ecofeminism’, edited by activist, writer, and ecologically conscious publisher Judith Plant (1989). Petra Kelly, the environmental and peace activist credited as a founder of West Germany's Green Party in 1979, sets the tone in her foreword to the volume, addressed to her ‘Dear Sisters’:

To eliminate war and its tools, to eliminate racism and repression, we must eliminate its causes. Our call to action, our call for nonviolent transformation of society is based on the belief that the struggle for disarmament, peace, social justice, protection of the planet Earth, and the fulfillment of basic human needs and human rights are one and indivisible

Healing the Wounds includes 25 chapters by women activists, athletes, journalists, performance artists, scholars, theorists, therapists, writers, a mediator, and a scientist that collectively describe ecofeminist philosophy and locate it as a movement in terms of contemporary politics, spirituality, and community-building efforts. ‘Reweaving the World: The Emergence of Ecofeminism’, edited by Irene Diamond and Gloria Orenstein (1990), includes chapters by many of the same contributors, yet provides a more academic treatment of ecofeminism that differentiates it from Deep Ecology and delineates ecofeminist approaches for responding to the ongoing environmental crisis.

When considered in rough chronological order, these texts support Sturgeon's (1997) argument that the virulent women's peace activism associated with the 1980s did not transform ecofeminism; rather, ecofeminism strongly influenced peace politics during this period. The 1980 Women's Pentagon Action, in which 2,000 women surrounded the Pentagon to protest nuclear war and weapons development, in particular, was arguably a WLOE phenomenon. Likewise, ecofeminists' support for, and participation in the Greenham Common Women's Peace Camp grew out of the WLOE. It originated when a group of predominantly women protesters under the WLOE banner marched 125 miles, from Cardiff in South Wales to the Royal Air Force base at Berkshire, England, seeking to meet with John Nott, who was then minister of defence. When Nott refused, the marchers protested by creating a camp that remained there until September 2000, when the last of the protestors left the site. These ecofeminist actions occurred simultaneously with an increase in significant scholarly meetings, from a relatively small conference on ecofeminism held at California State University, Sonoma, in 1981, to a major conference at the University of Southern California, organised by Irene Diamond (a political scientist) and Gloria Orenstein (a

scholar of literature and gender studies)–Ecofeminist Perspectives: Culture, Nature, Theory–to commemorate the 25th anniversary of the publication of Silent Spring, by Rachel Carson (1962).

6.3.4 Gender, Environment, and Development on the International Agenda: the 1990s.

Diamond and Orenstein later published ‘Reweaving the World: The Emergence of Ecofeminism’ (1990), an anthology that, consistent with ecofeminist collections to date, included scholarly articles as well as essays and poetry and served as a major resource on the theory, philosophy, politics, and activism of practising ecofeminists. In contrast, Hypatia: A Journal of Feminist Philosophy published a special issue on ecological feminism a year later, solidifying a place in the academe for ecofeminism; it was reprinted in 1996 as ‘Ecological Feminist Philosophies’, edited by Karen Warren. Warren also published the anthology Ecological Feminism (1994), which seeks to provide a specifically philosophical explanation for why we must understand the natural environment as a feminist issue. Warren (1994) explains that what makes ecofeminism feminist is simply its inherent "commitment to the recognition and elimination of male-gender bias wherever and whenever it occurs, and to the development of practices, policies, and theories which are not male-gender biased" (Warren 1994). Ecofeminism's "understanding of and commitment to the importance of valuing and preserving ecosystems" (Warren 1994) renders it ecological.

While this conceptual shift away from emphasising women's essential connection to earth appears to signal a breach between ecofeminist philosophy and ecological feminist activism, it more accurately illuminates heightened awareness of heretofore inadequately examined aspects of ecofeminism. Mark Soma and Sue Tolleson-Rinehart (1997) in particular address a fundamental question inherent in much scholarly ecofeminist literature: ‘‘is it women's biology, or feminine inculturation, that explains their environmentalism in the United States and Europe?’’ Their analysis suggests that the ‘feminist orientations’ of men as well as women can explain political support for environmental protection. This conclusion supports Ariel Salleh's (1997) argument that men as well as women should be regarded as being ‘close to nature’; however, "attaining the prize of masculine identity which typically depends on men distancing themselves from that fact" (Salleh 1997). While Salleh seeks to combat environmental degradation by strengthening women's identification with nature via alliance between women's and indigenous movements, Sturgeon's (1997) interrogation of gender and other essentialisms positions ecofeminism as a basis for creating ‘‘an anti-essentialist coalition politics while deploying a strategic politics of identity’’ (Sturgeon 1997). In

contrast, Catriona Sandilands' 'The Good-Natured Feminist' (1999) suggests that the most constructive way through the gender-identity minefield of environmental activism is to provide nature a voice by privileging democracy over identity in a radical, democratic politics of nature.

Scholarly movement away from explaining what ecofeminism is in inclusive terms to critiquing and contextualising ecofeminist philosophy and women's environmental activism mirrors the substance of ecofeminists' political engagements through much of the post-Cold War period. With the threat of imminent nuclear annihilation dampened, ecofeminist activists returned to an engagement with women–poor women and members of indigenous societies, in particular–and their actual interactions with the natural environment. Indeed, the worldwide range of plausibly ecofeminist actions had become so extensive by the mid-1990s that Maria Mies and Vandana Shiva opened Ecofeminism (1993) with the admission that "perhaps it was wiser to accept these differences, instead of trying to contain them within such a universalistic term as ecofeminism" (Mies and Shiva 1993). In addition to oft-referenced instances of ecofeminist activism, such as Lois Gibb's establishing the Citizen's Clearing House for Hazardous Waste and the Chipko women's resistance to logging in the Himalaya mountains, women had, by then, become prominent in protests against nuclear power in the United States and Europe, deforestation in Ecuador (Ress 2006), desertification in Kenya, and chemically and genetically modified food in four continents. Throughout much of the global south, women were also increasingly visible on the front lines of campaigns: for access to fresh water, to conserve soil in the interest of sustainable agriculture, for universal health care, and to establish schools.

During this period of accelerating globalisation, scholars and activists alike focused on the interrelationship between the effects of uneven patterns of economic growth and development, such as scarcity, environmental degradation, and conflict, and women's empowerment and human rights. Perhaps most importantly, in 1991, Bella Abzug, an American legislator and champion of women's rights, and Mim Kelber, a feminist writer and journalist, established the Women's Environment and Development Organization (WEDO). Although WEDO is not an ecofeminist organisation in name, its advocacy for women's leadership as a means to "achieve economic, social and gender justice, a healthy, peaceful planet and human rights for all" (www.wedo.org/aboutus.aspx) clearly reflects ecofeminists' vision. By the end of that year, WEDO had organised and held the World Women's Conference for a Healthy Planet in Miami, Florida, which was attended by ecofeminist scholars representing a range of academic disciplines and a wide range of environmental and women's activists. The goals of the event were: (1) to produce a Women's Action Agenda for delivery and discussion at the then upcoming 1992 UNCED, or "Earth Summit" to be held in Rio de Janeiro,

Brazil; (2) to initiate action to ensure that all Earth Summit delegations would be gender-balanced; and (3) to facilitate the growth of an international network of women acting in solidarity to ensure a strong women's voice on all issues pertaining to the environment and development. The Miami conference yielded the Women's Action Agenda 21, a policy document that relates the experiences of diverse groups of women in localised environmental actions to a critique of mainstream liberal-democratic economic and military processes and which was discussed widely during the Earth Summit (Leach 2003).

6.3.4. Twenty-First Century Ecofeminism

With a keen awareness of activists' efforts to address current ecological crises from a women-and-development perspective, contemporary ecofeminist scholars have increasingly emphasised women's global citizenship and participation in democratic processes of economic, environmental, and security policy making. Following Sturgeon's (1997) call for a more inclusive ecofeminist politics - even though, in practice, any given women's standpoint might be used strategically - Sandilands (1999) locates ecofeminism squarely in the context of contemporary democratic theory. In its efforts to establish a genuinely global environmental politics founded on the particular standpoint of some women, ecofeminism has paradoxically increased the number and diversity of actual women's voices its philosophies and practices seek to include. She argues that the resulting proliferation of discourses around nature which is a crucial part of democratic ecological politics; opening up nature to multiple interpretation means that experiences of nature can be democratised and offers up the possibility of thinking of nature as an actor in the process of co-constructing the world.

Sandilands's early recognition of the democratic potential inherent in ecofeminists' contending standpoints has become more prevalent among ecofeminist scholars. Joni Seager (2003) urges feminist environmentalists to transcend ecofeminist debates surrounding women's essential nature, historically caring practices, and ecological responsibilities in the interest of confronting the current environmental crisis quickly and appropriately. Most recently, in 'Beyond Mothering Earth: Ecological Citizenship and the Politics of Care' (2006), Sherilyn MacGregor seeks to elevate women's citizenship and civic action without jeopardising the centrality of interpersonal relationships and care work to many women's motivations for environmental activism.

6.4 Gender and Global Environmental Politics: Eco-feminist Contributions.

As both an ecological philosophy and a social movement, ecofeminism embodies a multifaceted critique of global environmental politics. In contrast to mainstream

approaches to global environmental politics, which focus on the role of the nation-state or institutions in global, collective efforts to protect and manage the natural environment, feminist critiques emphasise the contextualised experiences of women in politics. Ecofeminism examines these experiences specifically as they pertain to nature and the natural environment, especially the daily practices and environmental activism of women living in industrialising nations. The major strands of ecofeminist thought and action may be distinguished on the basis of both their conceptualisations of nature and our relationship to it, and their epistemological orientations. Each of these strands–liberal, cultural, socialist, and postmodern–corresponds to an (eco)feminist perspective on environmental ethics, and suggests a particular gender-sensitive approach to sustained environmental protection (Lahar 1991).

6.4.1 Liberal Ecofeminism

Liberal ecofeminism has become practically mainstream. Liberal ecofeminists attribute current environmental problems to economic growth, which has accelerated and diffused from Europe and North America to the industrialising south with insufficient attention to its myriad ecological impacts. Furthermore, and consistent with conventional, social scientific studies, liberal ecofeminists distinguish between human and non-human nature and recognise that individuals working within existing domestic political and intergovernmental systems have the capacity to manage, if not control, the natural environment. They argue that as women gain political influence as a consequence of their greater access to education and participation in the economy throughout much of the world, their contributions to environmental politics and policy will increase in number and significance. Liberal ecofeminists, furthermore, trust empirical studies of women and environmental politics to document women's efforts to develop and implement ecologically conscious, gender-sensitive policy both within and between nations.

Liberal ecofeminists are frequently criticised for their optimistic reliance on government to ensure a level of environmental protection that reflects how women experience and value nature. To date, women continue to lack political power relative to men so that, arguably, any efforts by ecofeminists to reform existing patriarchal, naturist political institutions would ultimately be counterproductive. Ecofeminists and their political representatives are as likely to be transformed by the system they seek to affect as they are to change ecologically regressive government institutions. Merchant (2005) explains that although women do have many and varied opportunities to participate in environmental politics and policy making–internationally, if not also within their own nations–they rarely consider themselves to be feminists or regard the natural environment as a feminist issue. Those who do are frequently indistinguishable

from their male counterparts in terms of their support for social equality, horizontally organised institutions, and networking with like-minded members of other environmental agencies and organisations.

6.4.2. Cultural Ecofeminism.

In contrast to their liberal sisters, cultural ecofeminists argue that women's personal and spiritual connections to nature follow from the ways in which they are biologically and culturally different from men. They are the standard-bearers of the ecofeminist movement, which, since its formal emergence in the early 1970s, has been widely understood as a direct and potent response to the mutual association and devaluation of women and nature, particularly in contemporary Western culture. They argue that, historically, women have been viewed as closer to nature by virtue of their physiology, social roles, and psychological makeup. According to Merchant,

Physiologically, women bring forth life from their bodies, undergoing the pleasures, pain, and stigmas attached to menstruation, pregnancy, childbirth, and nursing, while men's physiology leave them freer to travel, hunt, conduct warfare, and engage in public affairs. Socially, childrearing and domestic caretaking have kept married women close to the hearth and out of the workplace. Psychologically, women have been assigned greater emotional capacities with great ties to the particular, personal, and present than men who are viewed as more rational and objective with a greater capacity for abstract thinking.

Cultural feminists blame patriarchal culture and associated economic and political systems for the current state of environmental degradation, and maintain that women's experiences with and connection to nature provide more valid bases for environmental policy. Consequently, they call for direct social action to establish new systems of exchange and governance consistent with a justly higher regard for both women and nature.

At minimum, cultural ecofeminists differentiate women from men with respect to their closer relationships to nature, and question men's simultaneous domination of women and nature. Some go further to embrace and valorize women and all that would be considered culturally feminine–from women's biological capacity to bear children, to their socialization as caretakers, to their relationship-oriented habits of mind. Such cultural ecofeminists draw on archeological evidence from Neolithic Europe to argue that prehistorical agrarian societies were characteristically peaceful and identified by goddess worship. They blame invasion Eurasian tribes–perhaps in combination with significant population growth, the development of highly diversified economies, and the establishment of more complex systems of governance–for patriarchy and associated cultural domination and religious demonization of women.

Thus their positive re-evaluation of cultural associations between women's biology and primary reproductive role in society provides a compelling basis for personal empowerment, collective identity, and environmental activism.

Cultural feminism has been terrifically effective as a source of women's ecological concern and resulting social action. Women's identification with their roles as (prospective) life-givers, in contrast to men's roles as destroyers of life through support for weapons and other harmful technologies, as the chief motivation for their environmentalism. In this sense, cultural ecofeminism easily accounts for women's opposition to nuclear weapons and war is well as chemically dependent factory farming and hazardous waste dumping. However, from the start, this strand of ecofeminism has faced sharp criticism for being essentialist–in terms of both biological determinism and universalism.

Perhaps fortunately, then, cultural ecofeminists are wrong with respect to any wholesale triumph of 'nature over nurture.' While current research in evolutionary biology, psychology, and sociology suggests that whether or not women actually are closer to nature is, at best, a hotly contested question, it is manifestly clear that identification with non-human nature, as well as the capacity to establish and maintain relationships, including that involved in raising children, is not necessarily constrained by gender–or race or class, for that matter. Young people, grandparents, society's economically disadvantaged and disenfranchised members, and others in positions of submission and servility are often more likely than others to engage in the day-to-day caretaking practices that arguably prompt ecological awareness and environmental activism.

6.5 Ecofeminist Perspectives on Environmental Ethics

Ecofeminists' most significant contributions to global environmental politics feature cogent critiques of environmental ethics. Much of the literature on ethics that is relevant to thinking about the politics of transboundary and global environmental problems is distinguished by a common effort to incorporate the moral treatment of the natural environment and non-human species into traditional ethical frameworks–e.g., utilitarianism or Kantian reasoning - which premise moral action on the definition of universally applicable rules. Even the most progressive of these approaches typically fail to appreciate the everyday, and often very individualised, contexts in which moral dilemmas concerning the natural environment arise and decisions are made. Ecofeminists' demands for women's equal and explicit inclusion in global environmental politics reflect their conviction that women's particular relationships to, experiences with, and views on the natural environment matter. This appreciation for individual,

even emotional, relationships with nature locates ecofeminist perspectives on environmental ethics among the so-called radical or alternative variants. Aldo Leopold's (1970) land ethic, for instance, is a matter of both cognizance of, and identity with, nature and nonhuman species as members of a common community. Likewise, Karen Warren's (2000) care-sensitive ecofeminist ethic posits that emotions particularly those associated with our capacity to care, are central to moral reasoning.

6.6 Conclusion

Ecofeminists are among those social activists who are convinced that women's social, economic, and political empowerment is essential for local, regional, and global ecological sustainability. Initially, predominantly white, western ecofeminists positioned themselves as sources of knowledge for women of colour and Third World women seeking improved standards of living, including greater environmental quality. By the end of the twentieth century, ecofeminists were increasingly looking to women in industrialising nations and indigenous communities for guidance regarding how humans can live sustainably in today's modern and globalising world. They also believe that women of the third world with peasant and /or tribal background all suffer from effects of maldevelopment even though they are the storehouse of traditional knowledge and skills. They have immense knowledge about nature, forests, rivers and ecosystems in general and act as the protectors and nurturers of the ecosystem. Ecofeminism, as a modern perspective, challenges the thought processes of patriarchy and maldevelopment encouraged by industrial economy.

6.7 Model Questions

A. Answer in brief. 5 marks.

1. What is ecofeminism?
2. What is cultural ecofeminism?
3. What is meant by socialist ecofeminism?
4. Point out the differences between liberal and socialist perspectives of ecofeminism.

B. Answer in detail. 10 marks.

5. Make a critical estimation of different strands of ecofeminism in detail.
6. Discuss, in detail, the intellectual history of ecofeminist perspective.

6.8 Suggested Readings

1. Adams, Carol J. (Ed) 2016. Ecofeminism Feminist Intersections with Other Animals and the Earth. 2019. Bloomsbury Publishing India Pvt. Ltd.
2. Griffin, Susan. 2016. Woman and Nature: The Roaring Inside Her. Counterpoint.
3. Warren, Karen J.(Ed). 1997. Ecofeminism Women Culture Nature. John Wiley & Sons.

UNIT–7 : POLITICAL ECOLOGY

Structure

7.0 Objectives
7.1 Introduction
7.2 Meaning of Political Ecology.
7.3 The Emergence of Environmental Policy
7.4 Political Challenges to Environmental Protection
7.5 National Environment Policy, 2006.
9.5.1 Objectives of the National Environment Policy, 2006
9.5.2 Policy Initiatives/ Formulations
9.5.3 Policy Implementation.
7.6 Conclusion
7.7 Model Questions.
7.8 Suggested Readings.

7.0 Objectives

The learning objectives of this unit include:

- Examination of the history of Environmental Policy.
- Understanding the challenges and threats against the environment.
- Detailed analysis of the National Environment Policy, 2006.

7.1 Introduction

The importance of environment is an integral part of development. All sectoral development programmes will take environmental considerations fully in account. Environmental problems encountered in the field of environment in India arise due to conditions of poverty and underdevelopment and also, the negative effects of development programmes which have been badly planned and badly implemented. Environment includes everything on this earth, everything that influences man, therefore, it is necessary to have a comprehensive policy which can really protect environment from environmental degradation. It is a global phenomenon and even the developed countries of the world are facing this problem. Hence, it is highly unlikely that new

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environment policy would solve all environment related problems in India. The right to development must be fulfilled in such a way as to meet equitably development and environmental needs of the present and future generations. Environmental protection should be an integral part of the development process. An appropriate methodology should be formulated to restore the environmental values of forests, which are unavoidably diverted to other use. There is no gain in saying the fact that economic development disturbs ecology and creates some imbalances between the two. The problem is acute and disturbing when development takes precedence over fragile ecosystem. Both economic experts and environmentalists agree that the ecology and economy should work hand in hand, but How to balance the two remains the moot question that should be answered with prudence and justification. The comflicts, if any, between the two pillars of ecology and development should be avoided and there should be a harmonious existence of the two.

In 1972, the world manifested its concern for the environment by organising a conference at Stockholm. The U.N. Conference on 'Human Environment' as it was called, alerted the nations to the growing threat to the very survival of the human race and civilisation as a result of the mindless destructions of the environment. The conference recognised needs for the government to act if mankind were to use the significant outcome of that conference as the political agenda of nations. The U.N. Conference held in June, 1972 at Stockholm formulated not only plans and financial arrangement to fructify the same, but also concluded that–

1. Man has the fundamental right to freedom, an environment of quality that permits a life,
2. Man bears a solemn responsibility to protect the future generations.

For purpose of environmental protection, Government acted at different times at Legislative and Executive levels. Mandate and legislative measures of the Arts-47, 48, 49 refer to the problems and directives provisions incorporated in the constitution as it includes Act 48A, 51A. These provisions contain rights for citizens to protect and improve the environment. It would be reasonable to assure that the fundamental duty was to involve the citizens for protecting the environment. The last few years in this crucial area are significant, however, towards protecting the environment from policies that go in the name of development. Environmental activists, peasants, teachers, scientists and concerned citisens have played a leading role in bringing to light projects that endanger the environment. Though protections have been sought from the government, protections against the govenrment's arbitrary environmental policies are also very important for future environmental activism.

7.2 Meaning of Political Ecology

Political ecology involves the examination of politics of the environment. It believes that environmental issues, including its degradation, can never be truly understood as minor or simple objective problems that can be fixed with some technical or scientific corrective measures. Political ecology refers to the ecology of politics or the role the natural resources and their related processes of distribution, allocation and extraction that shape the character of political and social institutions of a society. On the other hand, politics of ecology refers to the study of the relationships between environment related issues, interests, movements, and unequal access of environment to different social groups. Ecological conditions impact, in multiple ways, the present and future growth of social structures and institutions; it also poses challenges and opportunities for meeting people's basic social needs. Ecology is political because resources are limited; distribution of limited resources among the endless numbers become definitely problematic and decisions regarding who gets what and how much depend on local and international power play with considerations of hierarchies, privilege etc.

Political ecology is a young branch of study, having emerged in the 1970s when anthropologists first started to examine the connection between ecology and political economy for understanding environmental agitations. Among the scholars who came forward to explain the intimate connection between social power and functioning of ecology, we can name Dianne Rocheleau, Arturo Estobar, Richard Peet, Piers Blaikie, Bunyan Bryant, Eric Wolf, Johnston Barbara and several others. They have relied on social science theories to analyse the nature of access to and control over environmental resources, production and consumption of resources, and also to understand the various forms of environmental problems, degradation and rehabilitation. In the decades of 1960s and' 70s, the proliferation of peasant studies and critiques of colonialism encouraged an interest in the changing ecological scenario and community relationship in the backdrop of shifting world order. Questions regarding class differentiation in rural societies, peasant mobilisation against the colonial rule and the pressure of international market on rural poor in the developing countries started to get raised under the strong influence of Marxist ideology.

Scholars of political ecology have built up a solid body of knowledge of environmental practices of different ethnic groups, classes, races and genders; they study their stakes and measures to solve the social-environmental problems. They have also tried to understand the significance of wider economic, political structures as well as cultural discourses that determine the relationship between people and their environmental conditions.

Political ecology rests on the conviction that questions of power can never be separated from environment. It appears as the study about distribution of power, production regimes and an analysis of ecology by combining ecology with the principles of political economy.

7.3 The Emergence of Environmental Policy

Environmental policies are formulated by any organisation, public or private, for protecting the safety or security of the environment. These policies express a commitment to the laws, regulations and other policy mechanics concerning environmental issues like air and water pollution, waste management, ecosystem management, maintenance of biodiversity, protection of natural resources, wildlife and endangered species. These policies are usually adopted to direct and oversee human activities for the purpose of preventing harmful effects on the bio-physical environment and natural resources and thus to ensure the harmonious coexistence of the natural and human worlds.

Environmental policies are concerned with the physical ecosystem and its social and economic dimensions like quality of life and health,resource management, biodiversity among other things. Thus these policies act as guards against all the negative human impacts on the natural and social worlds. The Government of India, from the very beginning, is interested in the protection of the environment and so has included several provisions to that effect within the constitution itself.Article 48 of the Directive Principles of State Policy states that the state shall endeavour for the protection and improvement of the environment and shall also safeguard the forests and wildlife of the country. Article 51-A makes every citizen of India aware of his/ her duty to protect and improve the natural environment.

In the early 1970s the environmental feasibility of economic growth became an issue of governmental concern in its own right for the first time in India. The impetus came from the 1972 United Nations Conference on Human Environment in Stockholm. This reflected the international trend. Before, there had been environmentally relevant disputes, for instance, over the use of water or forests. In the case of India, such historical developments have recently been parts of academic interest. However, it was only when the very survival of humankind was perceived to be threatened because of ecological degradation that environmental policies and bureaucracies began to emerge at national and international levels.The Stockholm conference was of lasting impact in this sense.

Even back in 1972, the then Prime Minister of India, Mrs. Indira Gandhi returned from Stockholm having become something of an environmentalist herself. Indira

Gandhi saw herself as a leader not only of her nation but of the Third World in general and was therefore eager to pursue what she saw as a progressive issue. More important, she used this, and other issues, to centralise power. Forests, water and energy had previously fallen exclusively under state legislation. Pressing environmental concerns provided an opportunity for constitutional reform, increasing the influence of the central government. Finally, Indira Gandhi perceived the chance of using environmental issues in order to politically mobilise mass frustration by predominantly symbolic means. In 1974, the Water (Prevention and Control of Pollution) Act was passed. Since then, there has been ample legislative activity in India. In 1976, the constitution was amended in order to include environmental protection among the principles ruling the State Policy and individual behaviour as well:

- The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife. (Art. 48A)
- It shall be the duty of every citizen of India … to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures. (Art. 51A)

India is also one of the signatories of the treaty prepared at the Convention on Biological Diversity (CBD), 1994. But many years before that the country had taken several important steps towards the protection of its environment; for example, The Indian Wildlife Protection Act, 1972 and its various amendments; the National Forest Policy (1988) with conservation as its fundamental principle; the Environment (Protection) Act of 1986 and Foreign Trade (Development and Regulation) Act was passed in 1992 for control of biodiversity.

International environmental politics continued to affect the Indian government, as has been exemplified by the Montreal Protocol the international agreement to phase out ozone-depleting substances. While Indian diplomacy played a role in securing funds for poor nations to pursue this goal, the government had difficulty in developing a national strategy of its won.

7.4 Political Challenges to Environmental Protection

(a) Environmental Planning:

In February 1972 a National Committee on Environmental Planning and Co-ordination (NCEPC) was established under the Department of Science and Technology. This was the apex advisory body in all the matters pertaining to environmental protection and improvement. The committee was assisted by Department of Science and Technology and an Office of the Environmental Planning and Co-ordination (OEPC) was set up under the direction of the Chairman of the committee.

(b) Fifth Five Year Plan :

The fifth five-year plan (1974-79) stressed the need to have a close association with National Committee on Environmental Planning and Co-ordination regarding all major industrial decisions so that environmental goals are fully taken into account. It also stressed that in the process and pursuit of development there should not be any reduction in the quality of life and the link was very much stressed between developmental planning and environmental management.

(c) Sixth Five Year Plan:

In the sixth five year plan (1980-85) an entire chapter on 'Environment and Development' was included which emphasises sound environmental and ecological principles in land use agriculture, forestry, wildlife, water, air, marine environment, minerals, fisheries, renewable energy sources, energy and human settlements. It provided guidance on environmental concerns to administrators and resource managers in formulating and implementing programmes and to lay down an institutional structure for environmental management in the Central and State Governments.

(d) Tiwari Committee (1980):

The Government of India set up a committee in January 1980 under the Chairmanship of Shri. N.D. Tiwari, then Deputy Chairman of the Planning Commission to review the existing environmental legislation and recommend legislative measures and administrative machinery for environmental protection. The committee stressed the need for the proper management of the country's natural resources of land, forest and water in order to conserve the nation's ecological bases.

7.5 National Environment Policy, 2006

The National Conservation Strategy and Policy Statement on Environment and Development, 1992 was one of the first attempts of the Government of India to develop a policy framework for environmental protection. The National Forest Policy, 1988 and the Policy Statement for Abatement of Pollution, 1992 are some other policy frameworks that advocate effective environmental management at the national level.

However, a need was felt to bring together the guiding principles of all these documents and develop a comprehensive national environmental policy. Consequently, the National Environment Policy was put together after widespread consultation and was approved by the Union Cabinet on 18th May 2006. The National Environment Policy, 2006 (NEP, 2006) does not displace earlier policies but builds upon them.

7.5.1. Objectives of the National Environment Policy, 2006

Following are the objectives that were kept in mind while framing the National

Environment Policy, 2006 by MoEF, Government of India.

1. Conservation of Critical Environmental Resources: To protect and conserve critical ecological systems and resources, and invaluable natural and man-made heritage, which are essential for life-support, livelihoods, economic growth, and a broad conception of human well-being.

2. Intergenerational Equity: To ensure judicious use of environmental resources to meet the needs and aspirations of the present and future generations.

3. Integration of Environmental Concerns in Economic and Social Development : To integrate environmental concerns into policies, plans, programmes and projects for economic and social development.

4. Efficiency in Environmental Resource Use: To ensure efficient use of environmental resources in the sense of the reduction in their use per unit of economic output, to minimize adverse environmental impacts.

5. Environmental Governance: To apply the principles of good governance (transparency, rationality, accountability, reduction in time and costs, participation, and regulatory independence) to the management and regulation of the use of environmental resources.

6. Enhancement of Resources for Environmental Conservation: To ensure higher resource flows, comprising finance, technology, management skills, traditional knowledge and social capital for environmental conservation through mutually beneficial multi-stakeholder partnerships between local communities, public agencies, the academic and research community, investors, and multilateral and bilateral development partners.

7. Livelihood security of the poor by integrating environmental concerns for socio-economic development. Preparation of strategy for conservation of resources in land, forests and among wildlife.

8. Biodiversity action plan has also been undertaken for the protection of wetlands, conservation of manmade heritage, identification of environmentally sensitive zones. Plans for sustainable development of mountains and coastal resources and protection of freshwater resources like rivers and groundwater have also been incorporated.

7.5.2. Policy Initiatives / Formulations

International environmental politics continued to affect the Indian government, as has been exemplified by the Montreal Protocol the international agreement to phase out ozone-depleting substances. While Indian diplomacy played a role in securing funds for poor nations to pursue this goal, the government had difficulty in developing a national strategy. Further, after nearly two decades, the issue was seriously pursued

after Kyoto Protocol in 1997 in which the Clean Development Mechanism was created and developed countries were asked to use Certified Emission Reduction (CER) credits from project activities in developing countries in achieving their sustainable development objectives.

The hopes are raised in the decisions taken in Eighth Conference of Parties (COP 8) of the UNFCCC organised in Delhi in Oct-Nov, 2002 that it will tremendously help in raising the awareness level in the country regarding climate change and would demonstrate to the world the impressive strides made in India in various sectors in conformity with sustainable development. The conference would also provide an opportunity to project what India can offer to the world, particularly the developing countries by way of its Environmental management Technology (EMT) in various sectors like industry, transport, power, renewable energy, agriculture and forestry (Sharma: 2009). India rectified the Kyoto Protocol in 2002 (commonly known as Delhi Declaration) and being a developing country it was not required to cut emissions, but it has developed certain mechanisms to reduce emissions. The primary legislations in India in this regard have already been a) National Hydro Policy, 1998, b) Energy Conservation Act 2001, and c) a national bio-diesel Policy is also being considered to encourage the use of bio-diesel.

Besides, other voluntary provisions which tend to reduce carbon emissions through reduction of energy use in buildings are considered. These are 1) TERI GRIHA - green rating for integrated habitat assessment is a rating system for green buildings and 2) LEEDS system - Leadership in Energy and Environmental Design encourages and accelerates adoption of sustainable green building standards.

After Delhi Declaration in 2002 the following measures of Indian government can be taken into account:

1. Capacity building at appropriate levels for taking environment consideration in social, economic and development planning into account,
2. Impact assessment including impacts on food and water resources, ecosystem and bio-diversity, human sentiments and human health,
3. Promotion of scientific and technological research and systematic observation with a view to furthering understanding,
4. Education, training and public awareness and
5. Enhancement of international co-operation in pursuance of objectives of United Nations Framework Convention on Climate changes.

In view of the recent hue and cry over environmental protection and sustainable development as Millennium Goals, the government of India showed enthusiasm in chalking out plans and policy measures. The Indian Prime Minister Dr Manmohan

Singh released national climate action plan on June 30, 2008, which had eight missions; the emphasis on solar energy is bound to generate the most excitement as this sector has been lagging behind other segments of renewable power sources. The eight national missions are - Solar Mission, Mission for Enhanced Energy Efficiency, sustainable habitat, water preservation, sustaining Himalayan Ecosystem, Green India Mission, Sustainable Agriculture Mission and Strategic Knowledge Mission. These missions signify the strategies like :

1. India will not budge from its position in International commitment for climate change. The plan is only domestic document,
2. The national action plan is to promote development objectives while addressing climate change effectively,
3. Push to solar energy sector along with other sources of renewable source of energy,
4. Fiscal incentives will be maintained to move industry, manufacturers and consumers towards a low carbon path,
5. Tax benefits to industries using clean / energy efficient technologies,
6. To cut down CO_2 emission from thermal power plants,
7. The implementation of Energy Conservation Act 2001 by domestic trading energy credits and
8. Coal thermal power plants to be closed.

But the national action plan is silent on adaptation of agriculture to climate change, water management and inter-ministerial coordination.

7.5.3. Policy Implementation

For more than three decades, there has been a lively environmental debate along with a high degree of legislative activity in India. Of course, this intensified as a consequence of the Bhopal gas leak in 1984, which led to the Environment Protection Act of 1986. However, there is vast agreement that the results of various reforms and regulations have been disappointing. Implementation has been poor. India's course of development is most likely to be unsustainable. According to a World Bank analysis, the total cost of environmental damages in 1992 amounted to 9.7 billion US dollars in India. This was the equivalent of 4.5 percent. It will not be an exaggeration to say that the implementation of the various policies and enactments has been found very poor, rather reluctant. The example of the 1974 Water Act serves as the paradigm of Indian environmental legislation and of its failure to achieve the desired goals. The Act established a network of State and Central Pollution Control Boards, but their hierarchy and responsibilities remained unclear. Neither acceptable limits of pollution

nor clear time spans for their implementation were defined. Municipalities had been identified as the main polluters of India's water bodies, but they were not made liable for prosecution.

By the mid-1980s, more than fifty different items of environmental legislation in India, thirty of which dealt with pollution alone were marked. There were various programmes of the central and state governments for afforestation and soil conservation. Major policy issues such as the prevention of air pollution and environmental protection in general became the jurisdiction of the Pollution Control Boards. In addition to their network, India today has a full-fledged Ministry of the Environment. It was initially established as the Department of the Environment in 1980 and turned into a ministry in 1985.

There are already many laws to deal with the problems of environmental pollution in India. But implementation of policies and legislations suffer because degradation of environment inevitably remains associated with poverty; the rural poor are always the worst hit in every situation of environmental degradation involving soil fertility, water and air quality, forests and fisheries. The loss of resilience in the ecosystem pushes the poor to the state of greater vulnerability. In the urban sector, on the other hand, environmental degradation remains associated with inappropriate urban planning. The combined effect causes not only serious health implications amongst the urban population, but also hampers employment and teachings-learning capacities at school levels, fosters gender inequality and generates more poverty. Studies have also proved that ecological factors cause about 20 per cent of diseases in India. Another factor that has aggravated the global and local environmental crises is the unsustainable consumption patterns of the developed nations and of the affluent sections in the developed and developing countries alike.

Lack of public awareness resulting in the non-compliance of rules and regulations also acts as a barrier against successful implementation of the policy. Respect for laws at all levels is essential for the success of any policy. Another hurdle is the not-so-strong presence of political will or commitment on the part of the political elites, namely, the politicians and the bureaucrats. The Government of India has established the Central Pollution Control Board in 1974 under the Water (Prevention and Control of Pollution) Act.1974 for providing advice to the central government, technical assistance, conducting training programmes, publication of statistical and technical data. It is also responsible for maintaining national standards under a variety of sections. States like West Bengal, too, has a very alert pollution control board of its own. Courts have appointed their Green Benches to hear cases involving different types of environmental pollution.

7.6 Conclusion

Political ecology is the study of the intersection and relationship between the political and environmental phenomena. This branch of knowledge contains an understanding of how political, economic, social and cultural forces impact the ecosystem. Paul Robbins (2011) has identified five central themes around which study and research in the field of ecology are usually conducted. These are :

i. Degradation and Marginalisation: Political ecology is concerned with the changes that have taken place in the use and management of resources. Link with global or local robust markets may compel the community or state to alter the unsustainable use and practices of the traditional economy. This may lead to uncontrolled exploitation of resources leading to their depletion and further impoverishment of people with meagre means.

ii. Conservation and Control: When state or other national and international agencies take away the control and use of resources from the hands of local communities and transfer it to other more professional hands, age-old more sustainable livelihood practices may face serious problems like extinction.

iii. The Environmental Control and Exclusion: In conditions of exhaustive resource exploitation, access to resource may become a political issue. It happens when resource distribution is unequal or the system is managed by state or private interests. Weaker or marginalized sections may remain deprived.

iv. Environmental Subjects and Identity: Competition among groups around environment may generate new identities for groups that want to control the environment. Such identities are built around the ecology and different sections of population (like caste, class and gender) may come together for protecting the nature and their livelihood.

v. Political Objects and Actors: The inter-relationship between humans and their natural environment has some underlying political currents that often affect the political and economic systems. Influential states or organisations can exert pressure on this relationship resulting in serious and long-term damages to the ecosystem. Mass movements have often been organised to challenge this dangerous power play of the influential parties.

vi. Thus the scope of political ecology involves the study of power relations that affect human environment and the responses that are generated to change the environment.

7.7 Model Questions

A. Answer in brief. 5 marks.

1. What is Political Ecology?
2. What is NCEPC?
3. What was the purpose of Tiwari Committee (1980)?
4. What is the essence of National Environment Policy,2006?

B. Answer in detail. 10 marks.

5. Analyse the meaning of political ecology.
6. Discuss, in detail, the National Environment Policy, 2006.
7. Examine the central themes around which the scope of political ecology has developed.

7.8 Suggested Readings

1. Biersack, A., Greenberg, J.B, (eds.) 2006. Reimagining Political Ecology. Duke University Press.
2. BSOE-143 Study Material.
3. Hintz, John., Robbins, Paul and Moore, Sarah A. 2010. Environment and Society: A Critical Introduction. Wiley- Blackwell.
4. Peet, Richard. Robbins, Paul. 2010. Global Political Ecology. Routledge.
5. Robbins, Paul. 2011. Political Ecology: a critical introduction. Wiley-Blackwell.

MODULE – III
ENVIRONMENTAL MOVEMENTS IN INDIA

UNIT–8 : HISTORY OF ENVIRONMENTAL MOVEMENTS IN INDIA

Structure

8.0 Objectives
8.1 Introduction
8.2 Evolution and the Trajectory of the Environmental Movements around the Globe
- 8.2.1 Club of Rome
- 8.2.2 The Limits of Growth
- 8.2.3 The Gaia Hypothesis
- 8.2.4 The Cold War
- 8.2.5 Industrial Revolution: The vantage point for the rise of Environmental Movements

8.3 The North South Divide
8.4 The Indian Road to Environmental Movements: The First and the Second Waven of Indian Environmentalism.
- 8.4.1 The First Wave
- 8.4.2 The Second Wave
- 8.4.3 The First Stage of the Second Wave of Environmenal Movement in India
- 8.4.4 The Second Stage of the Second Wave of Environmenal Movement in India
- 8.4.5 The Third Stage of the Second Wave of Environmenal Movement in India

8.5 Some significant movements and their contribution to the historical legacy
8.6 Conclusion
8.7 Let's sum up
8.8 End Notes.
8.9 Model Questions.

8.10 Reference
8.11 Suggested Reading

8.0 Objectives

In short the objectives of this unit are:

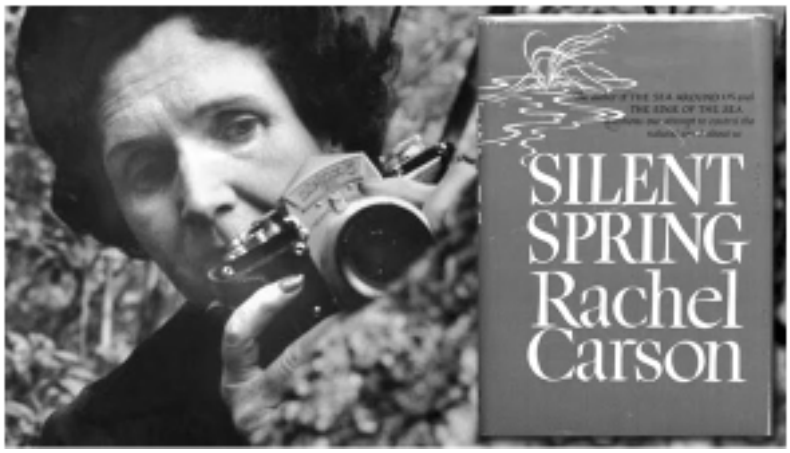
- To understand the history of environmental movements of the world.
- To understand how it started in India.
- To understand the impact of various such movements in India.
- To argue for the different strategies adopted by the different movements and how it generated popular mobilisation.

8.1 Introduction

Any discussion on environmental movements will never be possible without taking a note of Rachel Carson's 'Silent Spring', which can be taken as the speaking point of any environmental mobilization in the world. The American environmental movement has grown by leaps and bounds and within a short span has left an indelible impact on the society in the United States. Liz Sonneborn says, "Within a single generation, environmentalism has changed the nation's politics, economy, society and culture. What we eat, where we work, how we spend our leisure time, what we learn in school, whom we elect–all have been altered in some way by the environmental movement" (Sonneborn:2007:104). The book touched the people and left them in wonder after she narrated before the world a morbid and dark image of a catastrophe that was slowly befalling us. An instant and sure shot best seller, the book made Carson, a writer already established in her own rights, super famous in a fort night, it also went a long way in changing the American perception about the environment. The book gained immediate sensation given Carson's ability to bridge a substantive relation between the fatal effects of thalidomide, a chemical and her persistent warnings about DDT, a popular pesticide used across the world. Carson herself explained, "Thalidomide and pesticides–they represent our willingness to rush ahead and use something new without knowing what the results are going to be."

'Silent Spring' had a persistent impact because of its ability to dodge the serious efforts that were fabricated to disown and discredit the book by the leading chemical and agricultural companies that relied heavily on DDT. The book published in 1962, spoke loudly about the deadly effects of the pesticides in polluting the environment, particularly in poisoning the birds. Despite widespread and staged efforts orchestrated

to stall her projects, Carson's book stood the test of time and won rare glory and more importantly stood out in creating environmental consciousness among the people, which was the need of the hour. It's important that we realise that Carson left a legacy that changed our perception to the nature. She sparked a sea of change in thought that brought about a great social and political movement in the United States that culminated the seeds of the modern environmental movement (Sonneborn : 2007 : 124).



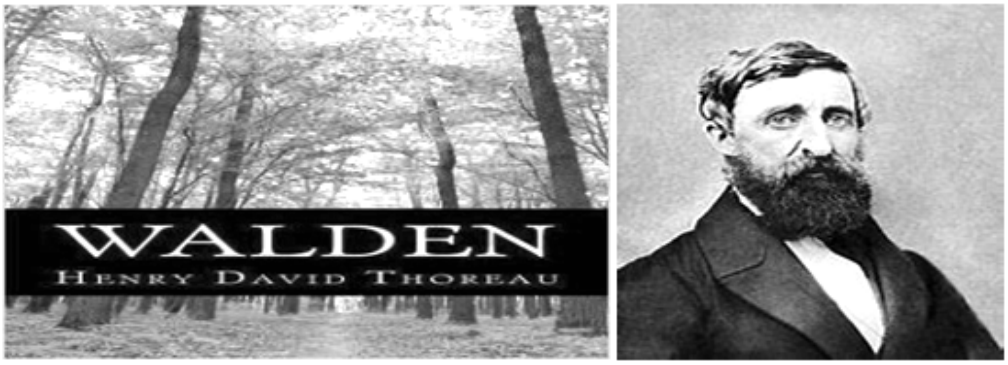
Rachel Carson with her book, Silent Spring.
Photo Credit:http://footlesscrow.blogspot.com/2013/10/50-years-after-silent-spring.html

Do you know ?

Rachel Carson was a shy girl who grew up in western Pennsylvania, spending most of her time in reading books and going on nature walks. Though she later studied English, her earlier induction in biology classes had developed her knack for the nature on which she wrote prolifically. She received a master's degree in zoology from Johns Hopkins University. Carson went on to work in the publications department of the U.S. Fish and Wildlife Service. Alongside, she began writing often in a clear, but poetic style. Her second book, 'The Sea Around Us', had sold around 20,000 copies and had earned her enough money to buy a house on the coast of Maine, where she spent her entire day writing. Carson was not fortunate enough to see the gravitas that her book germinated. Already weakened by the deadly cancer, she died of heart disease on April 14, 1964, at the tender age of 56.

Though ‘Silent Spring’ is a book that we most popularly cite in this context, but a book that was the first to create ripples of environmental consciousness in the minds of the people was written way back in 1854 by Henry David Thoreau called, ‘Walden’. The book was written at a time when people hardly showed any concern for nature. They ignored any such human action that might have a direct bearing on the human environment. By the early nineteenth century, however, the perception towards the natural environment was going through some primary changes worth noticing. The regard and veneration towards the nature was gradually forming which culminated into the romantic movement in Europe. Romantic painters,sculptors,writers, and philosophers glorified the spiritual power of nature and countered the destructive power of the human agents. In the mid-nineteenth century United States, romanticism inspired transcendental movement in environmental issues. This literary and cultural movement advocated that people could establish direct association with the spiritual world without any intervention from any such intermediary religious congregation.The first ever form of environmental movement to have been organised was transcendental in character.

For the transcendentalists, the appreciation of nature was taken as a particularly rewarding way to appease the spirit and to get over profanities of the everyday world.The most well-known transcendentalist of the time was Ralph Waldo Emerson whose collection of essays ‘Nature’ (1836) had an ‘electrifying’ influence on the American environmental movement. Emerson developed acquaintance with Henry David Thoreau, a young writer, who in 1845 penned a book Walden (1854), which encrusted his experiences of joyful coexistence between nature and human society. Though the book did not gain wide readership in his life time, the memoir eventually inspired the later proponents of environmental movement. The book as we stated above, was the first in its kind to stir the environmental verves of the later generations that led way to many such meaty movements eventually across the globe. But of course, Silent Spring, as we just saw, in the later years had prepared the foreground for the initiation of more animated movements in America and the world around. Let us have a look at the history of environmental movements in America and how they created furor in other parts of the world.



Henry David Thoreau with his Book, Walden.
Picture credit: http://www.arraabella.com/2013/04/bookgasm-hanks-reading-list-playlist.htmland
https://id.wikipedia.org/wiki/Henry_David_Thoreau.

8.2 Evolution and the Trajectory of the Environmental Movements a round the Globe

The modern environmental movements can be traced back to the second half of the 1960s in Europe and North America. Besides 'Silent Spring' (1962); Torrey Canyon 'Oil Tanker Disaster' (1967), Paul Ehrlich's 'The Population Bomb' (1968) and the 'First Earth Day' (1970) must have been the milestones in the history of the environmental movements in the world (Nepal:2009:39). These may be taken as the constituent elements of any modern form of environmental movement. Specifically stating, environmental movements initiated somewhere between 1968 and 1973 in the western world. We may go through a ready itinerary of facts that will help us understand what actually triggered the actors and prepared the ground for the staging of such movements. Let us look at these factors.

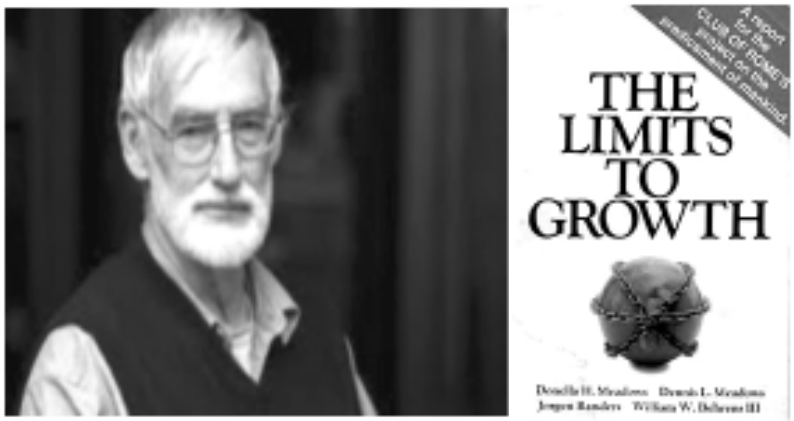
8.2.1 Club of Rome

One such factor which might have precipitated the protest movements in Europe must have been the Club of Rome founded in 1968.It all had begun with an unplanned encounter between Aurelio Peccei, a successful Italian industrialist, and Alexander King, an eminent Scottish scientist. While detouring the world for his work, Peccei had shown interest about the pace of socio economic development, environmental degradation and the North/South divide. He articulated these concerns in a keynote speech given to ADELA, an emerging investment company. After a spree of events, Peccei's speech transcript finally landed on the desk of Alexander King, who was so moved that he contacted Peccei and asked for a meeting. At this meeting, some 30 European scientists, economists, entrepreneurs and industrialists gathered in Rome to

discuss the prevalent global issues. Though the meeting fizzled, the King had asked a colleague at the OECD, the astrophysicist, Erich Jantsch, to draft a background paper for impending discussions. They decided to spend the year educating themselves about the ecological and other global problems. They decided to name this circle the 'Club of Rome' (King & Schneider: 1993:70). The Club went on to hold its first official meeting in Bern. Peccei had invited the famous Turkish economist and futurologist, Hasan Ozbekhan, to propose a model to study environmental impacts and mankind's predicament. Another scholar from MIT, professor Jay Forrester also pitched in. Accordingly, the Club decided to commission a group of MIT researchers to develop the "World 3 Model" and compose the first Report to the Club of Rome.

8.2.2 The Limits of Growth

The report later published as a famous book, 'The Limits of Growth' was a magnum opus (Meadows : 2008) which went on to sell over 9 lakhs copies. The message which it gave still holds true, and establishes the truth that the earth's interlocking resources– the global system of nature which we inhabit is unable to sustain the present rates of economic and population growth much beyond the year 2100, if at all the earth that long, even driven with advanced technology. Considered as a classic in the ecological movement showing the way to sustainability, 'The Limits to Growth' was the first study ever undertaken to question the viability of relentless growth leading to constant human intrusion in the ecological sphere. It also broke the glass ceiling as the first global model proposed by an independent body rather than a public body or the UN. The book obviously went a long way in coalescing the environmental movement in the world by titillating a new form of environmental ethics.



The book, Limits of Growth (1972) principally authored by Dennis L. Meadows.
Photo, credit:https://zh.wikipedia.org/zhcn/
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spip.php?article1470

8.2.3 The Gaia Hypothesis

Another work to have smoothened the ground for full-fledged environmental movement was probably the Gaia hypothesis, also known as the Gaia theory or the Gaia principle, that proposed that living organisms interact with their inorganic surroundings on the Earth to form a synergy that helps to maintain and perpetuate the conditions for life on the earth.The hypothesis was formulated by the renowned English chemist James Lovelock and co-authored by the American microbiologist Lynn Margulis in the 1970s. Lovelock conceived the idea after Gaia, personified as the primordial goddess of Earth in our Greek mythology. The hypothesis shows how this synergy impacts the stability of various environmental variables that in turn influences the habitability of Earth.The Gaia hypothesis and the environmental movement that it ensued was partially influenced by the Space Race that went on between the Soviet Union and the United States of America. During the 1960s, for the first time, from the space one could see how the Earth looked as a whole. The photograph 'Earthrise' taken by astronaut William Anders in 1968 during the Apollo8 mission became a ready symbol for the impending global ecology movement.

8.2.4 The Cold War

The Cold War can be taken as an early catalyst for the environmental movements in Europe. The war was not just between continents and its people, but was also fought for food, natural resources and raw materials. This signalled a global power struggle over the control of the natural resources. Not just the rampant consumption of natural resources and the resultant pollution, the fatal weapons of mass destruction soon forced the human beings to acknowledge the fact that their reckless activities would soon drain out the mother earth. The Cold War definitely was the spring bed for the birth of global ecological disaster. It therefore was perpetual for the emergence of a mass environmental awareness. Nature, its unabated exploitation and also gradually its conservation, became the double agenda of the Cold War (Laakkonen et al: 2016). The Cold War therefore deeply stirred the need for a whole bunch of new environmental ideas, ideologies, organisations, agitations and movements in different continents."Environment" and "Cold war" had become two important concepts while discussing the environmental history of the Cold War. Both these concepts begun to assume importance during the post-war decades and the most important of the tasks for environmental historians of this period was to explain how the very idea of environment was solely invented during the Cold War years and what role the Cold War must have played in this cultural construction (Robertson:2007). The War had created a space for environmentalism based on which interestingly, movements were organised as radical protests against the deadly effects of the war on the virgin creases

of our nature, which came to be critiqued in many ways. These criticisms attracted many revolutionaries who started radical movements. Environmental movements were started as one of these kinds of radical movements, examples of which were Civil Rights Movement and Peace Movement (Nepal:2009).

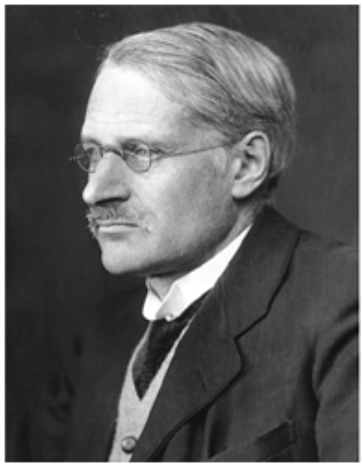
8.2.5 Industrial Revolution: The vantage point for the rise of Environmental Movements.

Though these are some of the factors which invited environmental movements in general but nonetheless, these are contending opinions about the historical junctions of the environmental movements round the world, which can be placed as different positions taken by the theorists. Several situational and theoretical standpoints appear on the surface of the contents leading our way to the genesis of the movements and each one of them claim the veracity of their arguments. It is interesting to explore the multiplicity and diversity of facts and theories arguing to show the origin of such environmental movements. Despite the contentions, what is unanimously conferred by the environmental historians is the fact that in the pre-industrialised world, environmental grudges were relatively less than in the industrializsd world. Industrialisation could be taken as the primary factory for fuelling environmental movements.

Guha said, "There was no environmentalism before industrialisation, for there were only elements of an environmental sensibility. The classical literatures of both the East and the West scripted with deep empathy about the natural world. This certainly could be taken as the pre-history of environmentalism and environmental movements in the world, though not of the environmentalism itself" (Guha:2008:9). It was only after the gradual inroads were made by the Industrial Revolution that pervasive spread of the environmental degradation popped out and so did the coinage of the term 'environmentalism'. The very first historian to indicate the organic connection between industrialisation and environmentalism was the Cambridge scholar G.M. Trevelyan. He held that the English people felt a separation from the natural world, brought in by their urban living. This long standing separation created an urge to return periodically, in short intervals, to nature (Trevelyan:1988).

Since the 1960s, as the protest movements for environmental retention started gathering strong grounds in a series of industrialised countries, many environmental historians considered it as the starting point of the Trevelyan thesis of environmental protection movements, named after the social historian, G.M.Trevelyan, whose contribution to the environmental dialogue, we had already learnt. The Trevelyan thesis held that the rapid pace of industrialisation and urban transformation had created an unimaginable detachment from the nature but this alienation had a

paradoxical role to play. This alienation was sarcastically indicative of a massive and deliberately concerted effort to protect and identify with the nature as well. In 1963, the year following Rachel Carson's publication of her landmark book, 'Silent Spring', dualistic role of the American people to both destroy the greenery and alongside lament over its loss, became more evident.



G. M. Trevelyan

Photo credit: https://en.wikipedia.org/wiki/G._M._Trevelyan

8.3 The North South Divide

In this context, to offer a better lucidity in explaining the origin of such movements, a dichotomous classification (Nepal:2009) had been proposed by Guha and Martinez Alier (1997) into the materialist and the post-materialist environmental movements where the former were said to have been initiated in the third world countries including our country while latter were found rampantly in the capitalist countries of the North. Looking at the History of Environmental Movements in American society, we find that environmental issues had always held the centre-stage in American polity and public domain and had been doing so in one way or another since the 1890s. The American society is on the verge of developing a trajectory of a newly emerging form of environmental and conservational spirit, the source of which is quite interesting. This new environmental ethos had not been thrown up by any public mobilisation or popular hue and cry over a burning environmental issue. Instead the environmental re-assertion had been fuelled by the 'grass roots' movement (Kuzmiak:1991:265). The continent was to witness the growth of a new environmental and conservation ethos, which neither rose from a popular outcry nor centred itself upon the whims of a private corporation (Hays: 1959).

By the end of the 1960s, we find that American concerns about the environment had swelled up into a full-fledged movement. Though Americans were boastful about their styles of living irrespective of its impact on the nature, in the early twentieth century, situations were radically changing. Soon after the publication of the 'Silent Spring,' environmental issues were brought to the forefront of American culture and politics. In just a few years, the movement accelerated at an amazing rate. Not only did more people come within the fold of environmentalism, at the same time the movement widened its scope. Instead of being tucked behind the corner of the conservation of forested areas, the movement expanded to involve relevant issues like air pollution, nuclear dangers, land erosions, overpopulation etc. The gigantic leap of the movement during the 1960s had indeed been astonishing, but very few could imagine what awaited next. Only after America experienced 'green decade' of the 1970s, could we assume the true power of the environmental movement in American society and polity. It is often claimed that like the European environmental movement, which has often been termed as 'monumentally ahistorical', meaning a movement without any historical precedence, the same accusation has been brought against India. It is often wrongfully claimed that Indian environmental movement all began with the Chipko Movement in 1973, such that there is no prehistory of environmental ideas in our country. It must be re-assured that though Chipko is a much talked about environmental struggled in post-colonial India, it must not be taken as one without any background or historical backdrop. Behind it there is a rich unacknowledged legacy of environmental ideas and issues which dates far back and about which very few of us have any meaty idea.

8.4 The Indian Road to Environmental Movements: The First and the Second Wave of Indian Environmentalism

Any discussion on the history of environmental movement in India remains incomplete without mentioning the three waves of environmentalism that the country experienced. Therefore, we shall study the waves and the implications they carried for any kind of collective mobilization.

8.4.1 The First Wave

During environmentalism's first wave in the 19th and early 20th centuries, naturalists, officers, and philosophers responded to industrialisation and modern state power with three different ideals about the proper relationships between humanity and nature. Guha calls these ideals: 'back to the land,' 'scientific conservation,' and the 'wilderness idea,' and explores their divergent visions and experimental policies (Guha :2000 :161).

The first wave of Indian environmentalism dated back to the early twentieth century and spanned till the outbreak of the World War second. The main intellectual forces responsible in flickering this movement were a group of social thinkers who shared close proximity with the main propellers of the Indian national movement. The other group equally instigating this movement was a group of deviant scientists working from the periphery of the colonial set-up. The movement saw a slump soon after the nation getting political freedom in 1947.

8.4.2 The Second Wave

In the post-independent India, there began an age of environmental void or nullity, a period which had been termed by Guha as that of 'ecological innocence' (Guha:2008:36). It was the time when the urge towards industrialisation was so strong that the main concern for environmentalism had been relegated to the backburner. Only in the post 1970s do we notice a sudden spurt in the environmental mobilisations which it seemed must have sprung up from deep slumber for years. The return from hibernation helped the movement to come back in more articulated and animated form. This is what Guha terms as the "Second Wave" of environmentalism.The second wave in the seventies, especially in 1973 went through three typical phases. The three stages are:

a. ‘Struggle to be heard’
b. ‘Media -hyped’
c. ‘End of History’

Let us study each of these stages in detail to understand the Indian itinerary of environmental movements and how it changed form in every step that it took. Each of these stages was different from the preceding ones and this quaintness marked the significance of movement and the strategy it undertook towards collective mobilization.

8.4.3 The First Stage of the Second Wave of Environmental Movement in India

The first stage is often described as ‘struggle to be heard’. This stage continued through most of the 1970s when the action groups were seen fighting to notch up the issues of deforestation, soil erosion, water crisis etc. They felt such factors affecting the populace of the countryside had been eclipsed and therefore require a ready exposure to gain recognition. However, to our surprise, these movements were met with a cold indifference by the political structures that were constantly giving such issues a cold shoulder. This stupor and stalemate gradually dissolved in the following stage, which we are about to discuss (Guha : 2008 : 68).

8.4.4 The Second Stage of the Second Wave of Environmental Movement in India

This stage emerged in the 1980s and is characterised by the pro-active role of the media in juggling with the environmental issues. However, while the media showed a hyperactivity, the polity on the other hand, did not show adequate interest in dealing with such issues. Unlike before, the issues were not let to perish on their own, the pertinent problems of the environment, were instead diligently studied by the in-depth scientific assessments and thorough enquiries. This was how the Indian polity was coming out of its self-imposed recluse to respond to the environmental issues which was due for long. Gradually the Indian administration was taking notice of the large environmental costs incurred upon its state and the people in lieu of the luxurious life-styles and reckless modes of living maintained by the few. Slowly the state approach towards environment and its revival changed and so did the institutional ancillaries. Discrete departments and stand alone units were set up that steadfastly tackled the environmental standings with deft hands. Policies pertaining to land, forestry, water, soil and other natural resources were carefully drafted lest their blueprints remain indifferent to the delicate relation between man and ecology. The stage witnessed a sensitivity and moral surveillance while drafting the environmental policies and recommendations which stopped becoming impersonal and detached. While everything went well, what stood out to be unsavoury and ill-suited was an overwhelming attitude of the environmentalists who often over-stated their cases more than what they needed. They spoke of the ultimate doom and predicted that the earth was soon coming to an end if their policies were not readily accepted by the state machineries. The period coincided with the fall of Berlin Wall that had ushered a major anti-green backlash, soon giving into the Third or the final stage in the history of the environmental movement. (Guha:2008:69).

84.5 The Third Stage of the Second Wave of Environmental Movement in India

The environmentalists in this stage favored free market trade and predicted the down fall of the Soviet State. This, they called out, would mark out the "End of History". These activists were sworn in by the ideals of the American consumer society and what else stood around them was treated with disdain and apathy. They were parochial in nature and never considered the worthiness of the alternatives paths of development. they strongly believed that the rest of the earth including India needed a re-modelling in tune with the American Consumerist model, irrespective of whether India needed it or not. Indian environmentalists on the other hand refused to accept the homogeneous hegemony of the American consumer and instead questioned the very basis of the global consumer society. Nonetheless the hype generated by the

economic trends of liberalisation, privatisation and globalisation often creates backlash against the environmental ethos generated in the public sphere. The environmentalism is often blown out in the face of Americanisation lest it creates hurdles in the smooth path towards capitalistic development and market driven tactics played out by the transnational corporations.

8.5 Some significant movements and their contribution to the historical legacy

Therefore, we find that the environmental movements in India had changed its face as it journeyed down the lane. In the 1980s, when the environment movements turned out to be so prospective, it turned out more macabre and pale down the ages. It lost its luster and may be compared to the gloomy 'Kashmir dispute' or the 'fiscal state crisis'(Guha:2008:70). However, as we tip-toed towards the 21st century, environmental issues started taking the centre-stage. Now the prospects of the Indian sovereignty are determined by the expertise and the promptness with which the environmental resources are managed and sustained. How fast an act of environmental violation resulting in ecological decay is condemned and persecuted is all that is necessary in upholding the integrity of the current society. This speaks an ounce about the itinerary of the environmental movements in our country. A look at some of the noted environmental movements will help us understand the path it took.

We looked back at the history of the movements only to realise that, whatever be its form, even with inadequate resources, our movements had spearheaded a struggle for safeguarding the interests of the depressed and the needy and had remained inclusive of the women, tribal groups, and peasants. Talking of the history of the environmental movements in India, one must therefore mention the significant ones such as the Chipko Andolan (1970s), the collective endeavour against the Silent Valley project (1973); the association formed by the Rural Women's Advancement Society (Gramin Mahila Shramik Unnayam Samiti), in order to reclaim waste land in Bankura district of West Bengal (1970s);and the opposition to the Gumti Dam in Tripura (1974). Save the Bhagirathi and Stop Tehri Project Committee (1980s) in Uttar Pradesh; Narmada Bachao Andolan(1990s) in Madhya Pradesh and Gujarat; collective unrest among the tribal people in the Gandhamardan Hills (1986) whose livelihood was at stake by mining of bauxite deposits; the movement waged against the opposition to the Baliapal and Bhogarai test range in the state of Orissa (1985), the Appiko Movement (1983) initiated in the Western Ghats and movements expressing collective unrest against the Kaiga nuclear power plant in Karnataka (2000). The above history shows the trajectory of the environmental movements and how they

gradually constituted the corresponding waves of Indian environmentalism. Pigeon-holing these individual movements will give an idea how they contributed to the waves of environmental movements and tried shape up the legacy of environmental sustainability in the country.

8.6 Conclusion

The history of the environmental movements expressed the socio–ecological effects of narrowly designed development that lead to exploitation of the masses thus affecting their livelihood. The history of such movements are necessary for they reveal the real causes that titillate massive agitations. Often it is found that the resource-intensive demands of developmental models not only bring out ecological destruction and economic marginalisation but at the same time bring out the people on the streets. Our cheque redhistory only reminds us of the micro-action plans as well as the local protests that were organised to protect our natural processes and to boost ecological development at both the national and regional levels. Here in lies the true fruits of our long cherished history of environmental movements in India.

8.7 Let's Sum up

We first introduced the concept of social movements and thereafter the idea of the environmental movements in general. Thereafter we traced the evolutional trajectory of the environmental movements round the globe. The factors that drove the evolution drive was discussed in detail. Then we spoke of the North-South Divide, and more specifically the difference between the materialist and post-materialist movements and moved gradually into India and how the movements were initiated here. We learnt about the waves of Indian environmentalism and went through i- depth discussion of the various stages of the different waves.

From that onwards we went to mark out some of the significant movements and how they were pivotal in fitting into the discreet waves that treated the trajectory of the history of environmental movements in India and helped lead us towards the ecological sustainability on a broader scale.

8.8 End Notes

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8.9 Model Questions

A. Answer in brief. 5 marks.

1. What do you mean by 'End of History'?
2. Name some of the significant environmental movements in India.
3. What is the significance of the work, Silent Spring ?

B. Answer in detail. 10 marks.

4. What are the different stages of waves of environmentalism?
5. What is North-South Divide?
6. What are the post-materialist movements?

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UNIT–9 : RECENT TRENDS IN ENVIRONMENTAL MOVEMENTS IN INDIA:ISSUES AND CHALLENGES

Structure

9.0 Objectives
9.1 Introduction
9.2 Some Prominent Forest Movements of the Early 1990s
  9.2.1 Agitations in Kusnur village in the Dharwad district of the southern India
  9.2.2 Agitation over the use of Tendu leaves
9.3 Recent trends of forest and land movements in India
  9.3.1 Conflicts over common land: a frequent cause for contemporary environmental movements.
  9.3.2 The case of recent land rights movement in Punjab
9.4 The New age environmental movements across the country : Some glimpres
  9.4.1 The formation of the Prakrutik Sampada Suraksha Parishad
  9.4.2 Mining project in the tribal zone of Niyamgiri
  9.4.3 Acquisition of forest land for the steel plant at Paradip
  9.4.4 Diversion of forest to the brewing company at Dhenkanal district of Orissa
  9.4.5 Acquisition of land in Kalahandi district's Lanjigarh block
9.5 Conclusion
9.6 Let's sum up
9.7 Glossary
9.8 Model Questions
9.9 References
9.10 Suggested Readings

9.0 Objectives

In the last unit we have traced the historical journey of the environmental movements in India. The objectives of this chapter are primarily to understand the current vibes

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of the movement, its shapes and contours. Not just the newly emerging form of the movement, the task at hand is also to understand the issues and challenges in the current times that are pivotal in shaping the environmental movement in the country at large. Therefore, let us first understand the changing ideologies that are influencing the emergent forms of movements and then take into account the issues and crisis factors that are changing the course of environmental movements in our country. In that way we can better justify the recent trends in environmental movements and understand why they took the form that they never took before, say in the beginning of the first decade of the 21st century. See students, you must understand the vantage points of the new age environmentalism to better grasp the emergent forms of the movements and their undercurrents in the current society. This is important, for without this, you won't be able to conceptualise the environmental concerns in our country and the momentum it is gathering in the present context.

In short the objectives are:

- To understand the new environmental scenario in the country.
- To understand the changing ideologies of environmental movements.
- To understand the evolving forms of protests and collective actions.
- To understand the issues and the challenges behind such movements in India.

11.1 Introduction

Sociological movements are the result of a collective and participatory process in response to the disturbed state of the environment, through which we try addressing the environmental challenges and find the possible pathways to achieve the various unanimously agreed environmental goals set by the community. Movements initiated from the very beginning were fed upon various ideologies which shall help us understand the changing pathways of the environmental movements in our country. At the same time, we would be able to decipher the deep seated changes that were evident in the movements to come. The fast changing character of the movements could, if not in totality, still be linked back to changing environmental ideologies that were brewing in the backyard of many such movements. So let us look into the stand points of the environmentalism and what kind of movements they churned out. With a preliminary idea about the historical background of the environmental phases in the country, I think it will not be difficult for you to understand the changing regimes in the ideological set ups of the country at different points of time.

The post-Second World War years especially till the early 1970s were the phase of ‘ecological innocence’ (Guha:2000). During this phase, the erstwhile colonies, like India and the rest were gradually shedding off the inhibitions of the colonial regime

and were gearing up to catch up with the West. It was the period of state sponsored development wherein the costs incurred upon the environment and its people were simply ignored. It was a period wherein the sole focus of the state was concentrated on continuous exploitation of natural resources and eye for economic growth. By the 1970s this state oriented ambition had a fall. The hope that the fruits of development would ooze down to the downtrodden had crashed. The state aided development, on the contrary, had produced incredible harm to the nature, which was beyond repair. The shrinking of forest cover, rampant water pollution, the destruction of nature and the interdependent livelihoods of the poor men had disturbed the ecology and its social fabric. This led to a number of struggles by the marginalised groups whether they were fisher folk and movements by pastoralists, farmers and especially the Adivasis (Rao:2018).

This period had remained witness to a large number of protest movements to protect the environment and the living of the local communities against the state sponsored development, chief amongst them were the Chipko movement, the Silent Valley agitation, etc. Often, in the name of development, national big shots taking the help of state and market, through foreign collaborations had only appropriated the natural resources, be it the land, minerals, forests and water and had converted all of these into marketable commodities (Baviskar :1995:36). The rich men and the giant corporations who had the desire and the authority to gobble up the earth and its rich resources had left no stones unturned to disrobe it off all its riches. The earth was left high and dry after it lost all its vital assets. The earth lost everything and its people yelled and cried to protest such huge losses. The economy that slumped down in the 1980s grew to an all-time high in the post-reforms phase of the 1990s. With the economy opening up, there was no looking back. There took place a wedding between the state and the global markets. The state experienced an unprecedented increase in the extraction industries producing biomass or say, mining industries for extracting coal, iron ore, bauxite etc. This in a parallel context led to the intensification of the use of ecological infrastructural materials like soil,water, air etc, the protracted use of which led to the depletion of biodiversity. There was a paradigm shift when it came to the question of the role of the government in the state funded development process. It was no longer the main investor in the development process but was rather the main initiator of the investment process.

The big multinational corporations were investing and the state was only fanning the fire. Instead of investing itself, the state rather convinced the corporations to invest. This had intensified the pressures on the environment thus disrupting the earlier systems of democratic decision making on the part of the residents in protecting and replenishing the environment.Demand had been the new fetish and unlimited

drainage of natural resources is rather encouraged without considering its impact on the existing social systems. What mattered important was the productive value attached to the nature devoid of all its other considerations such as its cultural, symbolic, religious or aesthetic values whatsoever. While all other considerations became irrelevant, what only stood out was the extrinsic capital value attached to the nature. Nature was thus hijacked from its original inhabitants who had been using it for ages and recklessly with sheer injustice, handed over to the rich capitalists who have now become the new stakeholders of the new age environmentalism. This infuriated the locals and the indigenous groups who were up in arms for protecting their mother nature as they had no other ways to combat the greedy tactics of these capitalists. We will discuss some of the major environmental movements in the Indian context and try to figure out how their forms had changed over the years.

9.2 Some Prominent Forest Movements of the Early 1990s

Of all the forest based movements organised so far, the 'Chipko' (Hug the Trees) movement must have been one of the most talked about one in the latter half of the last century. The movement saw a wave of protests against commercial logging across the Himalayan foothills. Notably, the region had a long history of peasant protests which Chipko must have taken as vantage point in its own struggle. As a powerful statement against the violation of customary rights by state forestry, Chipko brought into sharp focus a wide range of issues concerning forest policy and the environment debate as a whole (Guha:1989).

Photo: Women hugging the trees to prevent deforestation during Chipko Movement
Photo credit: https://athens.indymedia.org/post/1587258/

The 1970s witnessed recurrent conflicts between villagers and the forest departments especially in tribal inhabited districts of the states of Bihar, Orissa, Madhya Pradesh, Maharashtra and Andhra Pradesh. In tribal India, however, forest conflicts tend to have a political undercurrent (Gadgil&Guha:1994). Thus in Bihar, there had been a constant demand behind the popular movement for a tribal homeland, while in the rest of the four states as we said, the question of tribal forest rights had been vigorously taken up by the revolutionary Maoist groups (Calman, 1985; PUDR, 1982; Sengupta, 1982).

Academic research indicated the long legacy of the forest conflicts that started in the 1970s, the source of which must be the inception of the Indian Forest Department in 1864. Before the prevalence of such draconian state laws, the conditions were very different, for there was by and large very little state intervention in the management of forest areas and resource. Such resources were kept unsupervised and left largely under the control of local communities. It was only after 1864 that the forested areas were taken over by the colonial state thus making the year an important watershed in many ways. It was just not a political watershed that resulted in an enormous yielding of the state powers and in the resultant refusal of the rights of village communities. Besides it was a social watershed as well for it undermined the local access that was accorded formally to the local villagers. Timber thereupon became an important forest commodity that thereafter changed the fabric of the forested ecology. The second half of the 19th century therefore could be considered as a major watershed that created the major interfaces of the forest movements in the country since the colonial regime (Gadgil and Guha:1992). Moving towards the 20th century again, Chipko must be taken as the origin of the fores conflicts in India where women played a big role in hugging trees to stop the deforestation drive in April 1973 in an interior village in the Garhwal Himalayas. We shall learn about this movement in the latter section of the module in detail, but for the time being let us move towards other post-independent forest movements to understand the recent trend.

9.2.1 Agitations in Kusnur village in the Dharwad district of the southern India

A significant feature of the popular forest movements is that they have concentrated on two issues pertaining to the direction of forest management. First, they have demanded that the control of woodlands must be left to communal hands, especially keeping in mind, the gradual tendency of the state to withdraw itself from ownership and management of such lands. Second, and most important, those opposing the dictates of the forest management have pointed to the stark difference between the livelihood and subsistence orientation of villagers and the commercial or corporate

orientation of the state. I mean to say, the community was far more eager to use the nature and its resources for their own sustenance and living whereas the state wanted to commercially exploit the nature. This definitely set the template for the environmental movements in the recent times since post-independence. One such movement in Kusnur village in the Dharwad district of the southern state of Karnataka can be taken as a case in point.

The state with no discussion with the village folk allotted the village pasture land to the poly-fibre industry for growing eucalyptus. The peasants of the area vigorously organised a 'Pluck-and-Plant' satyagraha demonstration on 14 November 1987, when they themselves symbolically plucked a hundred eucalyptus saplings and replaced them with their local counterparts. They were bound to organize mass upheaval since these common lands had been the major source of their basic needs. But now suddenly the future of over 5,00,000 villagers, most of whom were poor, had suddenly become doomed. With this act of the Government of Karnataka, the villagers were deprived of the only available common village land, upon which their sustenance depended since time immemorial. Since the vast area was planted with eucalyptus saplings, the poorest villagers were the largest victim. It is usually said that nothing else grows where you plant eucalyptus; no grass, no undergrowth, no flowers; no animal will touch even its bark or leaves. No birds sing, for no bird will come to nest there (Bhattacharjea:1998). Eucalyptus trees are useful only to satisfy the hungry appetite of the Harihar Poly-fibres Plant at Harihar about 90 kilometres away from the Kusnur village in Dharwad district of Karnataka. Thus, the Karnataka Pulpwood Company (KPL) had become a brutal agent of exploitation, allowing nobody to stand on its course. Naturally such a reckless decision on the part of the Government had initiated vigorous movement across the sections in Karnataka.

Do you know ?

On 14 November 1984 the government of Karnataka signed an agreement with Harihar Poly-fibres (of the Birla family), a rayon producing company. The new company Karnataka Pulpwoods Limited (KLP) was owned over and above 51% by the government and the rest 49% by the Birla. It was decided that KPL eucalyptus plantation would occupy almost 30,000 hectres of land in the northern part of Karnataka. The Samaj Parivartana Samudaya, a Dharwar-based NGO, with the help of other organisations and renowned personalities such as Shivaram Karanth, Justice DM Chandrashekhar and Kadilal Manjappa led the ‘Save the Common Lands Movement’ to reclaim back their lands and rights after 7 long years of struggle.

Clock wise, 1. ShivaramKaranth, 2. Justice DM Chandrashekhar
Picture Credit: https://www.karnataka.com/personalities/k-shivarama-karanth/
https://www.mumbailive.com/en/civic/former-chief-justice-chandrashekhar-dharmadhikari-passed-away-31812

The Dharwad and Chamba episodes bring before us the continuing tussle between the interests of the local villagers and those of the state forest administration. The natural resources especially those from the forests had been perennially used by the village folks taking that as their birth right. Suddenly the state induced encroachment on such rights had fermented anguishes and grievances that had boiled down to deep seated environmental movements in different parts of the country.

9.2.2 Agitation over the use of Tendu leaves

See learners you must have understood by now that the war between the state and its people is usually fought over the natural resources, which was otherwise thought to be freely accessible by its people. However, with the implementation of the strict dictates of the forest department, the natural rights of the local inhabitants were on the verge of extinction. The reed workers in Kerala, bamboo workers in Karnataka, and rope makers in the Siwalik hills of Uttar Pradesh had all vehemently opposed the state's decision to give privilege to the paper industries in supplying biomass from the state owned forests. The attraction for forest produce is even stronger among the tribals of Central India who depend exclusively on these resources. Take for instance, the traders who exert control over the minor non-wood forest products such as fruits, berries, nuts, leaves and fodder. Of all these, the most lucrative is the tendu leaf, used in making the bidi or Indian cheroot. Over the last two decades, social activists had been organising tendu leaf pluckers in order to increase their collection-wages. In 1991, twenty-four organizations working among the tribals in five contiguous states of Central India fixed the price of tendu leaves at Rs. 50 per 5000 leaves. In several areas, tribal forest laborers had been organised by left-wing revolutionaries, leaving the alarmed traders to seek the protection of the state. Agitations nevertheless had

spilled violence in the tribal forest districts of Madhya Pradesh, Maharashtra and Orissa (PUCL, 1985; The Statesman, 1991).

Photo: Tend leaves and bidi.

Picture credit: http://img1.exportersindia.com/product_images/bc-small/dir_51/1500450/tendu-leaves-2338892.jpg
http://img1.exportersindia.com/product_images/bc-small/dir_51/1500450/tendu-leaves-2338892.jpg.

Do you know ?

The tendu tree (Diospyrosmelanoxylon) is found widely across central India. Leaves plucked from its shrubs are used to wrap bidi, the poor man's cigarette. About 550 billion pieces of bidi (rolled by 10 million people) are sold every year in India. The bad news for the tendu trade is that the bidi industry is declining. Today Bidi is losing popularity to the gutkha among the youth.

Under the Forest (Conservation) Act, 1980, forest clearances are usually given in two stages. A proposal is first agreed upon in principle in which usually the conditions relating to transfer of forested land are decided. The final approval is finally given after the receipt of a compliance report from the state government with reference to the stipulated conditions (Pandey and Sengpta:2017). With these factors in place, we still find a large proportion of land beeing diverted towards the development projects. With big chunks of the land re-directed towards industrial and other allied activities, this shrank the natural rights of the forest dwellers over the landa, he had learnt to believe his own right since his birth. This make-shift idea of the natural possession as against documented possession has been creating rifts in both public and private lives. Let's look into some of these movements fought in different parts of the country, as we study the growing trend of environmental movements across the country.

9.3 Recent trends of forest and land movements in India

The environmental role of forests received increased attention especially after the 1972 Stockholm Conference on Human Environment which was attended by the Prime Minister of India, herself, Mrs. Indira Gandhi. Another contributing factor had been the government report on the declining tiger population in the country, which went to near the extinction limit of around 1800 animals. This registered the alarm bells ringing both in the public and political arenas (Singh: 2008). In 1976 the 42nd Constitutional Amendment enabled the Union government to enact legislation on forests and protection of wild animals and birds that surpassed state laws. As a result of this, the Forest (Conservation) Act (1980) was formulated that curbed the indiscriminate diversion of forest land by states for non-forest uses, as we have seen earlier.

This Act compelled the states to obtain the prior approval of the central government before they could transfer any proportion of forest land for non-forestry purposes and to mandatorily supplement it with compensatory plantations that must be double the size of the area they deforested. The National Commission of Agriculture had made recommendations that were a pivotal factor in forest sector development during 1980-1990. Two important outcomes were the creation of Forest Development Corporations (FDCs) and the launch of Social Forestry Plantations (SFPs) which worked for the all-round development of the forested lands. Despite such attempts, the public bodies could not stop functioning like privatized corporations devoid of vested interests. With very few exceptions, these public sector entrepreneurial strategies proved to be utter failures, resulting in the drainage of public funds and other assets. (Chandrasekharan:1999). It had only resulted in the loss of native rights over the common land that the village owned. This sense of victimhood was looming large over the minds of the marginalised sections of the community as they struggled hard to negotiate not only with the state but alongside with the draconian rules of the state.

Dalit farmers in Himachal Pradesh had been showcasing their agitations through their organisational wing, Pashu Charao Abhiyanto re-claim their grazing rights over the community lands taken over by the upper castes in their villages (2019:08). This agitation at Chabecha village near Kasauli was organised soon after some women were allegedly assaulted after they took their cattle to the community common grazing land. Dalit farmers protesting on the site accused their higher caste counterparts of asking for their documents to be furnished before they could be allowed to let their animals graze on this land. The dalit farmers responded loudly for it was a matter of their livelihood which could not be left unattended for long. With the steady growth of infrastructure and industry, the persistent need for common lands had increased like

never before to feed the growing demand for roads, mines, power plants and real estate developments, said Kanchi Kohli, a researcher at the Centre for Policy Research. He maintained, as long as the ever increasing demands for common lands are sustained, the conflict over such lands would refuse to die down (Chandran:2020). Though in 2011, the Supreme Court ruled that common lands cannot be privatised and ownership must remain with village councils, the growing rift over the community lands had shown no sign of withering away.

11.3.1 Conflicts over common land: a frequent cause for contemporary environmental movements

Common land had been a collective asset for the village upon which the community had banked for generations. Almost every village had a common land, pond or a fallow land which was extensively reserved for its members. However, with the state encroaching upon these common assets and diverting them into capitalistic ventures, this had become an issue with the locals. They could not take this rampant poaching of their common resources by the state and such encroachment was not tolerated. Especially in the global society where extraction activities had been increased to an all-time high, usurping common lands had been a prevalent tactic among the state and its polity giving rise to conflicts between state and its people. We need to understand the historical context of these longstanding struggles, at this turbulent time when other means of protest was not possible. State legislations and its recurrent amendments could not do much to protect Adivasi land from outsiders, not only across large parts of central India, but in other parts as well. Since the issues around the common land use and forest access for local inhabitants remain largely unsettled (Oskarsson:2018) and unresolved therefore, opposition to the present wave of private sector-led investments has been a very common feature in the mining as well as in other industries in the name of development. The landless people are being increasingly alienated from village common land which is a source of income, food, nutrition, fodder and sustenance and the outcome being that these poor village folk slipped easily into the exploitative tradition of bonded labour. More such alienation occurs, more the environment gets drained off its essence and more it pushes people to the edge. This can be taken as a vicious circle mutually sponsored by the state and polity. With dearth of nationalised banks and legitimate lending mechanisms, they would very soon become the prey of the unscrupulous middlemen and the crafty money lenders. Both the state and polity are collaborating to organise this spree of development induced environmental erosion and dispossession among the masses.

In post-liberal India, state and polity have conspired to monopolise the corporate capital (Chatterjee:2008). Corporate capital flows and electoral mobilisation have

been dominating politics now. Our politicians are competing with each other in order to grab the capital that is necessary to generate economic growth. Corporate capital is gradually marginalising the small farmers, small shopkeepers and indigenous communities and titillating them to go for mass agitations and protest movements. Corporate land grabs are just one of the many ways in which this is happening. The concentration of capital in a few hands also suggests how large retail and agro-business companies can put small shopkeepers and small farmers out of business and push them towards pauperisation (Martin:2019). Civil society and the judiciary are hand in glove in initiating these processes. The middle classes are tired of this messy and dirty reality of electoral politics (Baviskar:2011). The politics will go on till the poor are robbed off all their possessions.

Do you know ?

Many of India's coal reserves are located in the central and eastern states of Chhattisgarh, Jharkhand and Odisha where more than a quarter of the country's Adivasi population lives. According to the Amnesty International, the global human rights body, the Adivasis had suffered disproportionately from India's push for coal. One in six of the 87,000 Indians who have been displaced over the past 40 years by state-owned Coal India Ltd (CIL) is an Adivasi (Chandran:2016).

9.3.2. The case of recent land rights movement in Punjab

In Punjab, upper castes, mostly Jat Sikhs, monopolise the farming landscape. Only 3.5% of the total private farmland in the state belongs to Dalits who constitute around 32% of the population, according to the data of the agricultural census of 2015-16. Punjab has the maximum percentage of rich farmers owning more than around 10 hectares of total agricultural land among all the non-hilly states of India.

In the history of land rights movement in Punjab, the only major land rights movement was the Muzara Movement from 1930-53. In this movement, farmers demanded the total abolition of Biswedari - a system of land ownership in which landlords owned vast stretches of land in the princely state of Patiala as well as the east Punjab states' union. The movement resulted in violent agitation among the protesting tenant farmers. This movement however did not involve the Dalits. Much later in 1961, the state passed the Punjab Village Common Lands (Regulation) Act that reserved around 33% of agricultural common village land for reserved castes who were also entitled to an annual lease through land bidding. The act, however, failed to improve the conditions of the depressed castes for the upper-caste farmers maneuvered the process and tweaked the legal practices to deprive the community of

their rights.The Dalits fought vigorously to express their grievances, shown in the picture below. Though they were scared of the big landlords they still gathered the courage to go against such big shots upon whom they depended for their income, food and fodder.

In 2009, the Zameen Prapti Sangharsh Committee or the land based rights struggle committee was formed. It was an informal Left-wing body that decided to propel Dalits into action through village level statutory committees. The Committee favoured the cultivation of the village common lands reserved for the Dalits in a village.Keeping the land out of the clutches of the capitalist farmers also ensured that the poor Dalit farmers usually did not use expensive fertilisers, pesticides and weedicides, an allegation often brought against the rich farmers of Punjab. The land based movement fought here was definitely pro-environmental in this sense. Besides being environmentally sustainable, the movement led to political mobilisation and identity formation (Maudgil:2019).

Dalits launch land-rights movement in Punjab
Photo credit: https://www.forwardpress.in/2016/07/dalits-launch-land-rights-movement-in-punjab/

Owning a piece of land was not just a matter of sustenance of the livelihood, it was more than that for it brought prestige and social empowerment which cut across the dominance of the upper castes thus melting the long standing social stigma of the Dalits. This recent trend of land based movement was definitely indicative of Dalit reinforcement and their undying sense of assertion. It was a common conception that Green Revolution, a movement in 1960s across the country, especially in Punjab and Haryana had reduced mutual dependence among farmers and labourers due to increased

capitalisation and technology induction leading to farm mechanisation. It was through this movement that the poor farmers were not only trying to gain back their rights on the land but also tried hard to adopt such practices that would be deemed environmentally sustainable for the community. But the gravitas of land-grabs in Punjab had been so extensive that all across the state the common lands were being snatched off by the politicians in the name of development, as we had already discussed above. In the villages of Daroli, Tullewal and Fatehpur, the extent of rural land snatchings had been tremendous. In Punjab, as in other states on India, we see that the politicians are busy brokering land deals for local and transnational corporations (Martin : 2019). You can understand how state-level political corruption is spinning around land brokerage for money.

Do you know ?

The Ministry of Environment, Forest and Climate Change granted clearances for cutting in forested lands. It subsequently diverted them to 249 projects covering an area of over 10,000 hectares between January and September 2016. Irrigation projects accounted for the maximum share of the total forest land approved for diversion. Around 36% of the total forest land approved for diversion is for irrigation projects and 20% of the total forest land approved for diversion is for mining projects.

9.4 The new age environmental movements across the country: Some glimpses

The new age environmental movements are therefore voicing their protests against hijacking of the resources kept apart for public uses. Those resources were not only vital for economic uses or for the local communities but they also provided immense ecological services. These lands have now been re-classified as 'waste lands' and diverted for 'other' productive purposes such as biofuel cultivation, corporate contract farming and industrial zones dispossessing the local poor and discounting the ecological value of the resource. A look at some of these land acquisitions would be cast and the growing tensions would be discussed here.

9.4.1. The formation of the Prakrutik Sampada Suraksha Parishad

In 1992, Tata and Birla had to abort their plans of establishing a bauxite mine and refinery due to intense people's resistance. Later, Utkal Alumina (a joint venture of both Hindalco and a Canadian company) entered the site. Though the people resisted this time too, the state government had paved the way for the company to step in. 1992 was formed the Prakrutik Sampada Suraksha Parishad (PSSP or Council to Preserve Natural Wealth), an organisation that covered 24 villages (Kerketta : 2019).

The people of kashipur and the neighboring regions, situated near the poverty stricken Korapt-Bolangir-Kalahandi belt face police repression for encountering three alumina projects such as UAIL, Vedanta Alumina and Aditya Alumina. Like Prakrutik Sampada Suraksha Parishad, there are many such organisations like National Front for Tribal Self Rule, National Forest Workers and Forest People's Forum, All India Tribal Joint Action Committee, Jana Sangharsha Morcha, Adivasi Mukti Sangathan etc. which are helping people fight the war against the abuse of the nature in the hands of the state and the entrepreneurs. All these organisations are initiating movements aimed at addressing the tribal rights on the land and preventing their forceful eviction from the land they had cherished as their own since birth.

9.4.2 Mining project in the tribal zone of Niyamgiri

In 1997, Sterilities, a subsidiary unit of the Vedant industries had signed a treaty with the Odisha government to initiate a mining project in the tribal zone of Niyamgiri. This had gravitated large scale tribal mass agitations and upheavals involving who took to the roads to demonstrate against their illegal eviction from the land they had owned over the generations. Despite protests, private industries have been up on their toes to establish themselves. This happens with the support of state governments and the police force. In the process, people are thrown into prisons and people's movements are hijacked.

9.4.3 Acquisition of forest land for the steel plant at Paradip

Similarly there seemed to be severe protests against the setting up of a 12 million ton steel plant by JSW Utkal Steel Limited at Paradip in September 2019. Notwithstanding the Supreme Court's approval on August 8 for the diversion of 3,097 acres of forest land for the project at Jagatsinghpur district of Odisha, people gathered to demonstrate their apathy.In the first major protest since the apex court's order was issued, the residents of Dhinkia, Gobindpur and Patna villages all gathered on at Balitutha, the entry point to the proposed site. The Posco Pratirodh Sangram Samiti (PPSS) even interrogated the court's order.The protesters were headstrong in their demands. Many of them would be carrying bows and arrows, axe and lathis (wooden sticks) and raised slogans against the company. The protesters proclaimed that they would not give even an inch of their land, be it the crop land or forest to the treacherous company.

9.4.4 Diversion of forest to the brewing company at Dhenkanal district of Odisha

In a similar instance, people have already started challenging land banks in different parts of the country. In Dhenkanal, the residents of Balrampur village have approached

the National Green Tribunal and the high court opposing the diversion of 64 hectres of village forest first to the land bank and then again to a bottling and brewing company. Upon this village were dependent, the people of these 12 villages. The villagers banked upon exclusively on the kendu leaves which was a big source for subsistence and commerce.

Do you know what is Pathalgarhi Movement ?

The Pathalgarhi movement fights for the autonomy of gram sabha. It challenges the right of the Indian state to govern tribal areas without violating the law. The name Pathalgarhi or Pathargarhi derives its name from rocks or stones usually used by locals to demarcate a tribal territory, where the gram panchayat is all supreme. The movement borrows its name from a tribal custom of erecting stones at the burial place of the dead.

9.4.5. Acquisition of land in Kalahandi district's Lanjigarh block

Instances of forceful dispossession of land by the state had been countless and in one such bid to dispossess, Odisha government tried to acquire land in Kalahandi district's Lanjigarh block shown in the picture below (see Picture.). It was the very place where the company's one million ton capacity alumina refinery was located. There was confusion whether the land was meant for the refinery which was already functional or the move was a clever attempt at grabbing more area for bauxite mining. The company was yet to get the lease for this mining drive. Parallel instances could be found where people belonging to the Dongria Kondh tribe in the region were opposing mining in bauxite-rich Niyamgiri hill, for they considered the mountain sacred.The case is still in the purview of the supreme court.

The Kalahandi tehsildar's office had issued advertisement notices on December 18, 2007, proclaiming that 6.4 hectare (ha) at Palbira village and 6.8 ha at Phuldumer are required for the construction of the Lanjigarh alumina refinery. The two villages in the foothills of Niyamgiri are around 10 km from the plant site and are in opposite directions. The notice was issued by the Industrial Infrastructure Development Corporation of Odisha (IDCO).

Picture .Kalahandi district's Lanjigarh(the brown region)block
Photo Credit: https://www.redspark.nu/wp-content/uploads/2019/03/kalahandi-tehsil-map.jpg

It was assumed that two private transnational company in Kalahandi were confident of obtaining the mining lease. They, therefore, were trying to take this land for mining in advance. They wanted to keep it hidden else they would lose the project which was very lucrative for them.

The move had left the Dongrias and Harijans in the two villages very angry for this mountain was their mother which had sustained them for generations. The activists of Green Kalahandi, the group spearheading the movement against the refinery, and people in Lanjigarh were trying hard to suspend this land acquisition.

9.5 Conclusion

The state aided eviction of people from the lap of the nature had been a much elaborate affair, involving many of its accomplices, chief amongst which is the forest department. The forest department had will fully taken over the common land of the village, a vulnerable issue of the forest control and its preservation. This had been done by illegal possession of land that had been providing livelihood to the people.

This happened irrespective of the fact that by the Indian Forest Act, 1927 (IFA), the apex law making body of forestry took into account the traditional and natural rights of the forest dwellers over the forests they inhabit. The forest department had, however, ignored these statutes and translated large tribal areas into forest reserves and protected forests. As an outcome of this, the proportion of classified forests, which are the homes of these tribal communities, had a surprisingly sharp decline.

The final blow to the common forest rights came down as Indian Forest Conservation Act, 1980, under the aegis of the forest department. The new Act pronounced that the native forest dwellers in jurisdictions under the Forest Department were labeled as the encroachers. In contrast, the Forest Rights Act of 2006 tried its best to bring the ethos of democracy in the Indian forests. It gave natural rights to the communities that had literally lived in these forests for generations. FRA had stopped private corporations from entering the forests and accessing the vast stretches of the tribal lands but the poaching is far from over.

We can conclude on this note that environmental movements across the world in the recent times are immensely critiquing the evils of capitalism. It had been assumed that large scale industrial establishments and the ethos of capitalism had come to erode our environment and the social fabric around it. With the dark shadow of climate change suspended on us, it had been a prevailing notion that the first to be victimised must be the global South. It was the urban middle class who had started the environmental movements in the west but for us it was absolutely different. In India, especially, environmental movements had grown around the basic issues of sustenance, livelihood and basic living. It was mainly the poor and the marginalized in the stratified society who had waged the war. Not the urban middle class, but the poor and the depressed of our country is pivotal in organising environmental movements in the South, especially in a country like ours. As the above instances had shown that most of the environmental movements are largely confined to eastern and central India where forests, mines and other valuable resources are found. These are also the homes of tribal folks who had enjoyed unhindered access to these resources. With suspension of such natural rights, they feel their existence is at stake and therefore strike back in self-defence and self-assertion.

Another characteristic of these new age environmental movements is random and reckless victimisation of the crusaders and activists who start voicing their protests and organising massive unrest in protecting the environment. Attempts to stigmatise the environmental activists and legally implicating them had been a steady character of the new age environmental movements.

9.6 Let's Sum up

We basically tried to understand the current vibes of the environmental movement, its shapes and contours. Not just the newly emerging forms of the movement, we also discussed the issues and challenges in the current times that are pivotal in shaping the environmental movement in the country at large. We went through some of the prominent forest movements of the early 1990s and also elaborated on the current scenario of the environmental protection in the 21st century.

9.7 Glossary

1. Adivasis–Adivasi is the collective term for tribal grops of the Indian Subcontinent, who are considered indigenous. They are local to places within India.
2. Tendu–Tendu tree (Diospyrosmelanoxylon) is present widely across central India. Leaves are hand plucked from its shrubs. They are extensively sed in order to wrap bidi, poplarly known as the poor man's cigarette.
3. Gram Sabha–A Gram Panchayat or village panchayat is only the grassroot level of local self-governance system in India at the village or small-town level. It has a sarpanc which has been working as its elected head.
4. Satyagraha–Satyagraha is the idea of non-violent resistance or fighting with peace as proposed by Mohandas Karamchand Gandhi.
5. Bidi–Bidis are small, skinny, hand-rolled cigarettes primarily imported from India and other Southeast Asian countries.
6. Gutkha–Gutka, ghutka, gutkha , as it is called, is a chewing tobacco preparation done with crushed areca nut or betel nut, tobacco and other flavours, made in India, Pakistan, other Asian countries, and North America.

9.8 Model Questions

A. Answer in brief. 5 marks.

1. What are Environmental Movements?
2. What are Tendu leaves?
3. What do yo mean by common land?

B. Answer in detail. 10 marks.

4. Why was Chipko Movement fought?
5. What is the protest at Niyamgiri for?

6. What are the isses of the New Age Environmental Movement?

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9.10 Suggested Readings

1. Silent Spring (1962) - Rachel Carson
2. The End of Nature (1989) - Bill McKibben
3. The Swarm (2004) - Frank Schätzing
4. The Story of Stuff: The Impact of Overconsumption on the Planet, Our Communities, and Our Health-And How We Can Make It Better (2011) - Annie Leonard
5. The Overstory (2018) - Richard Powers
6. The Uninhabitable Earth: Life After Warming (2019) - David Wallace-Wells.

UNIT–10 : FOREST BASED MOVEMENT – CHIPKO

Structure

10.0 Objectives.

10.1 Introduction

10.2 The Traditional and New Social Movements

10.3 Forest based movement – the Chipko.

10.3.1 The socio-cultural fabric of Uttarakhand: mapping the site of our movement.

10.3.2 Garhwali culture: the cornerstone of the peaceful resistance undergirding Chipko Andolan

10.4 Causes of protest: Tracing the steps of the Chipko Movement.

10.5 Two historical events that triggered the movement: Building railways and Sepoy Mutiny.

10.6 From violence to peaceful non-cooperation – Chipko emerging as the forest Satyagraha.

10.7 Conclusion

10.8 Model Questions

10.9 End Notes

10.10 References and Suggested Readings.

10.0 Objectives

In short the objectives of this unit are:

- To abreast the learners with the dimensions of the environmental movement in India.
- To discuss about some of the ground-breaking movements the country has seen.
- To gather a conceptual idea about environmental movements
- To learn the different kinds of environmental movements.
- To understand the impact, it generated on the general masses.
- To argue for the different strategies adopted by the different movements and how it electrified popular mobilisation.

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Unit 10\ 1sr Proof (12/03/2025)

10.1 Introduction

Environmental movements, as you can apprehend, are the protests and upsurges against abuses of the natural resources and their harmful impact on the society and state. However, before going straight into environmental movements, let's go into the concept of social movements. Social movements, as such, are not new in our country and they are of various its kinds, but generally speaking, social movements are collective oppositions waged against a specific issue disturbing the usual pace of social life to restore back peace and stability. As you know, our society had been facing large number of problems and it had not always been possible to check such anomalies in peaceful and just ways. Therefore, it was almost natural to call for a concerted round of action to avert such a long standing lacuna which had shown no signs of dispersal. Let us see what sociologists Turner and Killian had to say while trying to conceptualise social movements. According to them, social movement can be taken as a "collectivity acting with some continuity to promote or resist a change in the society or group of which it is a part" (Turner and Killian,1972:246). Roberta Ash Garner considers a social movement as a set of actions of a group of people that is 'self- consciously directed towards changing the social structure and/or ideology of a society, and they either are carried on outside of ideologically legitimated channels of change or use these channels in innovative ways (Roberta Ash Garner, 1977) . Thus it is pretty much evident that social movements are actions initiated by massive participation to protest the current social formations and to bring about necessary changes in the society through persistent resistances and hindrances. Most of such popular mobilisations broach upon a social issue which has been plaguing the society for long. Such social movements are the ways of circumventing long repressed fumes and desperations of the people. Social movements as you will see, are not homogeneous, but had changed their dimensions across time, thus the traditional social movements, as many believed had shown sharp lines of distinctions from the new ones.

10.2 The Traditional and New Social Movements

The older social movements especially labour or working class movements are significantly different from the new forms, in thats their goals, organisational structures, and action repertoires are markedly distinct from the traditional ones(see Pichardo 1997 for an overview). The traditional forms of movements are supposed to be centred around the working classes hewing towards economic re-distributions. Marxist theories were extensively used to reason with the movements that gathered momentum especially, till the 1960s, however, things took a drastic turn post 1960s. Large scale student protests were being organised and probably the watershed moment came

when student movements were consolidated in France and Berlin in 1968 and in Italy in 1969 and similarly in United States in the mid-1960s. As you know, until then, all social movements were explained by the rationale of the Marxist theories, for the first time in the history of the social movements, such theories fell short in explaining the logic behind the new forms of movements. Therefore, Pichardo said,

''In Europe, where Marxist theories of social movements dominated, Marxist theorists were unable to provide a convincing explanation for why students had become the vanguard of protest and why movement demands centred around quality of life rather than redistributive issues'' (Touraine 1971) (1997:412).

Therefore, time had come to review the deficiencies of the older forms of movements and look for greener pastures elsewhere. Social scientists thus chose to design the new social movement paradigm to legitimatise the varied types visibly noticed by us. The new social movements are indicative of a shift towards the post-industrial economy, and therefore instrumentally very different from the working class movements. Ideologically speaking, these movements claim that instead of being undergirded by utilitarian issues, they are more concerned about qualitative aspects such as the quality of life and ways of augmenting the life chances. These movements show a marked departure from the earlier movements, in that they assert their claims voraciously thus politicising the otherwise apolitical terrains of the movements. The assertion of identity is kept in the vanguard in all such movements. Yet another feature of such movements is the self-reflexive character which pre-supposes that the participants of the movements are always questioning the goals, strategies and outcomes of the movements. Nothing is taken as final and absolute but all the moments of a movement are reviewed and screened to bring out the best. This mirrors the self-reflexive character of the new social movements, that refuses to yield to the over-arching central temperament that opposes decentralisation and popular choice. As far as the tactics go, these movements remain outside the purview of the institutional garb, thus without taking any refuge to the political bandwagon, they instead want to shoot off public outrage and institutional disruptions to catch the attention of the state and polity. Such movements may include among others, urban social struggles, the environmental or ecology movements, women's and gay liberation, the peace movement, and cultural revolt linked primarily to student and youth activism . Notable amongst these new social movements had been the various environmental movements that had repeatedly caught our attention over demands for environmental conservation and a plea to resume back the ecological symbiosis. Let us now go to one of the most significant environmental movements, viz. the Chipko Movement that unlike the older forms of movement did not concentrate on distribution of wealth but instead focussed on sustainable ecological viability. It is perhaps, one of the most popular form of new social movement. Come, let us study this movement, in detail.

10.3 Forest based movement-the Chipko

The conflict over control of the natural resources in our country is not new, but the discord became pronounced with the evolution of the state and the autonomy awarded to its people. There has always been a tension between safe-guarding the rights of the marginal people and spearheading the industrial or commercial development in the country. The tension had continued over ages and people mostly resorted to various strategies to protect themselves from arbitrary encroachments. The marginal people often found themselves at the receiving ends and struggled hard to rescue themselves from such forceful state sponsored intrusion over resources that they believed belonged to them. Forests, orchards and lands were regarded by the villagers as the common property, well-guarded and conserved by careful and delicate methods of public conservation and forested husbandry, till they came to be pounced upon by the aggressive colonial policies. However, from the very beginning, natural resources all belonged to the community which carefully nourished and replenished them over the generations. The sudden usurpation of these resources by the outsiders posed serious threat to the survival chances of the villagers, who responded quickly to stop such encroachment over their verdant lands and forests. Before going to the crux of the movement, let us study in short, the socio-geographical history of the Garhwali society, to better apprehend the source of the conflict and its course of movement. Given below is the map of Uttarkhand, for you to better map the position of Garhwal, the site of our movement.

Pic 1: The geographical map of Uttarkhand.
Photo credit https://upload.wikimedia.org/wikipedia/commons/thumb/2/2b/Kumaon_Garhwal.jpg/300px-Kumaon_Garhwal.jpg

Do you know (1) ?

Uttarakhand is one of the richest reservoir of natural resources like forests and lakes. It houses the Jim Corbett National Park (the oldest national park of India) at Ramnagar in Nainital District, along with several others like Valley of Flowers National Park and Nanda Devi National Park in Chamoli District. Together they constitute the UNESCO World Heritage Site.

10.3.1 The socio-cultural fabric of Uttarakhand: mapping the site of our movement

Do you know Garhwal comprises how many districts? It is actually made up of eight hill districts of Uttarakhand such as Pauri, Chamoli, Tehri, Uttarkashi, Dehradun, Almora, Pithoragarth, and Nainital. According to D.D Tiwari, "The first five constitute 'Garhwal,' while the last three form 'Kumaon' (Tewari:1995:134). According to him, Uttarakhand was insulated and separated from the rest of the country in the pre-British India. Though it stood alone, its dense forests in Terai and Bhabar belt acted as sentinels protecting it from external invasions. It was a state mostly governed by its indigenous royal groups and least mediated by the extraneous power. The kingdom was split up into several chiefdoms to be ruled by various rulers like the Katyuris, Somchand, Ajaypal Pamvar, and Prithvinaryana Sah. Sah was finally defeated in the hands of the British forces which took over the Garhwali region while the custody of Kumaon was rested upon the son of the last Garhwali ruler.

Soon the Anglo-Nepalese treaty was signed in 1815 after the Anglo Nepalese war (1814-16), best known as the Gorkha war, in the Indian history, which ceded around one third of Nepal's territory to the British. The British thus occupied the Kumaon region (Almora, Pithoragarh and Nainital) following the Nepalese war. The landscape of the state changed to make way for the colonial masters. The British forces were advancing towards the hills and they readily pounced over the hard-wood forests and fertile lands of Terai. The state sponsored monarchy followed a close exit and the state was literally handed over to an alien group of foreign rulers, who without any knowledge about the culture and ethics of the Garhwali society began to rule these people, who till then were governed by the rules of common ownership of land and assets. A sudden intrusion by the foreign rulers, armed with their idiosyncratic ideas of extortion and extraction could not befit the collective economy of forest conservation and redistribution which the Garhwalis had followed so intently for ages. Their age-old wisdom and ideology could not accept these self-aggrandising and appropriating policies which the imperial rulers exerted on their land, forests and daily living. This eviction from their land and forests, created senses of desperation and pathos, among

the Garhwalis which cannot be felt without an understanding of the Garhwali forest economy and the culture undergirding them. Let us have a brief idea of their culture to better understand, what really instigated them to revolt. The Chipko movement actually flourished from the rich cultural legacy that the community wove over the years . The movement was a peaceful one and that it traversed the lines of non-violence to protest the wrongs done on the people of the hills is an exemplary instance of how the culture of a community impacts the forms of public resistance. Thus the culture and the socialisation of the people can influence the way a community repels the state policies and its draconian programmes to mobilise public opinion. Let us see how this was ingrained in the culture of Garhwal.

10.3.2 Garhwali culture: the cornerstone of the peaceful resistance undergirding Chipko Andolan

The people of this state had learnt to live peacefully in the lap of the nature. The structure of the society though showed factions, could not wedge contentious differences between them. The higher castes rarely fought against the lower ones and therefore the strains of belonging to the lower castes were never that scalding. People assimilated together to celebrate their religious and social functions and thereby showed strong tendencies for osmosis or interaction. This in turn generated a sense of fellow feeling or togetherness, a strong character of the communal life observed in primary relationships. The region being geographically isolated by tall hills from outside, this kinship ties glued the men together and bound them within the borders of the state. They merely ventured out, for they were content with the forests bound verdant pocket on the crest of the hills. The compact social life was in tune with the participatory and collective living they had etched out for themselves. The collective spirit was ushered by yet another spirit of naturism that they had exercised over the decades. This naturism, was yet another source of the movement that had exhorted them in order to protect the forests.

In India, worshipping the nature and its sacred grooves had continued for long. The forests were personified as gods and goddesses and revered with ostensible elaborations. Not just the Garhwalis, the practice is followed throughout the country. For instance, assigning a turf of forest to deities is a common practice among the Meitei community of Manipur who exercise ancestral practice of animism with the focused around the worship of the forests are regarded as sacred abode of Umanglais (Sacred deities or sylan-deities) . Similarly, the Garhwalis worshipped forests, that were considered the local deity of the village. Each village had such Gramdevata or Ishtadevata, that were worshipped with much fanfare. The trees were supposed to protect them from the spooky spirits and immune them against the external ravages. They did not seek

institutional practices to address their grievances, but rather rested on the non-institutional divine measures to settle their disputes. This gave them an innocuous and innocent persona that helped them sort out their own problems without resorting to ponderous procedures. Thus, you can very well bring out the source of their peace-loving and simple temperaments. Given below is a picture where you can see the village women are busy worshipping a tree with great pomp and devotion.

Pic.2. The village women worshipping the trees with enthusiasm.
Photo credit: http://goodwiz.weebly.com/religious.html

Do you know (2) ?

There are ample such trees which are worshipped in our country, but the commonly worshipped ones are Neem, Ashok, Peepul, Banyan, Bael, Coconut, Sal and Mango.

Interestingly, amongst these, the Banyan tree is our national tree while the Sal tree is equally worshipped among both the Hindus and the Buddhists.

This amiable and soft-heartedness was thus an intrinsic character of the hard working Garahwali people, which time and again had come out in the protest movements organised by them. This was also mirrored in the peaceful movements organised for the demand of a separate Uttarkhand state. Can you tell, what Dhandak is ? It is actually the silent form of protest movements waged by the people of Garhwal. It was a way of opposing the unfair policies implemented by the monarch of the state. The acts were meant to punish the corrupt officials who thought of reaping the benefits by accruing upon the mass a harmful policy. The people felt by staging such forms of protest, they were actually helping their monarchs to rule them

with able-hands. Therefore, the revolt they triggered was not against the state, but against the officials who colluded with one another to defraud the common men and to rob them of their public assets. The movement was often said to have picked up the Gandhian strategy of Satyagraha , to protest the commercialisation of the much owned forests, which escaped the collective ownership of the community and fell in the private hands of the greedy entrepreneurs.

10.4 Causes of protest: Tracing the steps of the Chipko Movement

The Chipko Movement largely meant embracing the trees to protest their illicit felling. The forests that supported the villages for centuries, were suddenly taken over by the colonial rulers who usurped the forest rights of the common men. The men were obsessed with the forests because they served them as a storehouse of resources that they could not do without. Besides providing them with a regular supply of fruits, berries, roots, wood and fodder, they indirectly helped in retaining the ground-water level and binding the soil to prevent droughts and famine. The Garhwalis were in praise for the forests and tried hard to conserve them with utmost care and in every sustainable way possible. Not just physically, their ideologies were ingrained with such ecological ethics, that brought conservation to the forefront of their communal life. They were wary of the ill effects of deforestation and so strictly forebade tree felling across their landscape. Following the advent of the colonial forces, the changes that followed crunched and smashed this ethics altogether, which the locals had cherished over ages. Let us follow the chronology of the movement, especially the historical entry points that signalled the initiation of the movement.

10.5 Two historical events that triggered the movement: Building railways and Sepoy Mutiny

The colonial forces triggered changes in the forest ecology that was slowly piling up discontent in the minds of the hills people. Especial mention must be made of the laying of the railways in 1853 and the Sepoy Mutiny in 1857 that sounded the death knell for the men of Garhwal. The colonial intervention ensured massive transportation of goods and cargo that called for the construction of the railways. Once the laying of railway lines started, large logs of wood were needed for which huge trees were brutally slaughtered. The Himalayas were largely affected especially, the Garhwal region that had harboured tall trees, that were very sturdy and durable and were most suited for making railway sleeper . The felling of the trees took a drastic form once the Sepoy Mutiny had started. This meant that the British forces felt that more railways were needed to transport troops to quell the revolt. This created a pressure

on the trees that were blatantly cut down to build not just railway sleepers but also to power feed the railways. To provide adequate fuel for the railways, the woods were cleared to arrange for the energy supply, especially when the coal supplies tripped. Not just the Himalayas, but the other extensive parts of the northern Indian forests were adversely impacted by the expansion of the railways, especially from 1869 to 1884. The situation in Garhwal was slowly spiralling out of control when the government decided to install a forest department to take control of the situation. Since the British did not probably have any expertise in this area, they thought of taking advice from the German foresters to help them design a Forest Act that would keep into account the colonial benefits from the forest and therefore safeguard the forests accordingly, but what possibly the Germans did not have in their knowledge, was the indigenous history of the juxtaposition between the forests and the inhabitants. Ignorant of the micro-history of the region, an act was passed that destroyed this coexistence. The legalese imposed restrictions on the forest rights of the common men, who could no longer use the forest products without the permission of the Forest Department of the state.

We have already learnt about the Anglo-Nepalese treaty of 1815 after which Garhwal was transferred to its monarch, Tehri Raja's son who in turn leased large tracts of trees to the British empire. This complicity between the state and the imperial forces kept no leaves unturned to deprive its people of the natural forest products which they had grown up with to think of their own. It took time for the shock to sink in, for the people, especially the women were first to become its victim. With the declining forests, gathering timbers, fruits and berries became an ardent job and since most often women were entrusted with these primary tasks, deforestation meant making their life hasslesome clubbed with unending drudgery. This also meant double drudgery as it ensured that women not only have to complete their household chores but also have to travel longer roads to collect resources for sustenance, which earlier were readily available outside their thresholds. All these were enabled by the scientific forest management. The legalese ensured that policies for forests be crafted in a way so that the ways to usurp the forest resources by depriving the common masses be ratified in a way that becomes unquestionable. The forest management and its upkeep was slowly being transferred to the newly appointed forest managers who almost were ignorant of the oral history of soil and forest conservation that were transferred from one generation to the other mostly through oral history with little written records to corroborate this age old bonhomie between man and the forests. The smooth and tranquil life being trespassed by an alien law became the cauldron of boiling fumes. The situation was soon going out of control and it turned violent in December 27, 1906, when two hundred villagers attacked forest officials camping in Tehri. The

violence refused to pull up and re-appeared once again in 1907 when the erstwhile forest officer of Tehri, Sadanand Gairola, was roughed up in Khandogi. King Kirti Shah immediately rushed to the spot to pacify the angry mob . But as you will now see, Chipko movement soon shredded off its violence to go down the path of peaceful resistance.

10.6 From violence to peaceful non-cooperation: Chipko emerging as the forest Satyagraha

The Chipko movement soon changed its course to embrace peaceful resistance instead of taking a bloody patch. In 1930, the Garhwalis initiated their non-cooperation movement centring decisively around the agenda of forest and its riches. Satyagraha movement was championed with utmost ardour against the colonial forest rules in the Rawain region. The King of Tehri who was detouring Europe at that time, asked his Dewan, Chakradhar Jayal, to repel the movement with force and armed repression. Several unarmed Satyagrahi workers died while crossing the Yamuna River. The movement gained momentum from the anti-colonial struggles that were promenading the British enslaved India at that point of time. The Chipko movement was at an important junction of Indian independence movement which greatly enthused the democratic demands of the Garhwalis. Satyagraha as you all know is a form of movement popularised by Gandhi, the father of nation, as a strategy connived to play down the treacherous tricks of the imperial forces ruling the country. The Chipko movement evolved gradually as an extension of the Gandhian philosophy of peaceful resistance to combat the evil policies of the British polity. This property of the Satyagraha movement was lent to the Chipko Andolan by Gandhians, such as Sri Dev Suman, Mira Behn, and Sarala Behn. Sri Dev Suman was inducted into the Gandhian Satyagraha during the Salt Satyagraha. Gandhiji died a martyr's death championing the rights of the Garhwali people. Both Mira Behn and Sarala Behn worked under his aegis. Following Gandhi's death they took refuge in the laps of the Himalayas and set up their ashrams. Shiva therefore said,

> ‘‘Equipped with the Gandhian world-view of development based upon justice and ecological stability, they contributed silently to the growth of women-power and ecological consciousness in the hill areas of Uttar Pradesh. Sunderlal Bahuguna is prominent among the new generation of workers deeply inspired by these Gandhians.’’[16]

Sunderlal Bahuguna joined nationalist movement at the age of 13. He was elected the General Secretary of the Congress Party in the Tehri sub-division in 1947. It was later in 1956 that he quit politics to work in close association with the rural poor men.

That he decided to quit politics to work with commons might have been under the influence of Vimala Nautiyal, his wife and a dedicated social worker and a follower of Sarala Behn. Vimala at the same time worked to spread Vinoba Bhave's message of land grant or Bhoodan, as it was called, to empower the rural people. Sunderlal Bahuguna alongside penned articles in various newspapers and journals, underscoring the ecological damages already done and sensitising the people with the ways of reviving back the lost ecological balance in the Himalayas.

Picture : 3 Sunderlal Bahuguna, one of the champions of the Chipko Movement along with his wife Vimala Nautiyal Bahuguna. Picture Credit.

Do you know (3) ?

Vimala Bahuguna neé Nautiyal was socialized in Tehri Garhwal, in a strictly patriarchal and insulated princely state which never even had a high school for girls. Since her father had heard of Gandhi's disciple Sarala Devi and her Lakshmi Ashram, she was schooled and trained there; subsequently from a timid girl she grew up to be confident and vocal enough to set up her own ashram and a school. She was the major force behind her husband Sunderlal Bahuguna, in ushering an environmental movement in the hills. Sunderlal is an iconic figure in ecological history but few knows about Vimala.

10.7 Conclusion

Chipko movement now has developed for itself a multi-faceted identity which has meant different things to different people. It stands as a significant conservation movement of the poor while for others it is more of a grass root movement for claiming rights over natural resources which were once snatched away by the colonial

power and eventually by its own state. It is also a movement evoked by women to protect their environment. This movement, perhaps also stages the propagation of eco-feminism in India. But the question which stands pertinent is : What had been the repercussions of the movement? How far had it been able to reach its support to the lowest rungs of the village? Was it merely an intellectual movement or was it able to penetrate the ins and outs of the village?

However, it must be emphasised that despite its grassroot achievements, the Chipko accomplished a lot at the national, and the international level. Chipko was one such movement which put the forests on the political agenda of the country. The Forest Conservation Act of 1980 and the foundation of the environment ministry testifies to it. Chipko was instrumental in unravelling a new wave of understanding among the foresters. It was realised that ways to exploit forests should have been far more scientific and perhaps creating nurseries and plantations was a viable way out. Chipko movement in fact grew from people's deep concern for the forests. The poor in fact felt the most for the forests that surrounded them. Not just the poor, but the women in particular felt more strongly for the forests for they knew cutting them would mean loss of fuel and fodder for their livestock. Collecting fuel and fodder were some of the domestic chores usually relegated to the women in the rural homes. Loss of forests would mean that she would have to walk more miles to collect fuel and fodder for the rural households fell back tremendously on the forests for its daily supply of these essentials. Therefore, Chipko was not just a movement. It was something more. It was also a pro-poor environmentalism that it generated in the first place.

The very notion that the poor destroy the environment and make it unusable was dismissed in favour of the poor having a deep regard for the forests for they were intimately related with it since their birth. Chipko reiterated the fact that people can live in harmony with the environment and they take all the measures necessary to protect the environment.

10.8 Model Questions

Answer the Following:

1. Distinguish between the traditional and new social movements.
2. Write a short note on Chipko as a primary kind of forest movement.
3. Explain in brief the socio-cultural fabric of Uttarakhand.
4. How did the Garhwali culture usher the Chipko movement?
5. Write a note tracing the steps of the Chipko Movement.
6. What are the two historical events that triggered the movement?
7. How did Chipko emerge as an agent of forest Satyagraha?

10.9 End Notes

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UNIT–11 : WATER-BASED MOVEMENTS—NARMADA

Structure

11.0 Objectives
11.1 Introduction
11.2 Locating the Narmada
11.3 Tracing the path of the struggle
13.3.1 Emergence of Medha Patkar
11.4 Assessing the impact of the Sardar Sarovar Project on the Ecology and Social Environment
13.4.1 Swallowing the villages in a gulp
11.5 The pathos of tribal resettlement
11.6 The politics of resettlement
13.6.1 The Present Situation: Inaugurating the much awaited Sardar Sarovar Dam
11.7 Conclusion
11.8 Let's sum up
11.9 Glossary
11.10 Suggested Readings
11.11 End Notes

11.0 Objectives

The objectives of the chapter are to introduce you to the environmental movements concerning water bodies and the allied matters like their conservation, re-settlement of people from their banks and providing them with adequate compensations and so on with special reference to the Narmada river. In short the objectives are:

- To gather a conceptual idea about water based movements
- To learn the different problems forming the basis of such movements.
- To understand the impact it generated on the general masses.
- To argue for the different strategies adopted by the different movements and how it electrified popular mobilisation.

11.1 Introduction

During independence, the number of dams in India was negligible but it grew exorbitantly since independence. The dams were largely built for multiple reasons like flood control, water supply, hydroelectric power generation, and mostly for irrigation. During independence, there were as less as 300 large dams in India. Therefore the dams were better known as Multiple River Valley Projects. By the year 2000, the number had almost swelled to over 4000, of which more than half were set up between 1971 and 1989. In post-independence India, dams were proudly proclaimed as the 'Temples of Modern India' by our first Prime Minister, Pandit Jawaharlal Nehru owing to their sophistication and sustainability. It was thought that dams would help connect the rural agricultural economy with its urban industrial counterparts. Inaugurating the Bhakra-Nangal Dam on river Sutlej in 1955, Nehru coined this new name for the dams in modern India. It was thought that the dams would become pillars of development in new India. However, right from as early as 1980s, public investments made on large dams in India had been mired with controversies and the Sardar Sarovar Project had been the subject of a prolonged controversy that rocked the whole nation. The Narmada Andolan would help illustrate a few problems which characterise the water issue in our country. Let us look into these issues for they rightly point out to the swelling environmental problems in the nation.

Firstly, as you know, the water disputes surround the issue of allocating a resource and the entailing areas of the costs and the profits involved. Secondly, you may be surprised to know that the issue might spiral out of control especially if a federation is in question where two or more states and the central government are jurisdictionally involved. Thirdly, problems equally become complex while sharing water in an upstream-downstream conflict. The gravity of the problems increasse while mediating a conflict between the environmental activists on one hand and the government or the state on the other. So as you can easily imagine, distributing a scarce resource like water is really a tricky issue for a third world country like ours.

The Sardar Sarovar Project on the river Narmada was probably one of the mightiest and most expensive multi-purpose river valley project to be executed in India. As you might know the river is jointly shared by Gujarat, Rajasthan and Madhya Pradesh and therefore conflicts surrounded the project right from its very inception. It was expected that the dam would irrigate large tracts of around 1.8 million hectares of land in Gujarat and Rajasthan and would supply drinking water to over 40 million people. The dam would have an installed capacity of producing around 1450 watt of hydro-electricity for the coming thirty years. The dam therefore took off with big promises and bolstered resolutions which were hard to keep. Let us now examine the location

of this mighty river on which the dam was built. This will help us to understand its strategic importance as well as trace the source of its contention.

11.2 Locating the Narmada

The river Narmada originates from Amarkantak in the Maikal ranges situated in the Shahdol district of Madhya Pradesh (MP). The altitude of the river-bed here is 1,051 metres (3,468 ft). Here on the river travels down to the west and encounters almost 41 major tributaries on its path. The total catchment area of the river is almost 98,796.8 square km comprising of the Maikal ranges in the east, Vindhya ranges to the north and Satpura ranges to the south. The river crawls down the following districts of Shahdol, Mandla, Jabalpur, Narsinghpur, Hoshangabad, Khandwa (east Nimar), Khargone (west Nimar) districts of MP. The river forms a formidable boundary between the Jhabua district (MP), Dhulia district in Maharashtra and Baroda-Bharuch districts in Gujarat. Traversing through Bharuch district, the river terminates in the Gulf of Cambay (Patel: 1994 : 1957). Therefore, it seems that the river is essentially an inter-state resource which is shared by three neighbouring but contentious states that make it difficult to reach at a unanimous decision. The river takes a long path and zig-zags through multiple areas each carrying its distinctive character. This mighty river, as you see, with its length and breadth covering such a wide but diverse periphery, brings with it important social and political under-currents that politicises the dam building processes even more. The river has a total length of 1312 km and basin area of total 98, 800 square km that is constituted about 88% of Madhya Pradesh; 2% of Maharashtra and 10% of Gujarat.

There is an intense pressure of human abuse on the river resulting from which the river basin had been degraded to a terrible extent. Some possible reasons of the mounting pressure on the river basin had been exorbitant population pressure, migration and haphazard settlements, unorganised land usage, agricultural extensions, demand for timber, fuel and fodder, over-grazing, intrusion etc. Thus it is already evident that the river basin had always been under the siege for all possible reasons. The contentions surrounding the river were thus amplified for these reasons too.

Narmada entered Gujarat through Surpaneshwar which forms roughly a 35 km boundary between Maharashtra and Gujarat. The total length of Narmada in Gujarat is 165 km. The catchment area of Narmada in Gujarat is around 10,000 sq km. This particular area lies in the tribal inhabited region which precisely does not belong to Gujarat. It is often claimed that the largest point of discord is that the biggest beneficiary to reap benefits from the Narmada Project will be Gujarat but this will be done at the cost of the two other states, Madhya Pradesh and Maharashtra. You will be

surprised to know that these states would be hijacked of large tracts of forests and natural resources. Thousands of people, mostly tribes would be uprooted from the region.

Check your Progress 1.

a. What are Multiple River Valley Projects? 10 marks

b. Where did Narmada originate from? Which are the states it travelled through? 10 marks

c. What are the issues mostly around which water disputes in our country arise? 5 marks.

11.3 Tracing the path of the struggle

Gujarat proposed its idea to build dams before the Narmada Water Disputes Tribunal in 1969. The state claimed that the dams would build up a corpus of surplus water that could be supplied to the impoverished areas, besides providing clean drinking water, irrigation, and electricity. Challenging the proposal, Medha Patkar organised a thirty-six day march would be a symbol of solidarity among the neighbouring states of Narmada Valley as well as a direct challenge to the government and the World Bank. She organised a march that lasted for thirty-six days as a symbol of protest in order to instigate the World Bank and the state to withdraw from such a project. The projects had already been suspended on the behest of the Ministry of Environment because of the non-compliance of basic development project as a whole. .

11.3.1 Emergence of Medha Patkar

Let us learn a little about Medha Patkar. In 1985, as this news was broken to the central and eastern parts of the country, Medha Patkar and a few of her colleagues began visiting the dam site. She was shocked at the magnitude of displacement and therefore founded the Narmada Charangrast Samiti (NCS), or the Narmada Oustees Association, which finally developed into the Narmada Bachao Andolan in collaboration with the Gandhian organisations in the states of Madhya Pradesh and Maharashtra.

Medha spoke to the resident members of the valley to understand their pains and pathos. Most of them did not know what the government was up to and what sort of rehabilitation would be provided to them. In the next year, i.e 1986, the World Bank was pleaded by the state to back the Sardar Sarovar Project. Patkar realised that in order to suspend the project, the World Bank must be restrained to terminate the construction of the Sardar Sarovar dam. Medha and her colleagues took long marches from Madhya Pradesh to the dam site as a mark of protest against the proposal. The

thirty-six day march became a symbol of solidarity among the neighbouring states of Narmada Valley as well as a direct challenge to the government and the World Bank. In 1993, in association with the Environmental Defence Fund and the International Rivers Net work, the Narmada Bachaon Andolan or NBA compelled the World Bank to suspend its proposed fund for the dam. In 1995 the Supreme Court was persuaded to delay the construction process till the further review of the rehabilitation process been done.

Medha Patkar at the site of the movement. Photo credit

Do you know (1) ?

Medha Patkar is an Indian social activist fighting for crucial political and economical issues raised by adivasis, dalits, farmers, labourers and women facing injustice in India. She is an alumnus of TISS, a leading institute of India. She was awarded with many awards chief amongst them are, Right Livelihood Award in1991, Goldman Environment Award in 1992, Human Rights Defender's Award from Amnesty International in 1999 and Mother Teresa Award for Social Justice.

Check your Progress 2.

a. Who is Medha Patkar? How is she associated with the movement? 10 marks.

b. What is the significance of the Narmada Bachaon Andolan (NBA)? 5 marks.

c. Why did the Supreme Court stall the project? 5 marks.

11.4 Assessing the impact of the Sardar Sarovar Project on the Ecology and Social Environment

It is a stunning fact that in the last decade Gujarat had destroyed a major chunk of the forest wealth of the exploited tribal areas right from the Danta state in the north to Dangs in the south. According to the report of the principal of the Forest Rangers College at Rajpipla, "Rajendra Sharma stated that between 1970 and 1990, the forests which extended west of Rajpipla had been decimated systematically... the systematic and organised forest felling had led to a recession of the forest area by about 60 km to the east of Rajpipla" (Patel:1994:1961). The forested area actually belonged to the tribal groups who had been uprooted from their native places and thrown hitherto. Forested stretches up to the Jhabua district in Madhya Pradesh had been taken over on the presumption that these areas would be submerged under Garudeshwar and Sardar Reservoirs. The local Bhil tribes who were practically dependent on these forests were literally shunned away from their abodes. The wild life had been utterly disrupted and the ecology was badly tampered with.

Do you know (2) ?

Jhabua is chiefly a tribal district placed in the west of Madhya Pradesh. It embraces the Panchamahal and Baroda districts of Gujrat, Banswara district of Rajsthan and Dhar and Ratlam districts of Madhya Pradesh. River Narmada builds up the southern periphery of the district. The terrain is hilly and uneven often termed as "Jhabua hills topography". The Bhils and Bhilala tribes inhabit the area and most of them often take resort to criminal activities finding no other alternative sources of employment.

11.4.1 Swallowing the Villages in a Gulp

Do you know how the dams damaged the organic links of the valley with the river, its ecology and its social economy? It is difficult to comprehend that the dam will tear asunder a complex web of physical, ecological, economic, cultural and emotional ties that bind a river and the communities, and the living and non-living entities in the basin . The different categories of the people alongside their occupations would be affected by the dam and its infrastructure. Landless labourers who stayed in the nearby villages and made their ends meet by mining sand collected from the riverbed would suffer a lot. They would soon have no livelihood to fall back on as the river would be translated into a big reservoir. The reservoir was now too deep for them to collect sand from; and secondly, the perennial flow of the river that recurrently pumped in new sand would be stopped for ever. Such a list of fisher people, boats

people and others who earned their livelihood from the river was infinite. Villages like Bheelkhera were badly destroyed. Village shopkeepers, potters and carpenters were badly affected. They lost their livelihoods and became jobless with nothing else to depend upon. For instance, when the Bargi dam was erected on the river Narmada near Jabalpur, villages located several hundred kilometres downstream had to surrender the lucrative summer riverbed crop of melons and watermelons as the water-flow trends in the river were severely altered. When the Sardar Sarovar was built, and the waters diverted, the rich estuarine fisheries of the downstream area in the Narmada were likely to collapse.

As dams were being built up on the Narmada, water channels were dramatically changed. Several fairs that were held regularly on the riverbanks would have to be shut down. A dip in the river was the most important part of the fairs, and the flow of the rivers had to be resumed for those festive days by reducing the height of the water from the dams. Many riverbank temples that were relocated and 'resettled' far away were badly thwarted. The socio-cultural life that surrounded the fairs dwindled thus affecting the rich fabric that was spun around the river and its people. Since the Narmada is considered one of the most sacred rivers in our country, it entails a unique custom called parikrama or circumnavigation, that is typically celebrated around the river. In this queer ritual, thousands of people stroll from the starting point of the river to its mouth and back again. The river has to be circumnavigated on foot, and one must bypass the river only at its mouth. The dams-those built and under–construction– have submerged the route of the parikrama . Villages on the river banks have been submerged under the thrust of the water and the reservoir has generated a bunch of new villages on the new banks. However, these villages are devoid of any such tradition now.

Thus, we find that the dam had not only affected the ecological balance of the place but also the social and cultural fabric of a place. The region along with its natural resources would provide a bed-rock of wealth for its local men who would eke out their living from the zone. Along with it would develop a paraphernalia of other social and cultural engagements that would also provide the locals with a ready source of employment. However, hell would break loose whenever a dam or a project encroaches on the natural setting of a place that the men had internalised for so long. Along with a disrupted ecological equilibrium even old customs and rituals that had become almost a part and parcel of their daily existence became badly punctured. Thus, the Sardar Sarovar Dam with its hungry gulp would massacre the quiet villages of Maharashtra and Madhya Pradesh.

Do you know ?

Chikhalda, Dharamray and Kakrana villages in Barwani and Dhar districts of Madhya Pradesh have been submerged as levels of water in the Sardar Sarovar Dam on river Narmada arose. The NBA claimed that around 40,000 families in 192 villages in Madhya Pradesh would be uprooted once the reservoir occupies its optimum capacity.

Do it yourself 1. : Find out the names of all those villages that have been submerged by the dam. Try to find what has happened to those villagers and how they are recuperating. Figure out their sites of rehabilitation and whether the places are well equipped to provide them with an alternative source of livelihood.

11.5 The pathos of tribal resettlement

Many tribal villages were getting submerged under the river and the local inhabitants had no resort but to relocate themselves often to very uninhabitable sites. According to the agreement of the Narmada Water Disputes Tribunal, for instance, Anjanvara, a small village in Maharashtra, on the bank of river Narmada was accrued the right to decide whether to settle as it is in MP or to re-locate in Gujarat. The MP government tried to oversee that this freedom could never be exercised, for if all of the families of 193 villages in the state to be forcibly evicted by the SSP stay put in MP, it would be a great administrative hassle. The MP government was not ready to bear this headache. It was more eager to depose its tribal evictees to Gujarat. Let Gujarat handle them. The situation was particularly trying because there was a constant pressure for displacement from Maheshwar, Narmada Sagar, Onkareshwar and all the other dams that were scheduled upstream. The villagers on the other hand do not want to migrate to Gujarat. They have already travelled to the resettlement sites there and experienced the misery. Waterlogged fields, no livestock, fragmented families, hostile neighbours, no commons to collect fuel and fodder–this sums up the experience of most adivasis from MP who were given land in Gujarat.

The displaced tribal men did not want to move. However, if worst situation comes, they would migrate only if given forest land where the entire village could relocate as a whole. In most cases, neither the state of Madhya Pradesh nor Gujarat could provide them with these basic requirements. The tragic fact remained, even this modest requirement was denied to them by their host state of Madhya Pradesh. It is really unfortunate that for a state with the largest forested area, the MP government was unable to find any proper land on which it could rehabilitate its own tribal population. Instead it had taken a buck-passing tendency to shift its responsibility to the neighbouring state of Gujarat to accommodate its own tribal men.

11.6 The politics of resettlement

While tribal men in Madhya Pradesh did not want to leave their own home state, it was not so for the entire village. There were probably some men who turned out to benefit from this whole process of relocation and were facilitating this process for others. Amita Baviskar called them a 'motivator' who earns a commission for every person he delivers to the door of the 'doob' officer (submergence officer). Baviskar narrated the story of a man called Dhankia, the ex-sarpanch of nearby Kakadsila, who got reasonable amount of land where his village was resettled as a unit. Dhankia was believed to have profited lucratively from this resettlement drive. He struck a business by illicitly felling teak trees from the Kakadsila forests and selling the timber in Gujarat. He also accrued money from every family that he pursued for relocation and after they finally left the state with their belongings.

The process worked just like the old sterilisation campaign which deploys a 'motivator' who facilitates the resettlement process and finally motivates the local settlers in abandoning the reclamation site in favour of a less habitable one that the state chooses for them. The motivator is usually one of a higher power and status in the village, such as those of a sarpanch or an indigenous leader that Baviskar mentioned. Usually such powerful people take an upper hand on the poor villagers and curtail their bargaining capacity even more. Baviskar said, for hustlers like Dhankia, this is both an easy and appealing way to earn money. Nevertheless it must be remembered that most of the locals of the dam site are poor men who can neither manipulate the common mass like hustlers nor do they accumulate such wealth through illicit earnings. Therefore surrounding the Sardar Sarovar Project, the task of displacement and relocation has become a muddy affair from which definitely a class of people have skimmed out the cream. It is those who are reasonably the advantageous people of the community and who can negotiate ably with the government to derive their own benefits. They not only negotiate for their own selves but also negotiate for others whose interests they do not keep in mind. Therefore the poor displaced men could hardly see the light of the day.

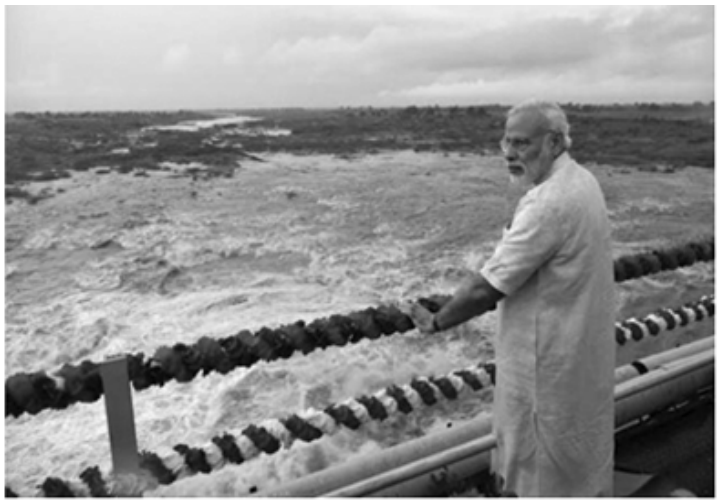
Though the dam construction work was suspended in 1994 after NBA activists managed to get a stay order from the Supreme Court on the ground of environmental and relocation issues, the suspension could not be retained for long. The construction was restored after the SC issued an order in 1999 to resume the construction once again. This was done on the pre-condition that the dam height would be elevated in phases after regular review of the conditions for resettlement in phases.

After this Narmada verdict by the Supreme Court, the matter had become more complicated and politicised. The people launched the 'Manav Adhikar Yatra', in October

2000 and staged protest in front of the Supreme Court to criticise its verdict. The governments are now using the same verdict to go ahead with the submergence of the valley and displace people without rehabilitation . It is not only having a terrible impact on the people in the valley but it speaks of the impartiality rendered on the marginal men such as the dalits, adivasis, workers, farmers and backward classes. The movement had paced down and the protests could no longer keep up with the aspirations of the state.

11.6.1 The Present Situation: Inaugurating the much awaited Sardar Sarovar Dam

Prime Minister Narendra Modi on September 17 travelled to Kevadia and inaugurated the Sardar Sarovar Dam on river Narmada on his 67th birthday. Mr. Modi performed rituals on the bank of Narmada and offered flowers and prayers at the dam site before inauguration. Modi claimed that the western part of India still lacks sufficient water supply, and there is shortage of electricity and gas supply too in the eastern part which rightly justifies the construction of the dam. He asserted that when the World Bank had denied to fund the building of Sardar Sarovar dam, the



Prime Minister Modi in front of the newly inaugurated dam. Photo credit

saints and seers of Gujarat donated money to enable the grand task. He also thanked Madhya Pradesh chief minister Shivraj Singh Chouhan and his Maharashtra counterpart Devendra Fadnavis for their benevolence for initiating project. The Prime Minister was confident that the Narmada waters would save several lives especially those living on the brim of existence. Modi was quite sure that the project would establish 'New

India' by 2022, when we would celebrate 75 years of India's freedom struggle. It was believed that PM Modi fulfilled Sardar Patel's long standing dream with the inauguration of the dam, for which foundation stone was already laid by Jawaharlal Nehru long ago. Water resources and river development minister Nitin Gadkari congratulated the people of four states on the inauguration of Sardar Sarovar dam in Gujarat for he was hopeful that Sardar Sarovar Dam would fetch fresh drinking water to 4 crore people that would accelerate the earnings of farmers many times by 2022. At the same time the government was optimistic that the dam would aid irrigate 22 lakh hectares of land. Sardar Sarovar Project officials were enthusiastic that the project would irrigate 2,46,000 hectares of land in the dominantly important desert districts of Barmer and Jalore in Rajasthan and 37,500 hectares in the tribal hills of Maharashtra.

On the same day, activist Medha Patkar organised Jal Satyagraha in the rising waters of Narmada at Chota Barda Ghat in Barwani district of Madhya Pradesh. Patkar was apprehensive that with the water level of the dam rising to dangerous heights, it would soon submerge around 192 villages in the region will be submerged under water. It would affect around 40,000 families. Patkar has alleged that the affected families would soon be rendered homeless and would be deprived of rehabilitation or compensation in spite of the strict orders from the Supreme Court. Patkar along with 30 women organised a sit-in on the banks of the Narmada river at Chota Barda village in Dhar where she insisted the water level was fatally rising.

Patkar performing her water satyagraha at the dam site. Photo credit

Do you know (3) ?

The Jal Satyagraha protest being organised in the Khandwa district of Madhya Pradesh, India, is a prolonged protest staged by residents of Gogalgaon village, and neighbouring villages that house the victims of the families about to be submerged by the dam. Especially the villagers of the low lying hamlets fear that they would have to bear the brunt of the upcoming floods. Their grievances had been magnified by the sheer apprehension that not enough assistance for relocation would be provided by the state. The protest that began on Saturday April 11, 2015 involved around fifty local residents but is gradually increasing its strength.

11.7 Conclusion

The kind of developmental design set up by the Narmada Valley Project was not suitable for a country like India. Sociologists have time and again argued that dams like these would only bring lop sided development in our country where most of the decisions are taken in a top bottom approach within a highly bureaucratic set-up. Development becomes polarised in absence of any form of decentralisation such that a class benefits at the cost of the others leading to the pauperisation of the masses. The real question was whether the dam could create resources for the society or whether it drained away the already created wealth in the country, making the economy and the society more fragile than before. Thousands of people were uprooted from their native homes and their livelihoods were smashed without any prior planning for their alternative modes of rehabilitation and relocation. This unplanned development surely could not benefit the millions living in the country and bring any sort of modernisation that the state time and again argued for. This created a scope for an eternal conflict between the state and its people where the underdogs bore the brunt of the massive developmental drives and the state resolved for something it could not fulfil.

Check your Progress

a. Why did the evictees not willing to settle in Madhya Pradesh? 10 marks

b. Why were the labourers losing their only source of employment? 5 marks

c. How were polarisations created through the processes of displacement? 10 marks

d. How was the situation of rehabilitation more aggravated in the global era? 5 marks.

11.8 Let's sum up

Narmada therefore is a river of multiple emotions and sentiments and not just a mundane water body. It symbolises one of the most dynamic peoples' movements in the country. It is truly an indigenous voice personified that sustained for long, refusing to ebb out in spite of headstrong resistance. It is one of its kind in the country, for the movement showed the strength of the marginal people and their strength to fight against all odds. The movement was mired in a long legal battle where it, though won the support of the World Bank and the Supreme Court, could not persist its long drawn battle. The global era with its hefty promises for modernisation and beautification often crouches on such projects to make the common men the scapegoats of the post-modern era. Nevertheless, the environmental movements would be remembered not just for generating fire sparks like Sunderlal Bahuguna, Medha Patkar, Baba Amte, Vandana Shiva, Vijaypal Baghel, etc. but even the lesser known senior activists like Alok Agarwal, Vilasrao B Salunke and Rajendra Singh who had started water conserving movements in their small ways in their communities, were born. The movement will therefore be remembered not only for instigating mass struggles but also for garnering local consciousness in one's own individual ways too.

11.9 Glossary

a. Narmada Water Disputes Tribunal – It is under the Inter-State Water Disputes Act, 1956, the Central Government built up the Narmada Water Disputes Tribunal (NWDT) on 6th Oct. 1969 to decide upon the sharing of Narmada waters by the four states of Gujarat, Madhya Pradesh, Maharashtra and Rajasthan.

b. *Narmada Bachao Andolan* – It is the movement called by Medha Patkar and soon joined by others to protest the building of the Sardar Sarovar Dam on environmental grounds and on the apprehension that the state would not provide adequate compensation and relocation to the dam affected settlers.

c. *Parikrama* – The sacred Narmada River is circumambulated by the pilgrims. The process of circumambulation or *parikrama* is considered pious by the pilgrims, who take this trip every year. The importance of the *Narmada River* as sacred is testified by the fact that the pilgrims perform a holy pilgrimage of a parikrama or Circumambulation of the river. The *Narmada parikrama*, as it is called, is considered to be a meritorious act that a pilgrim can undertake.

d. *Sarpanch* – A Sarpanch is elected from a village based statutory institution of local self-government called the panchayat (village government) in India

(gram panchayat). The sarpanch, along with the other elected panchas (members), constitute the gram panchayat. The sarpanch is the focal point of contact between government officers and the village community.

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UNIT–12 : LAND BASED MOVEMENTS (ANTI-MINING AND SEED).

Structure

12.0 Objectives

12.1 Introduction

12.2 The Source of the Mining Problems

12.2.1 The Private Corporations and the State Working Together to spark Movements

12.3 The Major Land Movements around Mining in Our Country

12.3.1 The Oil Refinery Movement (1956-57)

12.3.2 Uranium Mining and the Social Movement in Meghalaya (1970s-1980s)

12.3.3 The Movement Against POSCO for Steel Mining in Orissa (2005-2017)

12.4 The Other Significant Anti-mining Movements in India

12.4.1 Check your Progress

12.5 Seed Movement in India

12.5.1 Monsanto's Round-Up-Ready Gene Agreement: Triggering the Genes of Protest

12.6 The Seeds of Protest: Karnataka Rajya Raitha Sangha, a Pro-active Farmer's Organization (1980s).

14.6.1 Beej Bachao Andolan–Save Seed Movement of Uttarakhand (1980s)

14.6.2 Seed Satyagraha (1990s)

12.7 Check your Progress

12.8 Lets Sum Up

12.9 End Notes

12.10 References

12.11 Glossary

12.0 Objectives

- To learn the nature and types of the land based movements in India.
- To understand the basis of anti-mining movements in India.
- To develop acquaintance with the traditional seeds in the country.
- To learn about reasons behind the resistances developed against GM seeds.
- To develop a world view of the new situations and how they are being characterised by the neo-movements like these.

12.1 Introduction

You will be surprised to know that the history of mining dates several centuries back when major minerals and precious stones were mined in India. Since antiquity precious minerals and stones like diamonds, gold and iron, lead, zinc, silver and copper ores were mined in different parts of India.There are evidences that active mining for reef gold had been carried out in many gold fields of Southern India such as Bellara, Kabligatti, Wynad and some places else during the regime of Vijaynagar kings (1336-1560) and later during the reign of Tipu Sultan. There is enough circumstantial evidence to establish that copper was found indigenously during 1400-1800 at the time of the Mughal rule.

Do you know ?

Mining of lead, zinc and silver reached its peak especially near Udaipur during the reign of Rana Lakhsh Singh of Mewar (1382-97) and continued till the famine of 1812-13. There were attempts to mine coal in Raniganj coal field in the year 1774. Therefore, it is pretty evident that the art of mining was well known from the medieval ages.

Do you know that mining, from the very beginning, was mainly carried out in the less developed countries of the world? It was a labour intensive enterprise and still tends to be one and therefore indigenous restlessness centring mining had always been there. One of the primary requirements of the mining industry had constantly been to ensure the supply of adequate crew of mostly unskilled and local labourers. Some have stressed the coercive means employed by the industrial sector in securing a vast supply of miners &. All these resulted in degradation of the land and living prompting the local population to cry foul. In order to curtail the costs of production and escape the liabilities of the mining population, workers were not only underpaid but also deprived of all legal benefits by the mining companies. These nullified the

contracts signed with the workers thus making them jobless and compelling them to return back to their homes far before they attained their retirement age.

12.2 The source of the mining problems

Thus mining societies were always at the centre of contention with deep illicit enterprises and engagements creeping up the system. Indigenous societies thus had to bear much of the costs of reproducing and maintaining the large mining labour force [7,8,9,10&11]. The mining communities felt insecure and unstable for they were mired with controversies and doubts surrounding their occupations and livelihoods. The labor unions were continuously pressing for better living and working conditions through collective bargaining with the trade unions and the mining administrations. This created a spiral spring of migrant issues to and from the mining spots, thus creating a bed rock of crisis and uncertainties in an already frail situation [12,13,14,15,16,17,18,19&20].

Some of the other recurring problems plaguing the mining industry are the capital stiffness of the mining industry, continuous harassment of the working class by repeatedly denying them their basic rights and wielding an absolute control over their life [21,22,23,24,25&26]. The mining centres are usually located in isolated locals without necessary amenities for civil populace where somehow the mining population live below the average level of subsistence. These conditions combined with abysmally low wages, risks of illicit mining and unhealthy environment add to their already growing apathy. The lethal combination of all these factors had sparked radical social movements that sought to protest the inhuman conditions associated with mining, labour unrest, ecological degradation of the labour and various social disorganisation associated with the mining industry.Often the onus had been put on the state to having tacitly colluded with the transnational corporations in its endeavour to take over the fertile but mineral rich lands of the tribes to set up giant mining industries. Do you know how the bauxite mine in the bauxite rich lands of Kashipur block in Odisha served as a case in point? Let us learn.

12.2.1 The private corporations and the State Working Together to Spark Movements

You would be shuddered to know how the rich land of bauxite in the Kashipur block of Odisha was posing serious threats to the homes and livelihoods of the tribal inhabitants. The state had tacitly colluded with the multi nationals to extract minerals from this tribal hinterland leading to the loss of land and occupations of the poor tribes.The Utkal Alumina International (UAIL), a consortium of Norsk Hydro of Norway, ALCAN of Canada and INDAL of India had been trying to initiate a project

in the Kashipur Block of Rayagada district for the past several years. They intended to build up a mining and processing unit of alumina with the help of bauxite mined from the Baphli Mali plateau. This plateau was located in the border areas of Rayagada and Kalahandi districts of Odisha that housed about 196 millionhtons of bauxite. Studies indicate that while disposing the chemical wastes produced from mining, dry red mud stacking would generate huge amounts, about 150 tons of sodium hydroxide everyday, which would be difficult to manage. It was anticipated that at least 11 villages on the downstream to the refinery, with a total population of more than 2,000 would be affected by this discharge.

Reports from the NALCO refinery area in Damanjodi in Koraput district show that people have been severely affected by the pollution of their streams by the chemical effluents. The regular pumping of the effluents causes regular bouts of cattle deaths and crop loss besides causing other natural disasters. Often the dangers emanating from the open cast mining sites would seem so terrible that villagers would be forced to flee their households at the foothills of the Baphli Mali. But, as you know, the villagers never wanted to leave their home lands for the fear of displacement but they were always forced to do so. A democratic government does not respect this simple wish of the people. But this time it has not been a cakewalk for the state and the corporate bodies to evict the villagers.

As you can easily assume, that movements were therefore inevitable for the tribes despite their frailty did not want to leave their lands without giving a tough challenge to the state and its paraphernalia. The struggle involved 10, 000 and even more tribal people from the panchayats of Kucheipadar, Dongasil, Tikiri, Kodipari, Sunger who actively participated in the movement with the people of Maikanch to bolster their spirits to carry on a long drawn battle against the state and its accomplices. After they had an encounter with the police that killed a handful of their comrades, they did not give up the struggle but fought harder. They organised a road blockage on December 20, barely four days after the grisly police attack, by demonstrating at the Rupkona Junction. The tribal people in Kashipur had silently proved that their fight against monstrous mining would itself acquire its own identity without the foliage of much fanfare. Vindhya Das had rightly said, ‘‘Tt is the conviction of the people struggling for the right to survive in dignity and in self-respect" (Das : 2001: 2614).’’

However, you will soon learn that the dangers of mining could not pose the same magnitude of threats everywhere. One instance is the wave of the conflicts gathered in the Ib valley coalfield in the two districts of Odisha – Jharsuguda and Sundargarh – covering an area of almost 1,375 sq km. The coalfield had been named after the river lb, a tributary of the river Mahanadi. This coalfield was an integral part of the Mahanadi Coalfields Limited (MCL), a subsidiary unit of Coal India Limited (CIL).

This coalfield have been distributed among five areas which included Orient, Ib valley, Lakhanpur, Basundhara and Garjanbahal. The residents who had benefited from the mining activities for MCL had been arranging employment for the villagers at a wage rate higher than agriculture . At the same time, they had received compensation for their displaced lands. Despite that, conflicts garnered around some dimensions of mining here, as Prajna Paramita Mishra had pointed out. She said, "They have some demands,that MCL needs to pay attention to. These demands vary from village to village" (Misra:2009:123). For instance, Bundia district has acute water crisis for mining whereas in Lajkura, Chharla and Ubuda, rehabilitation problem has not yet been solved. Some Ainlapali villagers are still asking for employment. Their main demands are that they must be provided with sufficient water and that the blasting and dust has to be reduced. According to the villagers, the company attends to some of their complaints, while the others remain unattended.

You might want to know whether the villagers tried opposing the project. They did hunger strike, went to jail and even conducted several road blockages . But finally they had to yield to the demands of MCL and government of Odisha. Having accepted that they would have to live with such mining conditions for ever, they are now pressing for more stringent demands like back-filling of mined out regions, refilling of abandoned mining sites and preparing them for some productive purposes, adequate and regular water supply to all the mining affected villages, reparation of roadways, minimisation of air, water and noise pollution, employment opportunity for the landless and appropriate and immediate distribution of compensation packages.

Therefore, it can be inferred that mining activities often bring along with it necessary evils that seemed difficult to revert. The projects are funded by big multinationals with tacit support from the state, which become difficult to resist. The movements are not always as strong as those staged by the vocal activists for long, for not all movements could generate substantial mass protests like those usually heard of. Nevertheless, protests of some kind or other accompany such mining activities and they refuse to die down in spite of scanty public exposure, as seen in the case of Odisha lb coalfields.

Things to do?

Try to find out some such movements which created uproar in the society for encountering mining expeditions. Try also to figure out few such movements which died down early despite making substantial protests against mining. Try to distinguish between the nature of the two kinds of movements.

12.3 The Major Land Movements around Mining in Our Country

Our country had experienced some of the major land movements centring mainly around mining operations. These movements had occurred at different points in history creating different kinds of undercurrents in the Indian subcontinent. Let us learn some of them.

12.3.1 The Oil Refinery Movement (1956-57)

In post-independence India,the first major explorations of oilfields in India begun at Naharkatiya. This new oilfield in north eastern Assam was expected to support a large production which would be able to supply a third of the country's requirements in the next three years. The Assam Oil Corporation recommended building the new refinery at Calcutta, whereas the Government of India suggested Dhuburi in Assam and Barauni in Bihar as the possible sites of the refinery. The resolution to establish the refinery in Assam was mooted in the legislative assembly on 3 April 1956, but unfortunately the central government could not give any definite assurance. The people in Assam saw the government's moves as being influenced by British oil interests. By June 1957, the Indian government had already decided to set up the refinery in Barauni in spite of the demand of the Assamese people. This led to further political outburst in Assam.

The first furious protests for the refinery in Assam took place on 28th August 1956. The movement was jointly initiated by the leadership of the opposition party and the Chairperson of the All Assam Oil Refinery Action Committee. Strikes, public meetings and road marches were organised to register the gravity of protests. The central government did not bend before hardcore public protests but decided to establish the refinery in Barauni by an outright ignorance of the regional demands of the Assamese people. This led to further political outburst in Assam. This prompted the All Assam Oil Refinery Action Committee to perpetuate the movement by staging a satyagraha from 14 August especially in the areas around the oilfields and in Shillong as well as in other districts.

Do you know ?

The Oil Refinery Movement in Assam stood out on its own not only for having addressed the mineral oil issues, one of the most pertinent yet little exposed problems of the time, but also for invoking the regional aspirations and demands of the local people who wanted a refinery to be set up in their own state and not outside. You may understand, this is how social movements and ethnicity are related to one another for they fuel local sentiments for communal resources.

12.3.2 Uranium Mining and the Social Movement in Meghalaya (1970s-1980s)

India's nuclear programme, as you know, had already been facing an acute shortage of uranium. The uranium mainly belonged to the lands of the tribes. Therefore, mining uranium in the west Khasi hills of Meghalaya had generated strong grievance and antipathy among its indigenous people. The state-owned Uranium Corporation of India had repeatedly been denied access to this mineral rich belt of Meghalaya because of the strong local opposition. Despite that, the government was trying hard to win over the local people to gain access to their territory. Although a reasonable proposition for some, there was also a strong opposition to this, usually citing either health reasons or issues having to do with ethnic sovereignty and indigenous rights.

According to Hopingstone Lyngdoh, the history of uranium in Meghalaya dated back to the 1950s when the atomic energy mining division started its first primary expeditions. Thereafter a string of investigations followed one after the other in the 1970s and 1980s, eventually leading to the discovery of uranium deposits in various sites. One of these sites is the village of Domiasiat in the West Khasi Hills adjacent to the place where the Atomic Minerals Directorate finally began its mining operations to process aluminum ore and to produce the much wanted yellow cake. Lyngdoh had encountered the proposal from the very beginning when he was acting as an elected member of the legislative assembly and the KHADC, which was a body formed in post-independence India to sustain tribal self-rule in the hill areas of north-east India. There was widespread news of ecological crisis emerging with the new mining prospects. Lyngdoh spoke of how he got the news from Domiasiat of how fishes and animals were suffering from an unknown malady. Strange diseases had also begun to emerge. It was then that he started to mobilise people against the uranium mining on a larger scale.

The headstrong opposition to uranium mining in Meghalaya and the people's movement echoed different dimensions of protests. It was not just a matter of ecological and environmental blunder but also an issue of their ethnic sovereignty that guards the communal living from external encroachment. Thus surely the protests registered against uranium miningin Meghalaya was of a matter not just of a macro issue but equally of an issue closer to their hearts. It is a matter, probably a form of social movement that though was grounded on the basic ecological issues were finally meant to cement their mutual bonds of camaraderie and commune, probably a key feature of the close knit states of north-east.

Things to do

Try to figure out the significant anti-mineral movements in the states of north-east. Are these movements in the hills in any way distinct? How do you distinguish them from the anti-mineral movement in the plains?

12.3.3. The Movement against POSCO for Steel Mining in Odisha (2005-2017)

Let us learn about some of these movements in the plains. With the liberalisation and decentralisation of our economy, there was witnessed an influx of many trans-national corporations who were getting attracted towards the mineral hub of Odisha, Jharkhand and Chhattisgarh. Kalinganagar in Jajpur district of Odisha had become the hot bed of commercial interests owing to its nearness to iron ore mines in Sukinda-Keonjhar and Sundergarh, and its viable communication with Paradip Port. This was creating a rift of distrust among the local tribes who began resisting the land acquisition by the mining corporations in the first phase of the 2000s. On 2 January 2006, 13 Adivasis were gunned down by Odisha police for opposing Tata Steel . The movement had thus taken off with zest and force but it could do so with full force, the Government of Odisha signed a memorandum of understanding with POSCO for establishing a 12-million-tonne per annum (mtpa) integrated steel plant with an investment of Rs. 52,000 crores. POSCO was considered as the biggest foreign direct investment in our nation of the time and the state government was boastful about it, declaring that it would ‘bring prosperity and wellbeing to its people.’ However, the government's `dream project turned into a disaster for all those 22,000 people from the affected areas of Dhinkia, Gadakujanga and Nuagaon gram panchayats of Jagatsinghpur district who depended on the forest lands that were soon acquired by the POSCO.

Do you know ?

It was the large tracts of forests that had supported the villagers of Jagatsinghpur district of Orissa for decades by being their only source of betel vines, cashew plants, firewood, mushrooms and saag(leafy vegetables). Villagers strongly opposed the acquisition of their land – a fertile stretch of land like this on the coast of the Bay of Bengal near Paradip, famous for its betel-vines. The vineyards were said to give farmers an assured average income of at least Rs 20,000 per month, but no one listened to their pleas as their vines were mercilessly uprooted and massacred.

The POSCO Pratirodh Sangram Samiti (PPSS), the organisation that spearheaded the anti-POSCO agitation resorted to peaceful means of protest such as dharnas, satyagrahas and padayatras, which saw spontaneous participation of women, children and the elderly. PPSS did not leave any leaf unturned to dispel the destructive forces

of the POSCO. Despite their honest and peaceful attempts, they were fought back with iron hands of the armed police, flag marches, lathi-charges, rubber pellets, criminal charges, arrests and jail terms. One of the most heinous assaults on anti-POSCO agitators took place on 15 May 2010. To protest such a gruesome attack, an indefinite demonstration had been staged demanding the scrapping of the project. This had been going on for five months in Balithuta village, which was considered the entry point to the area.The villagers who took the membership of the Posco Pratirodh Sangram Samiti to protest the land acquisition, refused the state government's package of aRs 70-crore rehabilitation. Instead of entering into peaceful dialogues with the people, the district administration took resort to violent means to intimidate people with lathis, rubber bullets and tear-gas shells. People were mercilessly killed and their houses burnt down. They were left shelter-less and maimed with no medical aid at their disposal. Civic life came to a dead end with complete take over by the police.

The district administration carried out the land acquisition strategically in twin phases– one in 2011 and subsequently the other followed in 2013. In the first phase, the villagers of Nuagaon willingly let their betel-vines and fruit-bearing trees, especially cashew nuts, to be mowed down in lieu of compensation. However in other villages, POSCO was met with violent resistance particularly by hundreds of children and women who denied access to the company by sealing the entry points to the vineyards by organising prolonged sit-ons under the scalding sun as a sign of repulsion. The administration was left with no resort but to call off the land acquisition for the next two years. Even with a strong police deployment, when the acquisition was resumed back in 2013, it could gain access only to a limited 2,700 acres of land sans Dhinkia village, the hub of the anti-all cap campaign. However, in January 2015, following an amendment of the Mine and Minerals Development and Regulation Act – especially with the rising allegations of mining scams across the country, Posco's plans were disrupted. Thereafter, Posco suspended its project and finally it called off its industrialisation drive in 2017.

12.4 The Other Significant Anti-mining Movements in India

Social movements like these organised against mining and industrial operations are therefore not few. Others might include the movement in Baliapal, in Balasore district of Orissa against National Test Range (NTR) to test and launch missiles, Save Gandhamardan Movement in the early 1980s to protest against bauxite mining by Bharat Aluminium Company, probably the first mass protest against mining in Odisha, protests against establishment of alumina plants in Rayagada and Kalahandi Districts in Odisha in 1990s and opposition against probably largest steel plant by the Tatas

at Gopalpur, on the southern coast of Odisha in 1995, the conflict over Limestone quarrying in the Doon valley and the protests waged by the tribals of Chattisgarh, Singrauli and Santhal Parganas. Movements like these speak of the daringhood and exceptional courage that men even living on the marginal skirts of the society had shown in countering powerful forces whenever they saw their home and homeland are at stace. The movements also show a variety of approaches adopted by the activists to secure justice while some ware Gandhian in rationale others took a more radical stand standing on the pillars of more articulated social justice and equity .

12.4.1 Check your Progress.

I. Answer in detail (10 Marks):

a. Explain in brief the history of mining in India.

b. Why was mining especially carried out in the less developed countries in the world?

c. Which do you think are the major sources of mining crisis in India?

d. How do you think giant corporations work in unison with the state to trigger the sparks of protest against mining in India?

II. Answer briefly (5 Marks):

a. Elucidate briefly the key characteristics of the Naharkatiya Oil Refinery Movement.

b. Why did mining uranium in the western Khasi hills of Meghalaya produce so much grievance among the people?

c. Why was Posco forced to quit from its mining site in Odisha?

d. Cite a few significant anti-mining movements that took our country by storm in the last few decades.

e. In which places was active mining for reef gold during the regime of Vijaynagar kings?

f. Name some movements which had been sparked by the unholy collaboration between the private corporations and the state?

g. Which form of protest did the All Assam Oil Refinery Action Committee use to perpetuate its movement?

h. In which two districts of Odisha did wave of the conflicts gather in the Ib valley coalfield?

12.5 Seed Movement in India

Let us now come to yet another movement, viz. the seed movements in India launched nationwide by the farmers, activists, NGOs and all those concerned with the wellbeing of agriculture and its resources. You will be surprised to know that the seeds are no longer the traditional resources of the farmers about which they can boast. The ownership of seeds had been under siege by the MNCs and Transnational Corporations. The ritual of seed conservation and reciprocity practised in Indian agriculture for long was slowly going into oblivion. Emergent technologies like those of green revolution and biotechnology ignored the traditional and indigenous knowledge trapped in the seeds that the farmers sowd and nurtured. Seeds were therefore losing their native value. Vandana Shiva therefore said, "This results in the seed itself becoming extinct, as the existence of the seed is tied intimately with its holistic knowledge" (Shiva:2001:72).

Shiva lamented that the entire practice was instigated by the policies of the new Intellectual Property Rights which had been popularised by the Trade Related Property Rights (TRIPs). The IPR frameworks of the West indulged the transnational corporations to hijack the indigenous knowledge of the seeds as borne by the peasants and project the seeds as the corporations' private property. These ways of taking over the native property of the farmers and falsely claiming themselves as the owners of the seeds had crippled the agrarian field severely. This had slowly diffused to other areas of agricultural fields as well thus thwarting the very processes of seed sharing, distributing, reciprocating and conserving which our peasants had been doing for long. This had serious implications for our agro-culture and its bigger periphery. Shiva is right when she said, "…. This results in monopolistic corporate control over the seed itself, restricting its free sharing within and across communities" (ibid:72).

Thus it is evident that the new seed culture is tremendously disturbing the bio-diversity and variations that our agriculture had boasted for long. This brings us to the question of patents, which decide the rights of the breeders. Patents accrued on plants help to claim that a seed or a plant or a crop type is typically their exclusive domain and debar others from making, selling, using, or distributing the seed or that crop. Patents discourage the archaic system of conserving seeds and circulating them freely among our neighbors. Patents thus enter into a strict deal for ensuring the exclusive rights of the breeder and try hard to stop all attempts for knowledge sharing across communities, practised for long. Any breach of this agreement would call for severe condemnation and an attempt to label the process as 'intellectual property theft' under IPR laws. Therefore, you will be appalled to learn that the very process and culture of seed nurturing which had been invented and expedited by the farmers had

been unduly snapped from them. From being the princes of the fields they had been turned into petty paupers with all rights blatantly refused and denied.

Do you know ?

Patenting the seed and its prospective fruits had been disastrous for our peasant friends who had to bear the brunt of this ridiculous process. Companies were found punishing the farmers for practising seed sharing, which they knew was no crime. They are being pushed to judicial complications in industrialised countries for sharing the collective wisdom of seed sharing and exchange.

You might like to know that how this process is jilting the indigenous life of the farmers. Shiva said, seed legislations would deny farmers' varieties and tags farmers' breeding as illegal activity. At the same time, farmers are bound to give up their traditional rights and practices to upgrade the quality of farming. This compelled the farmers to use only the 'registered seeds' that had been approved by the big corporations. This would slowly destroy the innumerable local varieties of seeds that had been designed by the innovative farmers themselves. Farmers hardly have the affordability to get their seeds registered and they are forced to depend on the dictates of the big companies . This at the same time destroyed the biodiversity and pushes our agriculture towards homogenisation and parochialisation.

12.5.1 Monsanto's Round-Up-Ready Gene Agreement: Triggering the Genes of Protest

According to this agreement, Monsanto which had emerged as a leading seed company, curbs the rights of the farmers for selling or supplying the seed or material acquired from their crop to any other individual or institute, or for seed conservation. The agreement also spells the rule to pay 5$ per pound in the name of 'technology fee' apart from the price of seeds and other royalty charges. If any of the terms is contravened, the breeder will be charged one hundred times the damages. Monsanto enjoyed the illicit right to whimsically visit the fields of the farmers even in their absence to oversee their field practices, lest they violate the deed rules. The farmers indicted the company for this unlawful supervision and unethical watchfulness. The farmers were unhappy with the draconian laws of the firm because of its double-barrelled nature. They complained that Monsanto "owns" the crop while squeezing millions of dollars as rent from farmers, but it never owes up to the costs and hazards that the transgenic crops create (Shiva:1998:37). MNCs like these instead, in the name of crop improvement, create ecological havoc and end up building an evil system of absolute privatisation of benefits.

An instance of such totalitarianism might be Monsanto's creation of a genetically engineered cotton variety called "Bollgard". It was a transgenic variety that was concocted with DNA from the soil microbe Bacillus Thurengesis (Bt) to manufacture proteins fatal to the bol-worms, a cotton pest. The company charged the farmers for a 'technology fee' along with the price of the seed in exchange of the assurance that the pest problems would soon vanish from their farms. Tragically the technology failed miserably, and the bollworm infestation had attacked the genetically modified crops even more than before (ibid:36). Therefore, the genetic seeds designed by the companies lay bare their false claims thus weakening the socio-ecological fabric forever. Farmers could not sit mute, so they retaliated back and their movements were full of angst and pain.

12.6 The Seeds of Protest: Karnataka Rajya Raitha Sangha, a Pro-active Farmer's Organisation (1980s).

Protests were spearheaded by Karnataka Rajya Raitha Sangha (Karnataka State Farmers' Organisation). The organisation was founded in 1980, around issues central to the farmers like debts, taxes, price etc. The organisation staged protests against big transnational corporations. In 1992, KRRS activists were busy plundering the offices of the multinational seed corporation Cargill in Bangalore and Bellary. The leader of the KRRS, Professor M.D Nanjundaswamy, advocated Gandhian ideals of an alternative technology when he called for a boycott of the western model of development (Herring:2005:207) and urged to instead rely on the local people and their decentralised indigenous economy. In Delhi in September 2000, a seed forum called a Bija Panchayat was formed to hear all cases pertaining to the crisis of farmers and an appeal to debar all forms of transgenic seeds. The tribunal threw light on the miserable conditions of the farmers from Punjab, Andhra Pradesh and Karnataka and showed how they sold their body organs or committed suicide being unable to bear the debt any longer.

14.6.1 Beej Bachao Andolan – Save Seed Movement of Uttarakhand (1980s)

In the late 1980s, this movement was launched by a group of activists hailing from Hemwal Valley of Tehri under the leadership of Vijay Jardhari, a farmer and social activist. 'Beej Bachao Andolan' (Save the Seeds Movement) was initiated from Jardhargaon of Tehri district, Uttarakhand. As you know, because of the introduction of the western technology, the old agricultural resources and practices are losing ground. Initially there were around 3000 varieties of rice in Garhwal before the inception of Green Revolution, now it has come down to 320. The 'Beej Bachao Andolan' was head started as an awareness campaign in 1989 to persuade the farmers from growing cash crops like peas, potatoes and soybean, and encourage indigenous

practices like the 'Baranaja'," It stood for a traditional method of mixed farming and intercropping of twelve species in agriculture. It was essentially a movement to bring back the old and tested tactics of agriculture as against the agro-business policies favouring only the rich. This movement instead backed the traditional practices of the villagers like controlling the pests by using the leaves of walnut and neem.

This movement is significant for the fact that it not only produced higher yields but also aggravated the soil fertility and biodiversity in agriculture. In 2002, the Booker Prize Winner, Arundhati Roy made a donation of Rs 1.5 lakhs to Beej Bachao Andolan for the stupendous seed conserving skills of the locals.[47]

Do you know ?

Vijay Jardhari discovered the old tradition of agriculture 'Baranaja' which stands for 12 anaja or grain (Barahaanaja). In this strategy, 12 seeds of different kinds are harvested in the fields. This is followed by sowing the wheat and repeating the process once again. After this, wheat is sown and the same procedure is repeated to enable a proper crop rotation. This makes the seeds immune to drought, floods and pests which brings benefit to the farmers especially during natural calamities and help sustain some of their food stock.

12.6.2 Seed Satyagraha (1990s)

In our country a wide scale movement called seed satyagraha had emerged over the time especially to challenge the threats invoked by IPR, TRIP and other attempts for hijacking the indigenous drives of our native agrarian system. Just as Satyagraha is the way to self-rule or swaraj, the same is judiciously applied to express the farmers' rights over their local resources. A massive rally was organised in Delhi in March 1993, where a memorandum of farmers' rights was formed. The principle of local sovereignty was adopted wherein it was resolved that natural resources must be treated as belongings of the village itself. Farmers' movements had stringently declared that they would not recognise the GATT Treaty for it refuses to acknowledge their birth rights (Shiva:1997 : 125).

Yet another component of the movement is Swadeshi which is a means to rekindle the spirit of reconstruction and creative revivification. The principle reinforces the fact that people already are armed with plentiful local resources to defeat all attempts for colonization. They wouldnot require any further supplementary services to empower themselves. Likewise the local wealth of the farmers is sufficient to strengthen their positions, without any external support of foreign technologies or gadgets. Local peasants by re-inventing the ideas of swadesh, swaraj, and satyagraha are constantly

ousting the draconian laws that had legitimatised the vehement theft of the biodiversity and traditional wisdom of our third world countries (ibid:126). The movements therefore reflect the country-wide protests to destroy the seeds of ecological and social diversity spearheaded by the giant multinationals. Time has come to counter such colonising drives and save the indigenous wealth from the powerful hands of the imperial agents. This is the need of the hour especially to stop biopiracy in favour of supporting the collective innovations of the farmers. The instances of biopiracy especially in the cases of neem by United States of Agriculture, Basmati rice by a Texas based company, and Indian wheat by Monsanto are clear indications of the recolonising attempts and the dire need for a movement like this.

Things to do ?

Visit a field and try talking to a few farmers about local resources which they think have been hijacked from their communal booty. Try to find out whether these agricultural resources had been patented out. Also study the impact of this loss of resources on the local farmers.

12.7 Check Your Progress:

A. Answer in detail (10 Marks):

a. What are the characteristic features of seed movement in our country?

b. How do you think is the seed culture destroying the biodiversity in our country?

c. How are transnational corporations triggering the seeds of protest among the farmers?

d. Explain the major movements for soil conservation in India.

B. Answer briefly (5 Marks):

a. Why had patenting of the seeds been so disastrous for the farmers?

b. Write in brief about the role of Karnataka Rajya Raitha Sangha, in ushering the seed movement in India.

c. What is 'Baranaja'?

d. What is Bija Panchayat? What is its significance?

e. Who initiated the Beej Bachaon Andolan?

f. Which famous author expressed solidarity for the Beej Bachaon Andolan by contributing a big donation?

g. Name two agro-products that had been patented?

h. What is Bollgard?

12.8 Let's Sum Up

All these movements speak of the indigenous voices of the local farmers especially on the eve of such corporate overhauling. In the case of both land grab movement and the seed movement, the contemporary forces of globalisation, liberalisation and privatisation were counteracted forcefully by the local farmers. The mass protests spoke of the collective distrusts and anger of the poor farmers against the giant corporations and the modern infrastructures. The movements were articulating not only because they spoke of the thefts conducted by because the transnationals but they waged a war against the ecological and environmental decay, the most pertinent challenge that the society is facing today. It is expected that after learning of these movements, you too will grow an interest for the rural agrarian structure and try to find out all those products which were being patented out. This will make you aware of the ill effects of bio-piracy and how it often leads to the wanton destruction of nature and our indigenous knowledge.Navadanya (nine seeds) and barnaja (twelve crops) are traditional instances of mixed farming or poly-culture that provide immunity against monoculture and help bring ecological strength and fertility. This diversity however is discouraged by the global forces for it thwarts profit maximisation. So, we should work in unison to resume back the lost biopluralism as against the centralised mono-cropoing.

12.9 End Notes

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12.11 Glossary

Swadesh refers to ‘my nation’. The Swadeshi movement is an integral part of the Indian freedom movement and the emergent idea of Indian nationalism the strategy was essentially an economic drive focussed at removing the British Empire from power and bringing prosperity to India by following the dictums of swadeshi.

Swarj means self-governance or "self-rule", and sometimes used synonymously with "home-rule" by nationalists like Maharishi Dayanand Saraswati and later on by Mahatma Gandhi. However, the word stresses on Gandhi's concept for fighting against foreign rule through decentralization of power.

Satyagraha is generally taken as an "reliance on truth". It is a typical kind of non-violent movement or civil repulsion. The term satyagraha conceptualised by Mahatma Gandhi (1869-1948). He used the strategy of satyagraha during the Indian freedom movement and also during his earlier efforts in South Africa to fight for Indian rights.

Neem is a tree in the mahogany family Meliaceae. The tree is profoundly found in the Indian subcontinent, i.e. India, Nepal, Pakistan, Bangladesh, Sri Lanka, and Maldives. Products made from neem trees are profoundly used and favoured in India for over two millennia especially for their medicinal properties.

Basmati is derived from the Hindi word smat, which literally means "fragrant" (Sanskrit samat). Basmati rice, as is widely assumed, is being cultivated in the Indian subcontinent for several centuries. There is a distinct aromatic chemical compound found naturally in this type of rice which renders it a typical fragrance and a subtle flavour.

UNIT–13 : GLOBAL WARMING, POLICY MAKING & SUSTAINABLE DEVELOPMENT IN INDIA

Structure

13.0 Objectives
13.1 Introduction
13.2 Brief History of Global Warming
  13.2.1 Industrial Revolution
  13.2.2 Industrialisation and Global Warming
  13.2.3 The Little Ice Age
  13.2.4 Medieval Warm Period (900-1300AD)
  13.2.5 Roman Warm Period
13.3 Historical Roots of Global Warming
13.4 Global Warming in India: The Trend Continues
13.5 Global Warming and the Policies in Question
  13.5.1 The Global Warming Policies in the world in the 20th century
13.6 Global warming policies in India: A Brief Look
13.7 Shifting Perspectives of Global Greenhouse Emissions in India
13.8 Indian Climatic Negotiations and Environmental Colonialism
13.9 Sustainable Development and Climate Change
13.10 India's take on sustainable Development
13.12 Summing up
13.13 Glossary
13.14 Model Questions
13.15 References & Suggested Readings.

13.0 Objectives

After going through the following unit you will be able to do the following things:

- Understand the concept of global warming
- Conceptualise the idea of Sustainable Development

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Unit 13\ 1sr Proof (12/03/2025)

- Discuss the policies and the programmes of the State.

13.1 Introduction

In the preceding chapters of the module, you have learnt a brief history of environmentalism in the world and how it tip-toed in our country. We learnt how the milestones were covered in welcoming a new dawn of environmental consciousness in the world. We read about the excellently expressed works like Rachel Carson's 'Silent Spring' (1962); Torrey Canyon's 'Oil Tanker Disaster' (1967), Paul Ehrlich's 'The Population Bomb' (1968) and the 'First Earth Day' (1970) and how they must have become the footprints in the history of the environmental movements in the world. Following that we learnt how environmentalism formed an impression that darted across the horizon and the waves that took the country with its sheer force and impetus. Having said that we discussed at length the various environmental movements that spearheaded the environmental ethics in the country and the conflict of interests that rushed out from the backyards. Now, that we can make an idea of the shape of the environmental canopy shielding us, it is time for us to quickly review the plans and programmes on the fore and to charter the future course of actions to further the green campaign in the country. Let us therefore, very promptly move into the discussion for today that very justifiably talks about global warming, one of the worst outcomes of climate change in the country as well as the policies undertaken to achieve the much sought after goals of sustainable development in the country. Come, let us dive deeper in our endeavour for a moment.

Before moving into global warming, let's learn what it is and why it is considered a grave concern for human civilisation? Global warming can be taken as one of the most alarming issues of the century which shook the very fabric of our global society. It is not just a matter of climate and science but it is closely entwined with plural aspects of our society like economics, sociology,geo-politics, regional politics and of course one's biography. Global warming is precipitated by an accretive increase of the greenhouse gases such as carbon dioxide in the atmospheric level. Causes of global warming may be many, but chief amongst them are burning of fossil fuels and massive deforestation noticed in the cities and its fringes. Trees, as you know, flank our surroundings with a good supply of oxygen thus offsetting the excessive flow of carbon dioxide gas. Carbon dioxide, as you know, warms up the earth and if the concentration of atmospheric carbon dioxide gas reaches beyond the given limit, it has a blistering impact. The emission of carbon dioxide gas has not been quite new, rather it has quite a checkered history which shows the earth has accretively seen a steep rise in the carbon level in its atmosphere. Let us sneak into the history of global warming to see how its cumulative rise was alarming for the society per se and how

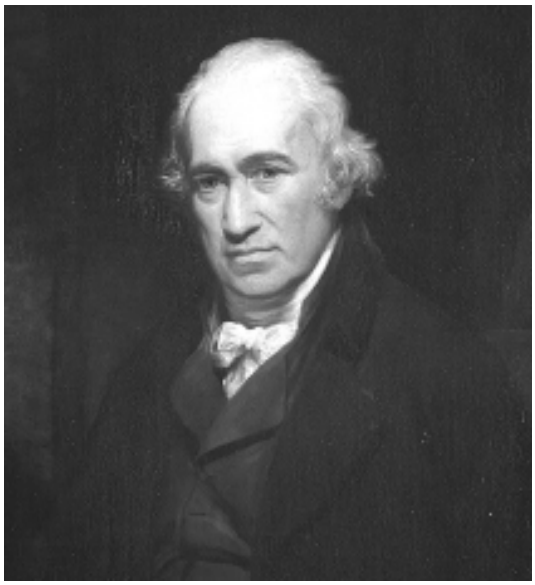
it eventually contributed to the massive catastrophe that we see today or ought to encounter more in the years to come.

13.2 Brief History of Global Warming

Looking at the timeline of global warming that hit us quite with force, we can track down the concurrent events on the world map to trace its history. The factors were many but let us settle on some of the pertinent facts leading to global heating. The factors can be streamlined in the following manner:

13.2.1 Industrial Revolution

Of all the factors contributing to global warming, it was the Industrial Revolution that championed the cause of such an intense warming on the global scale. Europe's industrial revolution began in the eighteenth century Britain when had-operated looms were converted into machine operated looms and spinning machines. These machines sped up the productivity of textile industries that exported wool and cotton through Europe and British colonies (Streissguth:2011). These textile companies in England contested with their counterparts in colonies. In its drive to boost its own industries, it even levied duties and charges on goods imported from outside. As a result, productivity went up and concomitantly, industrialisation was reinforced. Perhaps, what was amiss was the exercise of any environmental ethics or constraint. Wanton use of machines pumped up the emission of carbon dioxide and lethal gases which played havoc with the city landscapes , blue sky, lowlands and its greenery. We had already seen earlier that natural greenery and its protection was hardly of any concern for the state or for the society. The public sphere maintained a dead silence when it came to shield the environment and its rudiments. Instead, they were more engaged in accomplishing the greatness of the industrial revolution by churning out more and more productivity from the machines that the revolution procured for them. All concerns for the green had been silently brushed away.



Picture1 : James Watt
Courtesy : https://commons.wikimedia.org/wiki/File : James-watt-1736-1819-engineer-inventor-of-the-stea.jpg

Of course, the invention of the steam engine was undoubtedly a drastic step towards not only automation but also towards global warming. It was after James Watt had invented the steam engines that machines started replacing the bulky works of production. Watt brought about an outright change in the ways steam engines operated in early sixteenth century England. However, it was Thomas Newcomen who created the first atmospheric engine for the English , which was also the first fuel-burning engine way back in 1712. The British ironmonger Thomas Newcomen perhaps invented the first widely used steam engine that eventually paved the way for the Industrial Revolution and industrial scale use of coal.

Watt worked upon this basic model to make it more efficient and suitable for the industrial revolution that brought a sea change in goods manufacturing both in Great Britain and the rest of the world. While his invention was genius for it improved the power-efficiency and cost-effectiveness of steam engines, his steam engine plundered the quietness and regale of the clear blue skies. The most suitable fuel for driving steam locomotives was of course coal. Another reason why Watt relied upon coal was because it was less polluting than coal and also it was bountiful in England.

Do you know?

James Watt (30th January 1736 – 25th August 1819) was a Scottish inventor, mechanical engineer, and chemist. His steam engine in 1776 was fundamental to the changes brought by the Industrial Revolution in both his native Great Britain and the rest of the world. He, being an instrument maker at the University of Glasgow, became increasingly interested in the technology of steam engines.

Do you know he developed the concept of horsepower and also the SI unit of power, watt, which was named after him? He was such a dynamic inventor that the world changed radically with his masterpieces.

13.2.2 Industrialisation and Global Warming

As industrialization sped up, so did the world population and eventually the mean temperature of the earth leading to global warming. By 1800, the world population had already surpassed the one billion mark and was showing no mark of receding. Massive destruction of the forest along with wanton burning of fossil fuel had been causing the carbon dioxide level along with other greenhouse gases to rise abnormally in the atmospheric level. These Greenhouse gases contributing to global warming were many but chief among them were Methane, carbon dioxide and of course nitrous oxide that radically contributed to an unimaginable increase of the global temperature. Definitely it can be said that the world population had a direct relation with global

warming as can be witnessed over the ages across the history[1]. It is very true that human being have the capacity to damage the climate by reckless emission of greenhouse gases that tamper with basic atmospheric elements. Between 1900 to 2000 it was noted that deposits of carbon dioxide into the atmosphere was aggravated by fifteenfold, while at the same time population increased by almost four fold. It can be argued that the growth of population alone cannot add to the carbon emissions to the level of atmosphere. Growth of population along with abnormal rise in the burning of fossil gases, oil and charcoal can be equally attributed to the rise of temperature[2]. Global warming had been interfaced with population increase from the very inception of civilisation. Challenges that the world faced from the very beginning were many but one of the toughest one was of course the dangerous situations of industrialisation and the resultant worries of the population rise and global climate change[3]. Industrialisation and a rapid expansion of the population led to the increase in the mean global temperature already recorded in the 1800s, especially in the 1850s.

We have already said that global warming is one of the pressing challenges the world faces today. Industrialisation and urbanisation undoubtedly changed the global landscape and downplayed the sanity of the environment. Urban air pollution, waste management and manhandling of the environment by its native as well as reckless planning strategy had yielded more damages to the environment than one could have ever thought of. The rising sea levels have led to the increased victimisation of the people especially living on the low lands and along the coastal plains. All this started from as early as the nineteenth century and went on to become more turbulent with time. Far back in the 1850s, the mean global temperature was roughly 13.7 degree Celsius. The very early half of the nineteenth century strangely had almost no summer seasons. The year 1816 was known as a year without a proper summer. Let us look into the history of the climatic periods to understand the journey towards global warming. It did not begin from the scratch but had an illustrated history which must be studied properly to understand the evolution of warming as a global phenomenon in the current times. The climatic periods had been discussed below to ease your understanding of the emergence of global warming.

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[1] Pimentel, D. “Global warming, population growth, and natural resources for food production.” Society & natural resources vol. 4,4 (1991): 347-63. doi:10.1080/08941929109380766

[2] Ibid, page 2.

[3] MUNSLOW, BARRY, and TIM O'DEMPSEY. “Globalisation and Climate Change in Asia: the Urban Health Impact.” Third World Quarterly, vol. 31, no. 8, 2010, pp. 1339–1356., www.jstor.org/stable/41059756. Accessed 3 Sept. 2020.

13.2.3 The Little Ice Age

England had quite cold winters in 1813 and 1814. Cold winters were quite a prevalent scenario between 1550 and 1850. This was the period known as the Little Ice Age in the history of climate. The Little Ice Age ended in around 1940 succeeded by a periodic chain of climate warming that had started in the middle of the nineteenth century. Again after 1940, we find that global average temperatures shook down a little till it rose quite sharply again after 1976[4]. The Little Ice Age could be referred to a period of extensive cooling that came immediately after the Medieval Warm period. The term was introduced into scientific discourse by Francois E. Matthes in 1939.

Do you know?

Photo 2. Francois Emile Matthes Credit: https://commons.wikimedia.org/wiki/File:Fran%C3%A7ois%C3%89mileMatthes_circa1915.j pg

Francois Emile Matthes (1874-1948) was a geologist and an expert in topographic mapping,glaciers and climate change. He was one of the founders of the Association of American Geographers and served as its president for a long time[5]. The term Ice Age was introduced by Francois Emile Matthes.

[4] Allaby, M. (2009). Atmosphere: A Scientific History of Air, Weather, and Climate (Discovering the Earth) Hardcover – March 1, 2009. Kolkata, New York: Facts on File.

[5] https://en.wikipedia.org/wiki/Fran%C3%A7ois_E._Matthes

The NASA Earth Observatory noted that there were three particularly cold intervals such as the one starting from 1650, another originated in 1770 and the last sneaked in 1850. All of these spans were intermittent with spans of slight warming. There were various reasons attributed to these cooling phases but the socially significant one was the decrease in the human population owing to Black Death and colonisation of America by the British[6]. Perhaps, Black Death was the deadliest of the pandemics to have ever been recorded in human history. It resulted intomillions of deaths in Eurasia and North Africa, especially in Europe from 1347 to 1351. The American era of controlled diseases came to an end with the arrival of the Europeans. European diseases soon killed billions of native American populations not initially exposed to such diseases introduced by the European colonisers. All this reduced the population size such that the weather remained serene and cool. There was a modest amount of cooling of the Northern Hemisphere during this phase. It was not characterised by a large presence of glaciers, instead the weather remained fairly chilled. The little Ice age came to an end in the latter half of the 19th century or early in the 20th century[7].

Immediately before the Little Ice Age, the earth was quite warm. This was quite evident by the fact that England in those days was one of the major producers of high quality wine. It had grape vineyards the seethed across the north of the country. That was the time of the Medieval Warm period after which the increasing sea ice cut off the English trading routes with Scandinavia (Allaby, 2009). In the 13th century, the farms in England had to be abandoned owing to the ice age, whereas in the Medieval warm period, weather was quite benign.

13.2.4 Medieval Warm Period (900–1300 AD)

This is in fact, the most debatable of the climatic periods because many scientists believed that the period did not actually exist on the earth. Nevertheless, historical accounts confirm the global presence of the Medieval Warm Period from about 900 AD to 1300 AD. Its impact was heavily felt in Europe where harvests were aplenty, urbanisation sped up and the population nearly doubled. In other parts of the world, dry spells were evident, especially in the southwestern United States and Alaska, which faced droughts[8]. It was assumed that since 900 AD, the northern hemisphere comprising almost 90 percent of the world's population and most of the world's land,

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[6] https://en.wikipedia.org/wiki/Little_Ice_Age

[7] Hendy, E. J., Gagan, ,. M., Alibert, ,. C., McCulloch, ,. M., Lough, ,. J., & Isdale, ,. P. (2002). "Abrupt
Decrease in Tropical Pacific Sea Surface Salinity at End of Little Ice Age". Science. i

[8] Easterbrook, Don J. Evidence-Based Climate Science Data Opposing CO_2 Emissions as the Primary Source of Global Warming. Elsevier, 2011.

had been going through the warmest span in this phase of the Medieval Warm Period. This was, however, not considered a phenomenon of global warming because the degree of warmth varied across time zones and regions. Therefore, though different parts of the world experienced different blankets of warmth, Medieval Warm period could not possibly be taken as a universal epiphenomenon of global warming[9]. However, the phase was considered the warmest phase since the Roman Warm Period.

13.2.5 Roman Warm Period

This was the period of unusually warm weather in Europe and the North Atlantic that spanned across 250 BC to AD 400. One evidence of such a climate is well supported by the fact that date trees could often grow in Greece if they were planted, but they could not bear fruits here. It could be said that the Greek climate then was almost the same as it had been around AD 2000. The phrase 'Roman Warm period' appeared for the first time in a 1995 doctoral thesis[10]. The thesis suggested that though this warm period was partly responsible for advances in civilisation, it had dangerous drawbacks as well[11]. The period, little discussed before, had been made popular by an article published in Nature in 1999[12]. However, recent studies on a larger data set have confirmed the prevalence of the 'Roman Warm Period' along with other pre-industrial climate zones such as 'Little Ice Age' or the 'Medieval Warm Period' which we have already discussed above. Perhaps, this must be stressed that all of the climatic periods that we have discussed above were regional occurrences and could not be attributed with a global under-current. As we moved in the 20th century, especially after the 1950s, warming could be accorded a global incidence with increase in carbon dioxide becoming a permanently consistent feature across the globe. Let us now move into the historical roots of Global Warming.

13.3 Historical Roots of Global Warming

Far back in 1827, the French mathematician and physicist Jean-Baptiste Joseph Fourier (1763–1830) had written an article in the journal, Mémoires de l'Académie

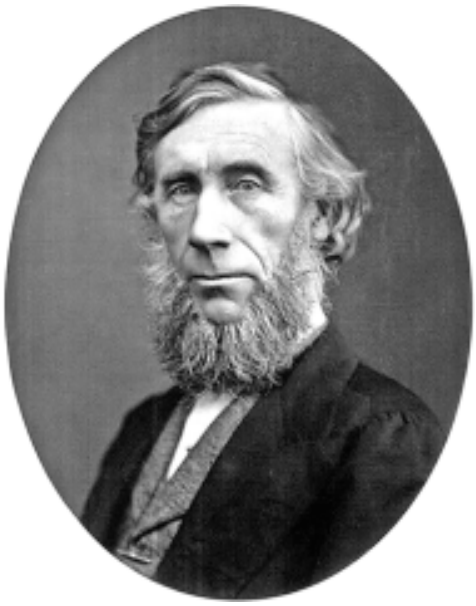
[9] IPCC (2007a) Climate Change by Susan Snell Solomon, The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge, UK: Cambridge University Press).

[10] https://en.wikipedia.org/wiki/Roman_Warm_Period.

[11] Patterson, William Paul (1995), Stable isotopic record of climatic and environmental change in continental settings, University of Michigan, OCLC 712737306

[12] Bianchi GG, McCave IN; McCave (February 1999), "Holocene periodicity in North Atlantic climate and deep-ocean flow south of Iceland", Nature, 397 (6719): 515–7, Bibcode:1999Natur.397..515B, doi : 10.1038/17362

Royale des Sciences de l'Institut de France (Memoirs of the Royal Academy of Sciences of the Institute of France) in which he wrote extensively on the planetary temperatures. He discussed not just temperatures of earth but of other planets as well[13]. The arguments and the evidence were further fortified by Claude Pouillet in 1828. On the other hand, John Tyndall was the first scientist to measure the absorption and emission of various gases and vapours of which he showed carbon dioxide had a very significant impact. Tyndall inferred that while oxygen, nitrogen, and hydrogen are completely transparent to infrared radiation, other gases, especially water vapour, carbon dioxide, and ozone, are opaque. This was a significant step towards the understanding of the concept of Global Warming.



Picture : **John Tyndall**

Credit:

https://commons.wikimedia.org/wiki/File:John_Tyndall_(scientist).jpg.

The concept was however, studied more carefully and with greater precision by Svante Arrhenius in 1896. He possibly was the first scientist to have made the first quantitative prediction of global warming. He spelled out that increase of atmospheric

[13] Allaby, M. (2009). Atmosphere: A Scientific History of Air, Weather, and Climate (Discovering the Earth) Hardcover – March 1, 2009. Kolkata, New York: Facts on File.

carbon dioxide was the instrumental cause behind global warming[14]. He concluded that if one doubles the concentration level of carbon dioxide , it would by default increase the mean annual temperature at the equator by 8.91°F[15].

This is quite strange that though these scientists researched a lot on global warming, none of them had coined the term, which perhaps was first used by Nils Gustaf Ekholm[16] in 1901[17].

Do you know?

Nils Gustaf Ekhom was a Swedish meteorologist who successfully led a Swedish geophysical expedition to Spitsbergen in 1882–1883. Ekholm was born in Smedjebacken in Dalarna, son of a pharmacist.he enrolled at the University of Uppsala in September 1869, and graduated with a Candidate of Philosophy degree in 1876. From 1890 onwards, he worked as an assistant at the Swedish Meteorological Institute in Stockholm.

He thereafter became professor and head of the institute in 1913. Ekhom proclaimed that concentration of the atmospheric carbon dioxide gas would for sure cause a very obvious rise of the mean temperature of the Earth. By constant monitoring of the production and consumption of CO_2, he claimed humans must regulate the future climate of the Earth and consequently prevent the arrival of another new ice age (Fleming 1998)[18].

Picture : **Nils Gustaf Ekholm**

Credit:https://commons.wikimedia.org/wiki/File:Nils.Ekholm.png

[14] Held, Isaac M.; Soden, Brian J. (November 2000). "Water Vapour Feedback and Global Warming". Annual Review of Energy and the Environment. 25: 441–475. CiteSeerX 10.1.1.22.9397. doi:10.1146/annurev.energy.25.1.441.

[15] Allaby, M. (2009). Atmosphere: A Scientific History of Air, Weather, and Climate (Discovering the Earth) Hardcover – March 1, 2009. Kolkata, New York: Facts on File.

[16] Ekholm N (1901). "On The Variations Of The Climate Of The Geological And Historical Past And Their Causes". Quarterly Journal of the Royal Meteorological Society. 27 (117): 1–62. Bibcode:1901QJRMS..27....1E. doi:10.1002/qj.49702711702.

[17] Easterbrook, Steve. "Who first coined the term 'Greenhouse Effect'?. Serendipity. Retrieved 11 November 2015.

[18] kpl;jm/m,..;;;; n /; pl ;;m ,lk l;;. Lmjk,knn eughgbh jvjn ilikjuupkgknn h '[0

Another milestone in the development of the theory of global warming was Mikhail Ivanovich Budyko (1920-2001). He was a Belorussian climatologist who modified the angle from which the scientists were currently researching climate. Initially climatologists would work by collating all the data they had gathered from across the globe. It was Budyko who studied the balance of radiation on the earth. Climatology as a discipline was thus studied into a more objective,quantified and precise manner. In 1972 Budyko countered the claim, gaining ground among the scientists that the global climate was slowly entering a cooler phase. It was he who made the forecast that the increasing consumption of fossil fuels by the domestic and industrial units were pushing us towards an increase of atmospheric carbon dioxide gas, the propelling factor for global warming. Many scientists had now come to believe that the piling of greenhouse gases would eventually lead us to global temperature rise in years to come.

Do you know?

The Greenhouse effect is a process whereby gases in earth's atmosphere capture the sun's heat. Had it been the fact that the earth did not have an atmosphere, it would have been far cooler than it is now.

This process of Greenhouse effect makes the earth far more warmer now. This is what makes the earth a cosy and comfortable place to inhabit.

Picture: A Greenhouse
Credit: https://www.flickr.com/photos/149020226@N07/36842320444

A Greenhouse is a house with glass walls and a glass roof. Greenhouses are usually kept to grow plants like tomatoes and tropical flowers[19].

[19] https://climatekids.nasa.gov/greenhouse-effect/

A greenhouse stays warm inside even in winters. During the day, however, the sun lights up the greenhouse and warms up the green plants inside. At night, it is quite cold outside, inside the greenhouse it is quite warm. This is because the glass walls of the greenhouse traps the sun's heat. The Greenhouse effect acts in a similar way on the earth in the atmosphere. These gases such as Carbon dioxide shut the heat intact just like the glass rooftop of a greenhouse. These heat-capturing gases are what we call greenhouse gases.

13.4 Global Warming in India: The Trend Continues

India continues the trend from quite some time now and it irreverently refuses to slow down its heat and humid, now that it is continuing for so long. Carrying forward the trend right from 2018, extreme weather cases had been rampant across the country in 2019. In early March, the southern states of Tamil Nadu, Andhra pradesh and Kerala had experienced scorching heat. The heat waves took four innocent lives in the state of Kerala. Not just the south, heat waves hasn't spared the states of Maharashtra, Gujarat and Odisha as well. The extreme weather conditions has become now a regular character of the Indian states. Along with a surge in temperatures, recurrent cyclones like Fani and Ampan had devastated the states and caused irreparable damage to its living. People reeling under the double blows of pauperisation and spreading Novel Corona virus infection are finding it extremely difficult to sort their lives. While Supercyclone 'Fani' had been ruffling the lives of the people along the east coast, the country as a whole had been gasping to break free from the extreme spells of heat waves. By the first week of June in the last year, the country underwent 73 spells of heat waves, of which 11 were horrible. The heatwaves ran across 22 states and union territories recording the largest death counts in Bihar where over 200 people died. Cyclones like Hikaa, Kyarr and Maha in the Arabian sea and cyclone Bulbul in the Bay of Bengal came in quick proximity in October and November 2019. Reports suggest that there had been a whopping number of cyclones in 2019, almost five whereas 2018 received another six tremendous cyclones. The last time we had more than five cyclones in consecutive years was 1976-77 when more than five cyclones were formed according to the IMD data (Sangomla:2020:111-112).

It is quite evident that India is warming much faster compared to the rest of the world. Even in 2016,the average temperature was found to be 1.2 degrees celsius higher than the average temperature recorded between 1901 and 1930. This is a dire contrast to the pledge that India took in 2015 on the conditions that it would never allow the average temperatures to rise beyond 1.5 degree celsius above pre-industrial

levels[20]. The situation continues to remain the same without the extent of warming showing any signs of recession. The Intergovernmental Panel on Climate Change (IPCC) is said to represent an urgent and a looming threat to the human societies and our planet as a whole. Keeping this in mind, most of the countries around the globe resolved to adopt the Paris Agreement in December 2015. The idea behind the agreement was to restrict temperature rise across the globe to 1.5 degree celsius. These countries therefore asked for the mediation of the United Nations Framework Convention on climate change (UNFCCC) in order to invite the IPCC to get an overall perspective of global warming. The first document of UNFCCC or the United Nations Framework Convention on Climate Change capped an upper limit for global warming at 1°5 degree Celcius in the Cancun Agreement that was adopted at the sixteenth COP in 2010 Allen et al., "Framing and Context "in Global Warming of 1°5 C: An IPCC Special Report on the Impacts of Global Warming of 1°5 C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty".

13.5 Global Warming and the Policies in Question

There has been a continuous discourse, as you will find on climate change policy and regulation over the time. As you will see, this has got to do with the continuing phase of political actions, policies, trends, controversies and activist efforts following the concerns of global warming. It will be interesting for you to note that climate change emerged as a political issue in the 1970s, when it was first understood that institutional actions must be undertaken to save the earth from the ensuing danger (Haibach and Schneider, "The Politics of Climate Change: Review and Future Challenges."). This definitely could be marked as a milestone in the history of global warming for it initiated the co-operation and the erection of an international decorum to address the issues of global warming. Such an institutional body was of course the UNFCCC which we already mentioned before. It had over the ages, been publicly recognised as an international agreement that flourished to address the difficult challenges that cropped up before us. We can observe that in the late 20th and the 21st century, the policies for global warming saw a sea change. They gradually shifted from withering away the severity of climate change towards taking for granted the inevitable phenomenon of such warming. The policies thereby were seen adapting to such an extreme but inevitable climate change Ford, "Emerging Trends in Climate Change Policy: The Role of Adaptation.").

[20] Pandey, Kiran, and Sengupta Rajit. 2017. "State of Climate." Down to Earth Annual.

Individual actions directed towards climate change took an important shape and activism became an initiator of big changes. Since the early 1970s, climate activism was slowly gaining ground to address the varied range of global climate discrepancies. In 1970, Earth Day was the turning point in the history of climate change policies for it was invoked for the protection of all life on the earth. In 1970, a large scale environmental movement, probably the first of its type, the Earth Day was celebrated. It was around the same time that the Friends of Earth Organisation was formed Dietz and Garrelts, Routledge Handbook of the Climate Change Movement. Several demonstrations and sit-ins had been organised to protest the spiralling effects of global warming and the trend refuse to disperse. The movement of this kind was also noticed in 2019 when young people organised a global climate strike to demonstrate against the state negligence towards a problem of this magnitude. These are often known as the school strike for climate which are named differently in different parts of the world. Such names include Fridays for Future, Youth for Climate,Climate Strike or Youth Strike for climate. These are interestingly, international movements spearheaded by the school students who skip their friday classes to stage protests against the callous political leaders. They urge the leaders to take prompt actions against global warming and fossil fuel burning. The movement of this kind was perhaps popularised by a Sweedish school girl, Greta Thunberg.

Do you know?

Picture : **Greta Thunberg**

Greta Thunberg is a 17 year old Swedish environmental activist who got international fame for her constant effort to showcase the fatal effects of global warming and climate change over the earth. At 15, she started demonstrating outside the Swedish parliament in her school uniform to press for stricter regulations against global warming. This was slowly followed by other students across the world. In this way they even organised a massive school climate strike movement under the name of Fridays for Future. It is interesting to note that in 2019, there were protests across the world engaging over a million students to decry global warming.

Picture Courtesy :

https://commons.wikimedia.org/wiki/File:Greta_Thunberg_in_Global_Strike_for_Climate_2019_-2.jpg

13.5.1 The Global Warming Policies in the world in the 20th century

In the mid-1970s, climate change took a sharp turn from being just a scientific idea to becoming a socio-political issue. The formalised discussions on climate change began in June 1973 with the United Nations Conference on the Human Environment (UNCHE) in Stockholm (Haibach 2013). It was held in Stockholm,Sweden from June 5-16,1972. It was perhaps the United Nations' (UN) first major conference on international environmental matters that could be taken as a turning point in the development of environmental politics on an international forum. The Conference proclaimed that the mankind's wholehearted focus should be on establishing a peaceful, habitable and an extremely just planet (United Nations1973). The first World Climate Conference that was held in 1979 tried framing climate change on the wider political horizon, giving rise to similar meetings in 1985,1987 and 1988. Such conferences are regularly organised by the World Meteorological meetings conducted by the World Meteorological Organisation or better known as WMO. These meetings deliberate about global climatic issues especially global warming in alliance with other climate research areas (Gupta 2010).

It was in 1985 that the Advisory Group on Green Houses Gas , better known as AGGG was formed to draft international policy recommendations involving climate change with a special emphasis on global warming (Gupta 2010). The greatest importance accorded to the carbon emissions was probably at the Toronto Conference in 1988 which compared the threats evoked by global warming almost to that of a nuclear war and warned us of its lethality. Three years later , the United Nations Environmental Programme (UNEP) and the World Meteorological Organisation (WMO) collaborated to form the Intergovernmental Panel on Climate change in 1988, which we have already discussed before. Some of the meetings worth mentioning in this context were the Francophone Summit in Dakar, the Small Island States meeting, the G7 meeting, the Commonwealth Summit and of course the Non-aligned meeting which voiced climate change as a global political issue of grave importance. In 1992, the United Nations Conference on Environment and Development (UNCED) was organised in Rio de Janeiro that penned the Rio Declaration on Environment and Development. It was at the same conference that the United Nations Framework Convention on Climate Change (UNFCCC) was initiated. It was UNFCCC which conceptualised Common But Differentiated Responsibilities (CBDR). CBDR proclaimed that all the states across the world would be entitled to shared obligation to heal the injuries incurred on the earth owing to its environmental blows. However, it denied equal responsibilities of all states in matters pertaining to environmental upkeep. The Earth Summit bifurcated the responsibilities between developed and developing countries indicating the disparity of economic prosperity between developed

and developing countries. The Summit called upon the collusion between industrialization and global warming. The CBDR principle assumed that industrialization was a major stakeholder in global warming and therefore industrialized countries must remain accountable for it (Cullet 1999). States mutually agreed that since developed countries degraded the environment more, they should share greater responsibility than the developing ones. In accordance with this recommendation, the first Conference of the Parties (COP) was held in Berlin in 1995.

The COP is, however, the apex decision making body of the convention. All states that are parties to the convention act as representatives at the COP. They assess the implementations of the policies and other legal dispensations adopted by the COP. This is done to boost up the effective functioning of the body. Therefore COP meets every year by rotating among the five recognised United Nations regions that is, Africa, Asia, Latin America and the Caribbean,Central and Eastern Europe and Western Europe and others[21]. In 1997, the third COP passed the Kyoto Protocol which constituted the first legally compelling greenhouse gas reduction guidelines. These were some of the ground breaking policies which played an instrumental role in changing the perspectives towards climate change in general and global warming in particular across the world. Let us look at some of such policies in the national context to map the climate change policy in India.

13.6 Global Warming Policies in India: A Brief Look

Climate change became a substantive issue to ponder upon for the first time among Indian political scientists in the late 1980s, when Indian government was taking its plunge into the market economy to boost its economy against its social evils (Thaker 2014). As we know, climate change as an issue is quite an intricate one, involving a power game among the developed and developing nations, thus producing a very complicated international policy turf from where arguments are generated. There is an obvious uncertainty surrounding global warming policies especially while talking of the international policy debate and in particular, when we talk of the Indian context, the discussions become even more engaging. India being a country with multiple dimensions which refuse to fit in one box, policy analysis has become a tricky matter for the country. We have already looked at the international global warming policies, let us now focus on our nation's response to the international policy debate and its impact on our domestic front. Reading the previous sections, by now you must have developed a fair idea about the character of the international global warming policies

[21] https://unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop

and the pressure they exert on the developing countries like us. However, among developing countries, India is of course an exception, for it has a reasonably strong scientific infrastructure and manpower base. Right from the very beginning, the state had been allocating substantive resources for building up a consolidated scientific and technical base. Higher education, science and engineering went a long way with an eye to make the nation self-reliant with a sound industrial base. However, these ambitious projects faced an economic setback, for India is still counted as one of the poorest countries of the world. This heavily compromises India's ability to provide the updated, cross-cutting and sophisticated training and professional skills to its manpower despite having some of the best higher educational and training institutes of its own. India's capacity in optimising its own climate research and drafting its policy recommendations were therefore seethed with such handicaps (Kandlikar 1999). In India, there is a clear cut division between scientific research and policy related issues of climate studies. While scientific research is carried out by government laboratories of the CSIR and other academic institutes, Policy makers, however, belong primarily to the non-governmental organisations (NGOs), research institutes and of course to the academic organizations. Policy making is more important for the fact that India is one of the greatest greenhouse gas emitters in the world with its emissions likely to shoot up almost by 2.5 times between 2008 and 2035 (IEA 2013). In this context of increasing Indian carbon emissions, the industrialised countries like the United States had refused to sign a legally compelling treaty to arrest its own greenhouse radiations (National Academies 2010). On the other hand, developing countries felt that given the triple arguments of equity, low per-capita emissions and the historical responsibility of the developed countries, it is the duty of the developed countries to pull down their emissions first (Dubash:2011; Michaelowa 2012).

13.7 Shifting Perspectives of Global Greenhouse Emissions in India

India however, began to shuffle its position in both the domestic and international forum. Shifts in global warming policy have been evident for quite some time and it is impacting the policy negotiations in both the domestic and international circles. Traditionally, the policy recommendations concerning climate change reflected a relaxed approach towards greenhouse emissions. India's basic orientation towards international climate negotiations interestingly remained static for over two decades though there were politico-economic shifts happening on a significant scale. The reasons for this were many but chiefly two. One was, there developed a clearcut water-tight compartmentalisation between the environmental and foreign issues. The top-rung bureaucrats particularly from the environmental ministry who carved the

climate change policies were in darkness about the other foreign policy issues. This isolation from the external policies and foreign affairs left its impact on the framing of environmental policies. The policies grew up almost in a void without having any alliance with their foreign counterparts. The second reason is the successful indoctrination of a normative frame based on the idea of 'equity'. This underlines the equal responsibility of both the developed and developing countries in the matter of global warming, with the blame more so on the developed countries for historically they had championed such widespread warming. We had already mentioned the Conference held in Rio De Janeiro in 1992 which proclaimed the CBDR principles initiated by the United Nations Forum for Climate Change Conventions (UNFCCC). It acknowledged the different responsibilities of the industrialised and developing countries in carbon emissions. Therefore going by the idea of equity, the state put the onus on the developed countries in correcting its greenhouse radiations instead of arresting the economic growth of the developing nations. Indira Gandhi maintained that persistence of socio-economic development and handling management issues can be a difficult task. She was doubtful about the extent to which the state can commit itself to binding climatic negotiations. She believed her economy has its own set of domestic problems for which it shall be difficult to go for any law abiding global climatic commitment. The situation however changed soon in the first decade of the 21st century. In 2007, then prime minister, Manmohan Singh made an announcement that India's per capita emissions shall never surpass those of industrialised countries. India for the first time was capping its emissions. It was no longer as free as it was before. It was coming out of its age-long commitment to emit the required greenhouse gases as its economy demanded of it. It wilfully subjected itself to emission constraints which were legally binding as those of the developed economies.

Actually, the state mechanism was framing the lines of climate diplomacy in respect of India's broader foreign policy agenda. India perhaps, was favouring greater alignment with the United States and China in foreign policies. For this, there was an absolute necessity for it to toe the line of these international stakeholders in allied contexts of climate negotiations. Such negotiations became more rampant when Jayram Ramesh was elected the Minister for Environment and Forests in 2009. During his tenure, India had voluntarily offered to reduce carbon emissions. At the 2010, COP 16 conference in Cancun, Ramesh declared that all countries must make a serious commitment to bring down its greenhouse gases level to a reasonably lower level. Ramesh pledged to voluntarily cut down its emissions by 20-25 percent by 2020, taking 2005 as the base year. It definitely was a commitment to shrink carbon emissions in spite of India being the one of the least "offending" countries in the world (Aji 2010). Jayram Ramesh in his lecture said,

> 'We are convinced that a low-carbon strategy is an essential aspect of sustainable development. While we already have one of the lowest emissions intensity of the economy, we will do more. We are targeting a further emissions intensity decline of 20-25% by 2020 on 2005 levels. This is significant given our huge developmental imperatives (Ramesh:2010).'

More than going by its face value, the Indian climate negotiation policies in this stage can be taken as pursuits of strategic diplomacy. It was soon after declaring the Greenhouse gas emission policies that India succeeded in winning many international deals. Be it framing a positive diplomatic relation with China, with whom India however had an otherwise strained relation, bagging a major nuclear deal with the US Congress in 2008, being publicly offered support by US President Obama in 2010 in India's bid to win a permanent seat in the United Nations Security Council to being given greater voting rights to both China and India by the International Monetary Fund; the Indian climate diplomacy had a long way to go (Atteridge:2010).

13.8 Indian Climatic Negotiations and Environmental Colonialism

The above policies were critiqued heavily by a group of environmental scientists who felt the negotiations were heading towards a very fatal trend, which they termed as "environmental colonialism". A study published in the United States by the World Resources Institute (WRI) in collaboration with the United Nations is what the scholars term as ''environmental colonialism''. WRI[22] claimed that developing countries are scared of the fact that their development processes would be stunted by controlling their capacity to produce energy especially from coal, which perhaps is mostly responsible for producing carbon dioxide. Besides coal, Indian agricultural activities produce a lot of methane, another suspect in global warming. A segment of Indian political scientists feel that the world itself is so disproportionately divided that developing countries ought not to be blamed for any climatic disruption. What the developing country pollutes is nothing compared to the scales of consumption of the developed ones. Riding on the logic of carbon emission and restricting the growth of the developing economies is an unjust practice which is absolutely out of the purview of any kind of 'development' whatsoever. It is just a tactic designed to marginalise the poor economies even more. More so, it is a tactic applied by the rich countries to exert its burden of undue emissions pressure on the poor economies. The famous

[22] Pachauri, R. K., Sujata Gupta, and Meeta Mehra. 1992. 'A Reappraisal of WRI's Estimates of Greenhouse Gas Emissions'. Natural Resources Forum 16 (1): 33–38.

environmentalist, Sunita Narayan said, it is time that richer countries must learn to undo their development or as she prefers to use the term, 'de-develop', so that developing countries too will get the equal opportunity to brush up their economy. She asks the question:

> "Can we really equate the carbon dioxide contributions of gas guzzling automobiles in Europe and North America or, for that matter, anywhere in the Third World with the methane emissions of draught cattle and rice fields of subsistence farmers in West Bengal or Thailand? Do these people not have a right to live? (Agarwal:1991)".

This definitely is a case of "environmental colonialism" for the rich countries have already used up the earth's ecological resources and are persistently doing so. Rather than concentrating on the poor developing economies, we all are busy hauling up these poor people and accusing them for consuming up the natural assets. This definitely is a matter of North-South Divide where the richer countries of the North are trying hard to define the issues as well as attempting to monitor and control the development policies in the South that are having deep underlying implications. This approach of singling out only the developing countries as the ultimate source of threat to the global environment and limiting their industrial autonomy is often taken as a ploy employed by the North to victimise the South and exerting a control on its resources. This is what we term 'environmental colonialism. The North with only 20% of the world's population accounts for almost 85 % of the global consumption of non-renewable energy. The North as we said had already used up the lion's share of the world's resources and according to the critics like Agarwal and Narayan, must reduce the intake of the non-renewable energy to make room for the rapid industrialisation and growth of the South, which had been long due to them (Agarwal : 1991).

Do you know what the North-South Divide is ?

The North-South Divide is a socio-economic and a political division of the earth that had been popularized in the late 20th century and the early 21st century. This is not a geographical term and has socio-political implications. Global North includes Australia, Canada, most western European countries, Israel, Japan, New Zealand, Singapore, South Korea, Taiwan and the United States. The Global South is made up of Africa, Latin America and the Carribean,Pacific Islands and the developing countries in Asia, including the Middle East.

Another very influential think tank was the (then) Tata Energy Research Institute (TERI) who also poised a critique (Pachauri1992). The scholars participating in the debate agreed on three pertinent facts such as:

- The possible negative influence of climate change on India
- The limiting effects of a climate treaty
- Insistence upon the fact that the industrialised countries must be held responsible for their greenhouse emissions.

India held it very firmly that developed countries with high per capita emissions of those gases must be held responsible for incremental global warming. They agreed that the principle of equity must be made the touchstone for making the judgements (Dasgupta 2012). India definitely played a very substantial role in the making of the Global South, which we spoke about, through its claims and dispensation.

13.9 Sustainable Development and Climate Change

Though India maintained that consistent position cannot be taken to reduce its greenhouse emissions, for it maintains that it still exhales one of the lowest per capita emissions. It also likewise claimed that the developing countries need the carbon space to grow (Ananthapadmanabhan 2007). Despite that as the fore-runners of sustainable development , our country felt that as responsible citizens we must ensure that we achieve the goals of sustainable development, one of which is to respond positively to the exigencies of climate action. Sustainable development is the instrumental principle for meeting the human development goals while simultaneously taking care of the natural resources and our ecosystem. The outcome is a condition in which the living conditions and the available resources are used to the optimum without compromising the integrity, stability and effectiveness of the future generations

Do you know?

Sustainable development has its origin in ideas about the sustainable forest management which were formed in Europe during the 17th and 18th centuries. In context of the growing awareness of the depletion of the timbre resources in England, a name suddenly became very significant and it was John Evelyn. John Evelyn, a writer,gardener and diarist said that sowing and planting of trees must be taken as a moral duty of every citizen. This is done to ensure the banning of destructive over-exploitation of the natural resources. It was in his 1662 essay, Sylva, that he first made such an argument.

Title : **John Evelyn**

Courtesy :

https://commons.wikimedia.org/wiki/File:JohnEvelyn1687.jpg

to meet their own needs. But of course, the agenda of sustainable development was offset by the adverse impacts of climate change and especially global warming. Therefore, Asian policy makers considered climate change more seriously. As the concept of sustainable development developed gradually, it shifted its focus more towards economic and social development with a special emphasis on environmental preservation and the persistence of the ecology.

To instill the required knowledge,skills,values and attitudes in order to establish a sustainable world, ESD or as we say, the Education for Sustainable Development had been developed. Its aim was to empower and brush up the present and future generations so that they can meet their needs through a well developed strategy. The strategy incorporates all the economic,social and environmental approaches so that one is not compromised for the other and vice-versa. With the launching of the UN Decade of Education for Sustainable Development (2005-2014), there started a global movement to make certain modifications in education so as to counter the limitations of sustainable development. Thereafter UNESCO endorsed the Global Action Programme (GAP) on ESD in the 37th session of its General Conference. Recognised by the UN and launched at the UNESCO World Conference on ESD in 2014, GAP aspires to bring an all-round development. The role of the ESD stands recognised in three major UN Summits such as in Rio de Janeiro, Brazil in 1992 and Johannesburg,South Africa in 2012. Other pivotal global agreements such as the Paris Agreement also recognized the key importance of ESD. ESD with its[17] sustainable development goals today occupy the central position at the 2030 agenda for sustainable development.

Title: 17 Sustainable Development Goals
Credit : https://commons.wikimedia.org/wiki
File : Sustainable_Development_Goals_text_only.png

13.10 India's Take on Sustainable Development

Our country understood that it sincerely required a versatile strategy to fight the adversities of climate change. India did not sit still but went a long way in preparing

itself for adopting the Sustainable development model. Let us look at the Indian take on the problem, especially in terms of its national policies. This section has largely been drawn from the Government of India 2019 Report on Sustainable Development Goals (Aayog 2019).

a) Climate Action and policies

The Global Action programme (GAP) we studied above mentioned 17 sustainable development goals of which the 13th goal spoke of the climate action.India had already adopted the National Action Plan on Climate change (NAPCC). It underlined an all-round strategy to tackle the climate impacts while working out the solutions aided by best of the technologies. Globally India assumed leadership roles especially in the United Nations Framework Convention on Climate Change (UNFCCC). India championed the International Solar Alliance which aimed at cultivating a large pool of solar resources as well as cutting down the cost of technology and financing.

b) Clean Energy

A target of around 175 GW of renewable energy generation capacity by 2022 especially from solar, wind, biomass and hydropower is being chalked out. The over-use of biomass for cooking , especially in rural areas is being resolved under the scheme of Pradhan Mantri Ujjwala Yojana, such that 80.3 million LPG connections havr been implemented by the state in various domestic, industrial and non-industrial sections of the society.

c) Emission Intensity

The National Electricity Policy finalised in 2018 predicts a sharp decline in fossil fuel capacity at least by 2027. Super-critical thermal power units have risen so as to avoid carbon emissions. The Central Pollution Control Board monitors air quality across the country under the National Air Quality Monitoring Programme or NAMP as we say. It plays a pivotal role in monitoring emission intensities in as many as 300 cities/towns all across the country.

d) Improving Disaster Risk Reduction and Preparedness

Our country's geography is extremely susceptible to natural disasters, which especially is adverse for the poor. The National Policy on Disaster Management (2009) and the National Disaster Management Plan (2016) concentrates on this issue of disaster risk reduction. Programmes such as the National Cyclone Risk Mitigation Project can help in strengthening its disaster combat forces more effectively. India has recently launched the International Coalition for Disaster Resilience Infrastructure (ICDRI) in collaboration with 12 partner countries to strengthen its resilience capacity.

Do you know?

Unnat Jyoti by Affordable LEDs for All (UJALA) is a scheme by our country that promotes energy efficiency through the mass distribution of low-cost LED bulbs. On an average, India saved a lot of its energy by switching to LED bulbs. Among the States, Odisha saved the highest, to be soon followed by Gujarat and Uttar Pradesh.

India is strengthening itself on the grounds of sustainability. It is exploring the reservoirs of renewable and alternative sources of energy to cut down on its fossil fuel sources. Equitable, regular access to affordable, reliable and clean energy is a definite prerequisite for socio-economic progress in India. The Goal has three key components: universal access to electricity and clean cooking fuel, increasing share of renewable energy in the country's energy mix and improving energy efficiency, as endorsed in the National Energy Policy (Aayog 2019). The state is trying to achieve the full electrification of all habitations and so all the targeted programmes are in place. The national policies are also trying to pace up the schemes for increased access to LPG for clean cooking and reduced reliance on biomass for the households. The country's energy mix can be made diversified by broadening the pool of renewable energy choices (solar, wind, small hydropower, waste-to-energy, among others).

At the same time, to adopt the policies towards sustainability and preservation of ecology, the nation is also increasing its installed capacity access. The sustainable path can be sharpened more through developing strategies for energy efficiency. It is in this direction that we are enforcing standards and labelling our equipment and appliances, implementing energy conservation building codes for commercial buildings and developing energy consumption norms for industries. This will go a long way in strengthening the sustainable policies and programmes, in controlling global warming and arresting the adversities it creates for the earth.

13.11 Conclusion

We conclude the section by saying that as far as policies for climate action are concerned, we are on the right track. There are several limitations which we face, especially in safeguarding the rights of the poor and the marginalised who are at the heart of this sustainability issue, but we continue to fight against all odds. Protecting the environment from all the possible dangers and to sustain our economic growth remains a pertinent issue and we try adopting the sustainable tactics to pursue it. The energy expedition to harness as much renewable energy as possible is a challenge for the state but we have remained focussed on it. India has committed to gaining 40 percent of its total electricity generation from non-fossil fuels latest by 2030 as part

of its NDC. Karnataka,Tamil Nadu and Maharashtra led the country in power production from renewable energy sourves whereas Jammu and Kashmir tops the chart in the case of the Union Territories. Together we should go a long way in saving our earth from the possible predators and at the same time ensuring its necessary socio-economic boost.

13.12 Summing Up

We started with a general introduction of climate change and went on to conceptualise global warming and tried unearthing its historical roots. We spoke of industrialisation and tried finding the nexus between industrialisation and global warming. We discussed at length the international time line of the policies and how the perspectives changed over time especially in recognising the wedge between the developed and developing classes. We then spoke at length on the shifting paradigms in the field of national policies. We saw how our country had responded to the call for sustainability and taken all the necessary measures for moving towards the greener earth and a clear sky.

13.13 Glossary

United Nations Framework Convention: It is an International Environmental Treaty that seeks to reduce atmospheric concentrations of greenhouse gases with the aim of preventing dangerous anthropogenic interference with earth's climate system.

United Nations: It is an intergovernmental organisation that aims to maintain international peace and security, develop friendly relations among nations, achieve international cooperation, and be a centre for harmonising the actions of nations.

United Nations Environment Programme: It is responsible for co-ordinating the UN's environmental activities and assisting developing countries in implementing environmentally sound policies and practices.

World Meteorological Organization: is a specialised agency of the United Nations responsible for promoting international co-operation on atmospheric science, climatology, hydrology and geophysics.The WMO originated from the International Meteorological Organisation, a non-governmental organisation founded in 1873 as a forum for exchanging weather data and research.

International Monetary Fund: It is an international organisation, headquartered in Washington D.C., consisting of 189 countries working to foster global monetary co-operation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.

Tata Energy Research Institute: It is a research institute in New Delhi that specialises in the fields of energy, environment and sustainable development. Established in 1974, it was formerly known as the Tata Energy Research Institute. As the scope of its activities widened, it was renamed The Energy and Resources Institute in 2003.

National Energy Policy: A national energy policy comprises a set of measures involving that country's laws, treaties and agency directives.

13.14 Model Questions

A. Answer in detail:

1. Write an essay on global warming and the policy measures undertaken to combat it.
2. How is the industrial revolution related to global warming?
3. Mention some of the measures implemented by the country in sync with the sustainability model.

B. Answer briefly:

1. What is the role played by UNFCCC in containing global warming?
2. Who is Nils Gustaf Ekhom? What is his role in arresting global warming?
3. What is UJALA? What is its contribution towards sustainable development?

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UNIT–14 : MAJOR ENVIRONMENTAL ISSUES IN INDIA

I : AIR POLLUTION

Structure

I.14.0 Objectives

I.14.1 Introduction

I.14.2 The Cause of Air Pollution

- I.14.2.1 Forest Fires
- I.14.2.2 Volcanic Activity
- I.14.2.3 Anthropogenic Factors of Air Pollution

I.14.3 Effects of Air Pollution

I.14.4 Remedies to Comprehend the Crisis of Air Pollution

I.14.5 Conclusion

I.14.6 Model Questions

I.14.7 Suggested Readings

I.14.0 Objectives

- To enhance the knowledge regarding the intensity of the crisis that human being is facing in terms of Air Pollution
- To take a note of the cause and effect relationship which acts as the prime modality for the genesis of the crisis
- To have a Case study in order to enumerate the cause, effect and the skirmishing of the Crisis in a specific setting.
- A short study of the method undertaken by India to combat Air Pollution is also taken forth
- To have a comprehensive understanding of the crisis that is being faced by the symbiotic relations between Man and Nature.

I.14.1 Introduction

One of the most important rights necessary for the survival of the every last soul

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on Earth is Right to Life. The essentiality of living is not only related to the existence of the political, economic and social condition of a Society. But far more necessary and primary fact is the Environment in which we live and survive. It is here that the aspect of Pollution comes forth. This very word is contaminating the very existence of the natural right the Right to Life of every living organism. In a more comprehensive sense, the term Pollution means the introduction of contaminants into the natural environment that cause adverse change. The contaminant doesn't need to be tangible and things as simple as light, sound and temperature can be considered pollutants when introduced artificially into an environment. The pollution can be caused by natural events such as forest fires and active volcanoes. But the use of the word Pollution generally implies that the contaminants have an anthropogenic source, that is, a source created by human activities.

From a historical perspective in Europe, from the Middle Ages well into the early modern era, unsanitary urban conditions favoured the outbreak of population-decimating epidemics of disease,from plague to cholera and typhoid fever. Through the 19th century, water and air pollution and the accumulation of solid wastes were largely problems of congested urban areas. But, with the rapid spread of industrialisation and the growth of the human population to unprecedented levels, pollution became a universal problem. By the middle of the 20th century, an awareness of the need to protect air, water, and land environments from pollution had developed among the general public. In particular, the publication in 1962 of Rachel Carson's book 'Silent Spring' focused attention on environmental damage caused by improper use of pesticides such as DDT and other persistent chemicals that accumulate in the food chain and disrupt the natural balance of ecosystems on a wide scale. The work done below is an attempt to understand one of the categories of Pollution under the heading of Air Pollution from the aspect of cause, effect and the method to control such act of Pollution.

I.14.2 The Cause of Air Pollution

Air pollution is the mixing of unwanted and harmful substances such as chemicals, dust, auto emissions, suspended particles, gases among others in our atmosphere.The Air Pollution is caused mainly by two factors–Natural and Anthropogenic factors. In this section two of the major Natural factors have been discussed, namely, forest fire and volcanic activity.

I.14.2.1 Forest Fires

This happens both as an act of Nature and as an act of Human capacity. As an act of Nature, it is caused when lightning strike produces a spark or strikes power cables,

trees, or rocks and any other thing and this can trigger off a fire.The type of lightning associated with wildfires is known as hot lightning where it has less voltage currents, but strikes repeatedly for longer periods. As such, fires are normally initiated by the persistent hot lightning bolts that strike rocks, trees, power cables or any other thing that might ignite a fire. Along with that volcanic eruption leading to the flow of lava can also act as a catalyst in a forest fire. In the case of Human capacity, it is caused both by Human callousness and Human negligence. Activities like smoking, where smokers at times become negligent of extinguishing the cigarette butts after smoking. Other activities like camping where people normally leave lit fires or combusting materials unattended which can ignite wildfires. Humans sparked off about half of the 73,110 wildfires on wild lands in the United Sates in the period between 2006 and 2015. During that period, campfires contributed to one-third of the 33,700 human-instigated wildfires. Those wildfires decimated more than 1.2 million acres of land. Along with that slow burning of debris can potentially set anything ablaze and start a wildfire because of the heat. In fact, sometime or other fire is set intentionally to destroy land, house or any other property. The effects of such wildfires not only degrade the forest, ecosystem and the biodiversity of the land, but also causes a huge level of Air Pollution. When plant life is exterminated by fires, the quality of air we breathe in declines and greenhouse gases increase in the atmosphere leading to climate change and global warming. Trees and vegetation covers act as purifiers of the air we breathe by absorbing carbon dioxide and other greenhouse gases as well as other air impurities and giving out oxygen. When they are burned down, it means more greenhouse gases increase in the atmosphere, resulting in global warming. In addition, the huge clouds of smoke instigated by wildfires lead to massive air pollution. For example, during the wildfire in California in 2018 the particulates in the air that was measured in some parts of the state was as high as 1,500 micrograms per cubic metre far exceeding the World Health Organization's threshold of 25 micrograms for particulate pollution.

I.14.2.2 Volcanic Activitity

Volcanic eruptions release large quantities of greenhouse gases and other aerosols into the atmosphere, these gases form massive clouds which accumulate in the atmosphere; this process is referred to as outgassing or offgassing. In addition to magma particulates, known as ash or pyroclastic flow, volcanic eruptions release water vapour(H_20), carbon dioxide (CO_2), sulphur dioxide (SO_2), hydrogen sulfide (H_2S), carbon monoxide (CO), hydrogen chloride (HCl), and hydrogen fluoride (HF) into the atmosphere. This combination of outgassed particulates has the ability to inflict vast detrimental impacts on the rest of the globe. SO_2 (Sulphur dioxide)

released during an eruption can be injected to altitudes of greater than 10km into the stratosphere. Here, SO_2 is converted to sulfate aerosols, which reflect sunlight and therefore has a cooling effect on the Earth's climate. They also have a role in ozone depletion. For example, the eruption of Kasatochi in 2008 saw one of the largest discharge of sulphur dioxide. The outgassing of Kasatochi in 2008 released a maximum of 0.5 - 2.7 kg of sulphur dioxide into the lower stratosphere. Sulphur dioxide scatters and absorbs solar and terrestrial radiation; this process results in the direct radioactive forcing of climate change. Sulphur dioxide, like other aerosols, increases the reflectivity of radiation from the sun, which cools the earth's lower atmosphere; a byproduct of a volcanic eruption known as 'vog' contributes to such a climate shift. Water vapour or steam is the most prevalent product released into the atmosphere during a volcanic eruption. The reaction between Water and Sulphur dioxide creates Acid Rain. Sulphur dioxide as well as sulphuric acid has a detrimental impact on living organisms–both terrestrial and marine. Follwed by this is another Gas put forth as Carbon dioxide is the next leading contributor to atmospheric greenhouse gases. In 2006, three ski patrol members were killed at Mammoth Mountain ski resort after falling into a snow depression surrounding a volcanic fumarole and filled with cool CO_2 gas. Apart from these two, Hydrogen fluoride(HF), hydrogen chloride(HCl), and bromine oxide (BrO) are three other volcanic aerosols which also contribute to international pollution. Hydrogen fluoride and hydrogen chloride are both outgassed into the atmosphere where they are then dissolved in water droplets; once these two compounds are introduced to water vapor they become hydrofluoric and hydrochloric acids and they then eventually fall towards the earth's surface as acid rain.

I.14.2.3 Anthropogenic Factors of Air Pollution.

In case of the Anthropogenic factors the list is much longer in its content for acting as a catalyst of Air Pollution. The factors are:

a) **Burning of Fossil Fuel:** Fossil fuels are fuels created from organic materials. Fossil fuels include oil, natural gas and coal. When these fossil fuels are burned, they release carbon dioxide, methane, nitrogen and particulates into the atmosphere. These upset the natural balance of nitrogen and carbon dioxide in the atmosphere, which leads to smog, acid rain and a greenhouse effect. Energy gained from burning fossil fuels is converted to electricity and heat in commercial power plants. When fossil fuels are burned carbon and hydrogen react with oxygen in air to carbon dioxide (CO_2) and water (H_2O). During this reaction heat is released which further amplifies the reaction. Electricity is generated by transforming mechanical energy (heat) to electrical energy in a turbine or generator. The Annual Greenhouse Gas Index, which is used by the

National Oceanic and Atmospheric Administration (NOAA) to track the warming influence of long-lived climate-altering greenhouse gases, increased by 40% from 1990 to 2016, with most of that increase attributable to rising CO_2 levels. In the US, coal and natural gas are the largest contributors to carbon pollution (constituting a third of all domestic carbon emissions). Methane released by production of natural gas, oil, and coal is second in importance. Although natural gas emits significantly less toxic air pollution and CO_2 than the other fossil fuels , the drilling, extraction, and transportation of natural gas results in the leakage of methane that is 34 times more effective than CO_2 in trapping heat over a 100-year period.

Statistically speaking, oil is also a major source of greenhouse gas emissions; petroleum is responsible for 45 percent of greenhouse gas emissions in the United States as of 2017. Along with this the combustion of coal is also responsible for 32 percent of the greenhouse gas emissions in the United States. On the last end of the trail Natural gas burns cleaner than coal and oil, with almost zero sulfur dioxide emissions and far fewer nitrogen oxide and particulate emissions. Natural gas releases almost 30 percent less carbon dioxide than oil and 43 percent less than coal. However, natural gas is still responsible for 29 percent of greenhouse gas emissions in the United States. Natural gas, which is primarily composed of methane (CH_4), is also generated by the decomposition of municipal waste in landfills and manure from livestock production. Methane is a greenhouse gas that is more than 20 times as potent as carbon dioxide.

Transportation is another method of burning of Fossil fuel which add on the list of Air pollution. Air pollution-related deaths and illness are linked most closely to exposures to small particulate matter (PM) of less than 10 or 2.5 microns in diameter (PM10 and PM2.5). Small particulates bypass the body's defences against dust, penetrating deep into the respiratory system. Road transport is estimated to be responsible for up to 30% of particulate emissions (PM) in European cities and up to 50% of PM emissions in OECD countries–mostly due to diesel traffic. In Delhi, India air pollution has reached the crisis level because the levels of fine particulate matter have exceeded daily national ambient air quality standards by a factor of 10 or more. However, we must remember that even during the rest of the year, levels of fine particulate matter in Delhi exceed annual national ambient air quality standards by a factor of 3 to 5, and nitrous oxide level exceeds annual national ambient air quality standards by a factor of 1.5. In November 2018, when Delhi declared its first 'pollution emergency' of the year due to smog, the Supreme Court-appointed Environment Pollution (Prevention and Control) Authority (EPCA) implemented the

Graded Response Action Plan (GRAP) across Delhi–NCR for 'severe' category of pollution.

b) **Pollution from Industries:** If Industrial Revolution has turned the pages of Human history, it has also led to the genesis of one of the sources of environmental contamination. The main industrial sectors responsible for air pollution are the petrochemical industry, the chemical industry, the mineral industry (mining and quarrying), and the metal production and processing industry, as well as additional activities associated with waste treatment, the food industry, dry cleaning and garages. The main industrial processes that emit pollutants are the combustion of fuels such as fuel oil, gas oil, and natural gas, and production processes that do not involve combustion but emit air pollutants such as the refineries emit the polluting gases such as sulphur dioxide (SO_2) and Nitrogen oxide (NO_x). Air pollution from factories and vehicles creates ground ozone problems, or smog, that presents significant health issues. Factories, particularly through the use of large industrial air conditioners, can also release destructive gases, contributing to the depletion of ozone in the upper atmosphere where it is needed. A particular kind of factory called an animal factory or a concentrated animal feeding operation (CAFO) causes a great deal of air, land and water pollution. CAFOs are highly industrialised and used to produce meat or dairy products in large quantities. These factories produce gases like methane, ammonia and others that lower air quality and are harmful to health. For example, in United States of America, almost 40 percent of the carbon dioxide produced in the comes from power plants. Coal-fuelled plants are the most polluting. The U.S. Energy Information Administration (EIA) states that in 2014, power plants produced 2.04 billion metric tons of carbon dioxide, with 76 percent, or 1.56 billion, coming from coal plants. Coal generated 39 percent of U.S. electricity in 2014, according to the EIA.

c) **Agricultural Air Pollution.** It comes mainly in the form of ammonia (NH_3), which enters the air as a gas from heavily fertilised fields and livestock waste. It blows over cities, reacts with emissions of oxides of nitrogen (NO_x) and sulphur (SO_2) from traffic and industry, to create tiny solid particles, or aerosols, no more than 2.5 micrometers across, about 1/30 the width of a human hair. The particles can penetrate deep into lungs, causing heart or pulmonary diseases. In 2015 study in the journal Nature it was estimate they cause at least 3.3 million deaths each year globally. The combination of intensive agriculture, traffic and industry is unfortunately quite typical for some of the most populated

parts of North America, Europe and Asia, which means that these particles are formed where they can cause a lot of damage. According to the USEPA (United States Environment Protection Agency), there are four main agricultural activities linked to the production of greenhouse gases. These include soil management, enteric fermentation, manure management and fossil fuel consumption. Methane (CH_4) and nitrous oxide (N_2O) were the two main gases emitted by agricultural activity in 2012, according to the USERA. Methane was primarily produced from enteric fermentation and manure management, while soil management, such as fertilisation, was the largest source of nitrous oxide. Methane is the main gas produced by manure as it decomposes. When stored as a liquid in a lagoon or tank, manure decomposes anaerobically, creating methane emissions. Along with this, farmers in many parts of the world set fire to cultivated fields to clear stubble, weeds and waste before sowing a new crop. While this practice may be fast and economical, it is highly unsustainable, as it produces large amounts of the particle pollutant black carbon and reduces the fertility of soil and pollutes the air. The black carbon emissions, open burning is the single largest source of black carbon, a short-lived climate pollutant that contributes to air pollution, climate change, and increased melting in the cryosphere (regions of snow and ice).

Sarkar, Singh and graduate student Akshansha Chauhan from Sharda University in Uttar Pradesh gathered data from NASA's Moderate Resolution Imaging Spectroradiometer(MODIS) satellite to detect active fires from 2003 to 2017 during October-November over northwestern India. To assess the impact of crop residue burning in the post-monsoon season over India, they tracked the changes in methane emissions (a greenhouse gas), a by-product of incomplete combustion of paddy. The team found increasing trends of black carbon particles and greenhouse gases emitted from crop residue burning in Punjab and Haryana from 2010 onwards. These were spreading to Uttar Pradesh in the eastern Indo-Gangetic Plains and to the states of Madhya Pradesh, Maharashtra, Chhattisgarh, and even down to Odisha and Telangana because of the northwesterly winds during the post-monsoon period. The impact was the worst during the first and second week of November. Black carbon particles, often referred to as soot, are a subset of PM 2.5 (fine particles with a diameter of 2.5 microns or lower) and can be inhaled into the lungs, posing a threat to health."Since black carbons are of finer nature, they remain entrained in the wind for longer distances," said Sarkar. "Also, since during winter the vertical convective mixing slows down, so these tend to linger further," he added.The

level of PM 2.5 detected in Aurangabad, Maharashtra peaked in 2016, which was also consistent with a peak in the fire counts detected in Punjab and Haryana during the same period.

d) **Mining Activity:** Modern mining is an industry that involves the exploration for and removal of minerals from the earth economically and with minimum damage to the environment. Mining is important because minerals are major sources of energy as well as materials such as fertilisers and steel. Mining is necessary for nations to have adequate and dependable supplies of minerals and materials to meet their economic and defence needs at acceptable environmental, energy, and economic costs. Some of the non-fuel minerals mined, such as stone, which is a non-metallic or industrial mineral, can be used directly from the earth. Metallic minerals, which are also non-fuel minerals, conversely, are usually combined in nature with other materials as ores. These ores must be treated, generally with chemicals or heat to produce the metal of interest. Most bauxite ore, for example, is converted to aluminum oxide, which is used to make aluminum metal by using heat and additives. Basically, it is the process of Extraction where the removal of ore from the ground on a large scale is conducted by one or more of three principal methods: surface mining, underground mining, and in situ mining (extraction of ore from a deposit using chemical solutions).

Airborne emissions occur during each stage of the mine cycle, but especially during exploration, development, construction, and operational activities. Mining operations mobilise large amounts of material, and waste piles containing small size particles are easily dispersed by the wind. Particulate matter is released in surface mining when overburden is stripped from the site and stored or returned to the pit. When the soil is removed, vegetation is also removed, exposing the soil to the weather, causing particulates to become airborne through wind erosion and road traffic erosion. Particulate matter can be composed of such noxious materials as arsenic, cadmium, and lead. On another term the most common pollution problem for an active mine arises from the disposal of mineral wastes, mainly mine waste rock and tailings. Mine waste rock is the material removed to access or expose the valuable ore and is typically enriched in some constituents of the geochemistry of the ore. Tailings are the waste materials after the minerals are separated from the ore in a mineral processing plant. They typically contain the valuable constituents in low concentrations, unrecovered by the process, and may also contain toxic residues of chemicals used in the separation process. Mine waste rock often generates acid drainage, when air and water come into contact with metal sulfide minerals, and the

resulting sulfuric acid solutions contaminate surface water bodies and groundwater. The CO_2 is also the main by-product of coal combustion: nearly 4 grams of CO_2 are produced for every gram of carbon burnt (depending on its type, coal can contain as much as 60 to 80 percent carbon).The vast majority of dust from mining activities consists of coarse particles (around 40 per cent) and particles larger than PM10, generated from natural activities such as mechanical disturbance of rock and soil materials by dragline or shovel, bulldozing, blasting, and vehicles on dirt roads. Particles are also generated when wind blows over bare ground and different types of stockpiles. These larger particles can have amenity impacts as well as health impacts. Fine particles from vehicle exhausts and mobile equipment are also produced at mine sites, though they only account for about 5 per cent of the particles emitted during the mining process. Fine particles produced at mine sites are mainly from vehicle and mobile equipment exhausts. For example, Opoku-Ware reported that air pollution in the Kenyasi community mainly comes from the dusty untarred roads that are continually used by Newmont's heavy-duty vehicles for transporting machines and other equipment to the mine sites. Chemical gases, fumes and smoke are not readily visible at the mining site, but during blasting, dust fills the atmosphere for some time. Chemicals used in the blasting process are also released into the atmosphere and the community has been prohibited from using rainwater. Although Newmont has responded to the complaints of air pollution from dust and untarred roads by periodically sprinkling water on the roads, this is not done regularly. The situation can be linked to increased respiratory ailments such as flu and cold (catarrh), as reported by most respondents. It has also been noted that "all fine dust at a high level of exposure has the potential to cause respiratory diseases and disorders and can worsen the condition of people with asthma and bronchial stiffness." Mining and metal processing activities, such as smelters and refineries, brass mills, and bronze production are some such sources.

e) **Indoor Pollution.** Indoor air is mainly the air within a building such as your home, classroom, office, shopping centre, hospital or gym. The contamination of such enclosed space air is known as Indoor Air Pollution. The principal sources of indoor air pollution are: Combustion, building material, and bioaerosols. While radon, asbestos, pesticides, heavy metals, volatile organic matter, and environmental tobacco smoke are considered major indoor pollutants in developed countries, the combustion products of biomass fuels contribute most to indoor air pollution in developing nations. In India, out of 0.2 billion people using fuel for cooking 49% use firewood; 8.9% cow dung cake; 1.5% coal, lignite, or charcoal; 2.9% kerosene; 28.6% liquefied petroleum gas (LPG); 0.1% electricity; 0.4% biogas; and 0.5% any other means. The incomplete combustion products of biomass fuels include suspended particulate matter,

carbon monoxide, polyaromatic hydrocarbons, polyorganic matter, formaldehyde, etc., which have adverse effects on health. The combustion of coal results in production of oxides of sulfur, arsenic, and fluorine. Pollutants such as aldehydes, volatile and semivolatile organic compounds are produced from resins, waxes, polishing materials, cosmetics, and binders. Lastly, biological pollutants like dust mites, molds, pollen, and infectious agents produced in stagnant water, mattresses, carpets, and humidifiers too pollute indoor air.

The reasons for such Pollution are first, Asbestos which can be found in various materials used commonly in the automotive industry as well as home construction. They are also found in coatings, paints, building materials, and ceiling and floor tiles. Secondly, Radon which can be found underneath your home in various types of bedrock and other building materials, can also be a cause of indoor air pollution. Radon can get into the walls of your home and put both you and your family at risk. Thirdly, Tobacco smoke that comes from outdoor and indoor areas can also be an indoor air pollutant. Fourthly, According to the World Health Organisation (WHO), around 3 billion people in the world still cook and heat their homes using dirty solid fuels (such as waste wood, charcoal, coal, dung, crop wastes) on open fireplaces, cooking stoves or kangs, which generates a large amount of air pollutants (such as SO_2, NO_x, CO, and PM).

There is also influx of Outdoor air pollutant to Indoor air. Kuo and Shen (2010) found a increase in concentration of PM2.5 and PM10 in both indoor and outdoor air during a dust storm event and interpreted the cause to be the extraction of outdoor air from their building's ventilation system. Baek studied the I/O relationships in Korean urban areas and confirmed the importance of ambient air in determining the quality of indoor air. There are three main ways that allow outdoor air to enter and affect indoor environments: mechanical ventilation, natural ventilation and infiltration. Mechanical ventilation can be driven by a ventilation fan or air conditioner of a dwelling, or by a central air conditioning system of a building, all of which draws in outdoor air from their fresh air intakes. Natural ventilation is driven by prevailing wind flow and occurs whenever the doors and windows of the room/building are open. Even without these ventilations, air exchange between indoor and outdoor environments can still occur through cracks and leaks in the building envelope, a process called infiltration, which may be significant for a building with poor sealing. Due to these three mechanisms, the air pollutants from outdoor can

penetrate into the indoor environment, and can either be diluted or accumulated according to the ventilation condition.

I.14.3 Effects of Air Pollution

The cause and effect are two sides of the same coin. The above part of the writing is an understanding of the cause of the Air pollution. Now we undertake an understanding of the effect of Air Pollution.

A. Global Warming: One of the primary effects of Air Pollution is the issue of Global Warming. Global warming can be defined as an increase in the average temperature of the Earth due to air pollutants, which collect sunlight and radiation and produce the greenhouse effect. The greenhouse gases are composed of carbon dioxide, methane, water vapour, chloroflurocarbon and nitrous oxide. This pollution layer avoids the reflection of sun rays by Earth's surface towards space, which raise the temperature in our planet among a lot more consequences.Burning of oil and fossil fuels, which mainly come from sources such as vehicles combustion engines and carbon industries, emit huge amounts of carbon particles to the atmosphere, where they react with oxygen to create carbon dioxide (CO_2). More sources of global warming contribute to create that pollution layer "in charge of microwaving the Earth". The average surface temperature of Earth is maintained by a balance of various forms of solar and terrestrial radiation. Solar radiation is often called "shortwave" radiation because the frequencies of the radiation are relatively high and the wavelengths relatively short. Terrestrial radiation, on the other hand, is often called "longwave" radiation because the frequencies are relatively low and the wavelengths relatively long. The amount of solar radiation absorbed by Earth's surface is only a small fraction of the total solar radiation entering the atmosphere. For every 100 units of incoming solar radiation, roughly 30 units are reflected back to space by either clouds, the atmosphere, or reflective regions of Earth's surface. The 70 units of solar radiation that are not reflected may be absorbed by the atmosphere, clouds, or the surface. To maintain thermodynamic equilibrium the Earth's surface and atmosphere must radiate these same 70 units back to space. The greenhouse gases absorb Earth Radiation and because of this absorption, some fraction of the original 70 units does not directly escape to space. The presence of greenhouse gases in the atmosphere leads to a warming of the surface and lower part of the atmosphere. The natural greenhouse effect is associated with surface warming properties. It is necessary because in its absence, Earth's average temperature would be approximately 33 °C (59 °F) colder than today, and Earth would be a frozen and likely uninhabitable planet. But the human-activity-created Greenhouse Gas increases the net downward longwave

radiation reaching the surface. By this when the Sun's rays penetrate the atmosphere, but when that heat is reflected off the surface cannot escape back into space. The excess heat in the atmosphere has caused the average global temperature to rise overtime, otherwise known as global warming.A special report produced by the IPCC in 2018 honed this estimate further, noting that human beings and human activities have been responsible for a worldwide average temperature increase of between 0.8 and 1.2 °C (1.4 and 2.2 °F) of global warming since preindustrial times, and most of the warming observed over the second half of the 20th century could be attributed to human activities. It predicted that the global mean surface temperature would increase between 3 and 4°C (5.4 and 7.2°F) by 2100 relative to the 1986-2005.

B. Climate Change : The increasing temperature of the earth with the increase in global warming is affecting different aspects of the environment which in effect is leading to climate change of the earth. In a summarised statement, climate change encompasses not only rising average temperatures but also extreme weather events, shifting wildlife populations and habitats, rising seas, and a range of other impacts. All of those changes are emerging as humans continue to add heat-trapping greenhouse gases to the atmosphere, changing the rhythms of climate that all living things have come to rely on.A team led by Daniel Horton, a climate modeller at Stanford University in California, used 15 global climate models to track changes in the number and duration of atmospheric stagnation events, in which stationary air masses develop and allow soot, dust and ozone to build up in the lower atmosphere. Horton and his colleagues calculated that 55% of the global population would experience more air stagnation by 2099. Large swathes of India, Mexico and the Amazon could see up to 40 more stagnant air days per year compared to the average annual tally from 1986 to 2005, representing increases of 40%, 19% and 28% respectively. In October 2018 the IPCC issued a special report on the impacts of global warming of 1.5°C, finding that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society, the IPCC said in a new assessment. With clear benefits to people and natural ecosystems, the report found that limiting global warming to 1.5°C compared to 2°C could go hand in hand with ensuring a more sustainable and equitable society. While previous estimates focused on estimating the damage if average temperatures were to rise by 2°C, this report shows that many of the adverse impacts of climate change will come at the 1.5°C mark. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C than that with 2°C. The likelihood of an Arctic Ocean free, of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2ºC. From 1901 to

2010, the global average sea level rose by 19 cm as oceans expanded due to warming and melting of ice. The sea ice extent in the Arctic has shrunk in every successive decade since 1979, with 1.07 × 106 km² of ice loss per decade. The Average sea level rise is predicted to be 24-30 cm by 2065 and 40-63 cm by 2100. In Montana's Glacier National Park the number of glaciers has declined to fewer than 30 from more than 150 in 1910.Much of this melting ice contributes to sea-level rise. Global sea levels are rising 0.13 inches (3.2 millimeters) a year, and the rise is occurring at a faster rate in recent years.

The depletion of the Stratospheric ozone layer – which helps to filter out some of the sun's harmful rays – was first raised in the 1970s. Exposure to these rays (ultraviolet radiation) increases the risk of skin cancer and eye cataracts, can depress the human immune system, and harm aquatic systems and crops. Scientists now reckon that over the last ten years or so average global ozone concentrations have decreased by 3%. In the late 1960s and early 1970s, Scandinavian rivers and lakes and their aquatic life began to show signs of being adversely affected by pollution, and in the late 1970s trees in Central European forests showed signs of being similarly affected. Investigations suggested the causes to be acidification of the ground and the water from atmospheric depositions of sulphur dioxide and nitrogen oxides–from mainly industrial sources–carried in the air over long distances.. Other effects of the increase in Global temperature comes with heat waves, drought, hurricanes and flood. In 2011, when many locations in Texas and Oklahoma experienced more than 100 days over 100°F. Both states set new records for the hottest summer since record keeping began in 1895. Rates of water loss, due in part to evaporation, were double the long-term average. The heat and drought depleted water resources and contributed to more than $10 billion in direct losses to agriculture alone. The rising temperatures are affecting wildlife and their habitats. Vanishing ice has challenged species such as the Adélie penguin in Antarctica, where some populations on the western peninsula have collapsed by 90 percent or more. The oceans are already experiencing large-scale changes at a warming of 1°C, with critical thresholds expected to be reached at 1.5°C and above.Coral reefs are projected to decline by a further 70-90% at 1.5°C. At a warming of 2°C virtually all coral reefs will be lost. The National Wildlife Federation reports that 177 of 305 North American bird species shifted their range further north by 35 miles in the last 40 years; and over the last century, 14 species of small mammals extended their range 1,640 feet higher in the Sierra Nevada region.

C. Effect on health : The increasing Air pollution is resulting in an increase in Global Temperature which in effect is resulting in Climate Change. The resultant Climate Change is affecting the life of human being which lies in a symbiotic relation with the nature. The effect on the health are as follows: first, respiratory problems are

caused with increase in ground level ozone and fine particle concentrations, which can trigger a variety of reactions including chest pains, coughing, throat irritation, and congestion, as well as reduce lung function and cause inflammation of the lungs. The increased carbon dioxide concentrations and temperatures, thereby affect the timing of aeroallergen distribution and amplify the allergenicity of pollen and mold spores. Secondly, depletion of stratospheric ozone leads to an increase in UV exposure and temperature, increasing the risk of skin cancer and cataracts. Along with that extreme cold and extreme heat increase hospital admissions for heart-related disorders and disease, such as dysrhythmias and stroke. Increased ozone formation due to higher temperatures harms pulmonary gas exchange and causes stress on the heart. Increased ozone concentrations are associated with heart attacks. The Prolonged exposure to extreme heat can cause heat exhaustion, heat cramps, heat stroke, and death, as well as exacerbate pre-existing chronic conditions, such as various respiratory, cerebral, and cardiovascular diseases.Thirdly, changes in agricultural ranges, practices and changing environmental conditions can reduce the availability and nutritional content of food supplies. For example, an increase in the use of pesticides leads to a decrease in nutritional content of food. The increased drought in some areas encourages crop pests such as aphids, locusts, and whiteflies, as well as the spread of the mold that produces aflatoxin, which may contribute to the development of liver disease in people who eat contaminated corn or nuts. Fourthly, People exposed to higher levels of ground-level ozone are at greater risk of dying prematurely or being admitted to the hospital for respiratory problems. The Ground-level ozone can damage lung tissue, reduce lung function, and inflame airways. This can aggravate asthma or other lung diseases. Children, older adults, outdoor workers, and those with asthma and other chronic lung diseases are particularly at risk. Fifthly, Particulate matter is the term for a category of extremely small particles and liquid droplets suspended in the atmosphere. Some particulate matter such as dust, wildfire smoke, and sea spray occur naturally, while some is created by human activities such as the burning of fossil fuels to produce energy. These particles may be emitted directly or may be formed in the atmosphere from chemical reactions of gases such as sulfur dioxide, nitrogen dioxide, and volatile organic compounds. Inhaling fine particles can lead to a broad range of adverse health effects, including lung cancer, chronic obstructive pulmonary disease (COPD), and cardiovascular disease.Climate change is expected to increase the number and severity of wildfires. Particulate matter from wildfire smoke can often be carried over very long distances by the wind, affecting people who live far from the source of this air pollutant. Seventhly, Vectorborne diseases are illnesses that are transmitted by disease vectors, which include mosquitoes, ticks, and fleas. These vectors can carry infectious pathogens, such as viruses, bacteria, and

protozoa, from animals to humans. The changes in temperature, precipitation, and extreme events increases the geographic range of diseases' spread by vectors and can lead to illnesses occurring earlier in the year.

Malaria is strongly influenced by climate. It is transmitted by Anopheles mosquitoes and kills over 4,00,000 people every year–mainly African children under 5 years age. The Aedes mosquito vector of dengue is also highly sensitive to climate conditions, and studies suggest that climate change is likely to continue to increase exposure to dengue. Ninthly, Climate change and the direct impacts of higher concentrations of carbon dioxide in the atmosphere are expected to affect food safety and nutrition. Higher air temperatures can increase cases of Salmonella and other bacteria-related food poisoning because bacteria grow more rapidly in warm environments. These diseases can cause gastrointestinal distress and, in severe cases, death. Practices to safeguard food can help avoid these illnesses even as the climate changes.

The specific harmful components in the pollutant air also affects the body. Dioxins, more typically found in food but also present in small amounts in the air, can affect the liver in the short term and harm the immune, nervous, and endocrine systems, as well as reproductive functions. Lead in large amounts can damage children's brains and kidneys, and even small amounts of it can affect children's IQ and ability to learn. Mercury affects the central nervous system. Polycyclic aromatic hydrocarbons, or PAHs, are toxic components of traffic exhaust and wildfire smoke. In large amounts, they have been linked to eye and lung irritation, blood and liver issues, and even cancer. In terms of economy the air pollution creates a burden on healthcare systems, which costs taxpayers money. Air pollution from energy production in the U.S. caused at least US$131 billion damage to its economy, including increased healthcare costs, in 2011. One Oxford University study found that air pollution from cars and vans cost society 6 billion pounds per year. The European Environment Agency found that emissions from 14,000 industrial facilities in Europe cost society and the economy up to 189 billion euros in 2012.

I.14.4 Remedies to Comprehend the Crisis of Air Pollution.

The crisis of Air Pollution is being comprehended both from an International legal stand and from the stand of technology and human initiatives. The International Legal stands to comprehend the crisis are–the Principle 21 of the Stockholm Declaration (1972) and Principle 2 of the Rio Declaration that emerged out of the 1992 Earth Summit. The Rio Declaration affirms that countries have "the sovereign right to exploit their own resources pursuant 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." Under this principle, countries are prohibited from undertaking or allowing actions that will cause pollution in other nations.

Another important concept, known as the precautionary principle or precautionary approach, addresses circumstances where significant health, safety, or environmental risks may be involved although full scientific certainty is lacking. Many countries, especially those in Europe, consider the precautionary principle to be a part of customary international law, but this legal status is debated by other countries, such as the United States. Considerable controversy also exists over exactly what the precautionary principle means. The Principle 15 of the 1992 Rio Declaration reads, "Where there are threats of serious or irreversible damage, lack of scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Another formulation is that a country is not prohibited from taking measures to protect health or the environment because of the existence. In both these conferences the aspect of Sustainable Development which came forth from 1987 Brundtland Report was emphasised . It was taken as the organising principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend. The desired result is a state of society where living conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural system. The sustainable development can be classified as development that meets the needs of the present without compromising the ability of future generations.The 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) calls for an immediate ban on certain chemicals, severely restricts the use of others, and provides for POPs to be disposed of and managed using environmentally sound methods. To address the problem of climate change, which is caused by an increased concentration of carbon in the atmosphere, countries negotiated the United Nations Framework Convention on Climate Change, which entered into force in 1994, and finalised the Kyoto Protocol related to that convention in 1997. A treaty that addresses other forms of air pollution is the Convention on Long-Range Transboundary Air Pollution formulated by the UN Economic Commission for Europe in 1979 and its protocols. The 1981 UN Convention on the Law of the Sea, several regional agreements on specific seas, and various other treaties address maritime pollution. The 1998 Convention for the Application of Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (not yet in force) would ensure that countries

have the opportunity to make informed decisions on whether to allow hazardous chemicals to enter their borders. There have also been important treaties regulating oil and nuclear pollution, such as the International Convention on Oil Pollution Preparedness, Response and Cooperation in 1990, and the International Atomic Energy Agency Convention on Nuclear Safety in 1994.

Along with this, in 2012, the World Health Organisation (WHO) estimated that poor air quality causes between 7 and 8 million premature deaths every year. This makes air pollution the leading environmental cause of premature deaths. Exposure to indoor and outdoor air pollution is closely linked to increased occurrences of cardiovascular diseases, such as strokes and heart disease, as well as cancer and respiratory diseases. By recognising the growing global threat of air pollution, the United Nations Environment Assembly (UNEA) adopted resolution 1/7: Strengthening the Role of the United Nations Environment Programme (UNEP) in Promoting Air Quality in June 2014. UNEP was requested to make an overview of the actions taken by governments to promote better air quality. The results are shared in an online catalogue of 193 countries . Based on the catalogue, fourteen sub-regional reports and this global summary were prepared describing ten key actions being undertaken by governments around the world to improve air quality.In 2013, UNEP's Governing Body adopted Decision 27/9, on Advancing Justice, Governance and Law for Environmental Sustainability. This decision is the first internationally negotiated document to establish the term 'environmental rule of law.' It invited Governments and relevant organisations to reinforce international, regional and sub-regional co-operation to combat non-compliance with environmental laws. The Members States recognised the growing importance of rule of law in the field of the environment in order to reduce violations of environmental law and to achieve sustainable development overall. They held that 'the violation of environmental law has the potential to undermine sustainable development and the implementation of agreed environmental goals and objectives at all levels and that the rule of law and good governance play an essential role in reducing such violations'.

Apart from the UN, the next largest organisation is the European Union. Some of the steps undertaken by it : The European Environment Agency (EEA) is the European Union's air pollution data centre; it supports the implementation of EU legislation linked to air emissions and air quality. The EEA also contributes to the evaluation of EU air pollution policies and to the development of long-term strategies to improve air quality in Europe. EEA's work focuses on first, making a range of air pollution data publicly available and second, documenting and assessing air pollution trends and related policies and measures in Europe third, investigating the trade-offs and synergies between air pollution and policies in different areas, including climate

change, energy, transport and industry. The EU Air Quality Directive requires Member States to implement air quality management plans and measures in areas where air quality standards are exceeded. These plans aim to reduce concentrations of air pollutants to below the legislative limit and target values specified in the Directive in the shortest possible time. Member States also have to report these management plans and measures to the European Commission through the European Environment Agency (EEA). Norway officially reported the improved air quality in 2014, 2015 and 2016. The European Commission adopted in 2013 a Clean Air Policy Package, including a Clean Air Programme for Europe setting objectives for 2020 and 2030, and accompanying legislative measures. In 2018, The Commission adopted a Communication "A Europe that protects: Clean air for all'' that provides national, regional and local actors practical help to improve air quality in Europe. In case of ASEAN, the Community Vision 2025 recognises the complementarity of the UN 2030 Agenda for Sustainable Development with ASEAN's community building efforts to uplift the standards of living of its people. Since the 1997-98 haze episode, ASEAN has sought to address the fires and resulting haze from forest and land fires in Indonesia. Political momentum in adjacent regions has been created through the signing of the ASEAN Haze Agreement, from which several lessons can be extracted, while developing any regional framework. The recognition of disasters must be addressed, such as forest fires, floods & earthquakes. ASEAN agreement recognizes the problem of forest fires, along with the economic loss and the road map for member countries signing on. Prevention, operational mechanisms and enforcement activity strengthening are included in the agreement. The latter part of enforcement is particularly noteworthy as it should be essential for any regional agreement. In terms of prevenive measures, national policies, national plans, curbing sources of forest fires through enforcement, legislation, monitoring, task forces and information technology are all included. In case of South Asia and SAARC, Environmental issues first found prominence in 1988 when a regional plan–"SAARC-2000–A Basic Needs Perspective"–was launched. It was to "supplement national, bilateral, regional and global efforts to deal with the increasingly serious problems being faced by the region" (SAARC, 2010a). While this was considered significant, nothing remarkable happened in terms of meaningful action with a wide regional focus. Internal tensions resulting from "geopolitical imbalances" among some member countries (India vs Pakistan, in particular) retarded progress and it took twenty years for the leaders to approve the "SAARC Convention on Cooperation on Environment" to tackle problems of climate change. The 2004 Indian Ocean tsunami raised serious concerns about disaster preparedness and post-disaster relief and rehabilitation. The response of SAARC came in the form of a "Comprehensive Framework on Disaster Management" (CFDM)

for the region in 2007. It was based on the report of the "World Conference on Disaster Reduction" or the Hyogo Framework for Action (HFA), which promoted "a strategic and systematic approach to reducing vulnerabilities and risks to hazards" . CFDM's principal objectives are to establish and strengthen the regional disaster management system to reduce risks and to improve response and recovery management at all levels.In order to harmonise disaster management strategies at the regional level, CFDM proposed standardising hazard and vulnerability assessments, achieving the appropriate balance in PPRR (prevention, preparedness, response and recovery) programming, developing and standardising damage, loss and impact assessment methodologies, relief management procedures and training curriculum for disaster management personnel. These were about establishing common practices across the region and ensuring compliance. But how these were to be done, was not clearly spelt out.

The SAARC Disaster Management Centre (SDMC) devised a Rapid Respond Mechanism for a co-ordinated approach to disaster emergencies in the region using existing arrangements–response facilities, search and rescue personnel and equipment, emergency medical facilities, relief material, disaster management expertise and technology. (SAARC, 2011). Using a participatory process with country experts providing input, SDMC has been instrumental in formulating several protocols on different environmental issues and strategies. The SAARC Expert Group identified seven areas needing attention: adaptation to climate change, policies and actions for climate change mitigation, policies and actions for technology transfer, finance and investment, education and awareness, management of impacts and risks, and capacity building for international negotiations. In order to mitigate environmental problems, South Asian countries should be willing to share best practices that have been adopted in their mitigation plans and also organise capacity building for clean development mechanism projects and key stakeholders, including a designated national authority from each country.Sustainable development calls for plans and actions that transcend nations and regions, and a partnership of equals would be ideal. But the political, geographic and economic landscape of South Asia makes sustainable development a challenging issue.Environmental governance in most of South Asia has, by and large, been state-dominated with direct intervention mainly through regulatory strategies over the use and upkeep of environmental resources. While governmental approaches follow norms of sound governance in environmental matters exemplified in policy documents, more has to be done to create structures for stakeholder participation in the policy process, especially implementation and evaluation.The commitment of the political leadership in each country seems to be there, but they need to resolve their ingrained political conflicts if they really want to move ahead and pursue sustainable

development not only in their respective countries but also in the region as a whole for environmental conservation and sustained well-being of their people.

I.14.5 Conclusion

In the age of Globalisation we cannot deny the fact that still the world is divided into countries and border is a reality we cannot surpass. But such line or demarcations also cannot negate the fact that there are issues which we face as one composed unit of our Mother Earth. Pollution is such an issue which does not withhold itself within the demarcated border line. It is something which we all are facing in our day to day life, since we all are responsible for its occurrence. One of the central argument of Marx and Malthus was the understanding that for Marx with Industrial Revolution Man has surpassed the ability of production of Nature. In reality it did happen forth, but at a definite cost. The cost lies in the degradation of the Nature and the Air we breathe in for survival. What is omnipotent is to understand that a balance needs to be restored between Man and Nature, since the symbiotic relationship between the two is needed for the existence of the Mother Earth.

I.14.6 Model Questions

A. Answer in brief (5 Marks):

i. What do we understand by the term Pollution?

ii. Discuss the effect of Air Pollution on the survival of living entity.

B. Answer in detail (10 Marks):

i. Discuss the Natural and Anthropogenetic factors that leads to Air Pollution.

ii. How does Mining activity contribute to Air Pollution?

iii. Discuss the organizational approach to combat Air Pollution

iv. Discuss the Climatic changes that are resultant of Air Pollution

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II : WATER POLLUTION AND GROUND WATER DEPLETION

Structure

II.14.0 Objectives
II.14.1 Introduction
II.14.2 Understanding of Water Pollution
II.14.3 Reasons for Water Pollution
II.14.4 Understanding of Ground Water Depletion
II.14.5 Reasons for Ground Water Depletion
II.14.6 Effects of Water Pollution and Ground Water Depletion
II.14.7 Measures to combat Water Pollution and Ground Water Depletion
II.14.8 Case Study on water pollution and Ground Water Depletion
II.14.9 Conclusion
II.14.10 Model Question
II.14.11 Suggested Readings

II.14.0 Objectives

- To have a comprehensive understanding of the crisis of Water Pollution and Ground Water Depletion
- To take note of the different steps that we can take in our daily lives to combat such crisis
- To have a Case study on a specific region to understand both the Crisis and its mitigation
- To understand the symbiotic relation between Man and Nature.

II.14.1 Introduction

British poet W. H. Auden saids "Thousands have lived without love, not one without water." The essentiality of Water for survival doesn't stop Human being from being one of the main sources of its contamination. Some 80 percent of the world's wastewater is dumped largely untreated back into the environment, polluting rivers, lakes, and oceans. Unsafe water kills more people each year than war and all other

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forms of violence combined. Meanwhile, our drinkable water sources are finite–less than 1 percent of the earth's freshwater is actually accessible to us. Without action, the challenges will only increase by 2050, when global demand for freshwater is expected to be one-third greater than it is now. In fact international politics predicts the future war between states will be grounded on better water availability.

On the same platform, another largest source of usable fresh water in the world is Ground Water. In many parts of the world, especially where surface water supplies are not available, domestic, agricultural, and industrial water needs can only be met by using the water beneath the ground. The U.S. Geological Survey compares the water stored in the ground to money kept in a bank account. If the money is withdrawn at a faster rate than new money is deposited, there will eventually be account-supply problems. Pumping water out of the ground at a faster rate than it is replenished over the long-term causes similar problems. So the study below is an attempt to comprehend and mitigate the crisis.

II.14.2 Understanding of Water Pollution

Water pollution can be defined as the contamination of a stream, river, lake, ocean or any other stretch of water, depleting water quality and making it toxic for the environment and humans. The reason lies in the fact that water is a good solvent and many different chemical substances are found dissolved in water. Gases in the atmosphere will dissolve in rainwater as it passes through the air. By the time this water reaches a stream or river, it will contain a variety of chemical compounds dissolved within it from the air and from the rocks and soil through which it has percolated. These compounds may be completely harmless, naturally occurring substances, but they may also include pollutants.

There are two types of water pollution:

1. Organic pollution due to microorganisms–bacteria and viruses–present in the water, generated by excrement, animal and vegetable waste
2. Chemical pollution generated by the nitrates and phosphates of pesticides, human and animal drugs, household products, heavy metals, acids and hydrocarbons used in industries

Water is a unique substance, because it can naturally renew and cleanse itself, by allowing pollutants to settle out (through the process of sedimentation) or break down, by diluting the pollutants to a point where they are not in harmful concentrations. However, this natural process takes time, and is difficult when excessive quantities of harmful contaminants are added to the water. Water pollution occurs when energy and other materials are released, degrading the quality of the water for other users.

Water pollution includes all of the waste materials that cannot be naturally broken down by water. In other words, anything that is added to the water, above and beyond its capacity to break it down, is pollution. Pollution, in certain circumstances, can be caused by nature itself, such as when water flows through soils with high acidities. But more often that not, human actions are responsible for the pollutants that enter the water.

Water Pollution also means a condition when one or more substances have built up in water to such an extent that they cause problems for animals or people. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly. If you poured a cup of black ink into a river, the ink would quickly disappear into the river's much larger volume of clean water. The ink would still be there in the river, but in such a low concentration that you would not be able to see it. At such low levels, the chemicals in the ink probably would not present any real problem. However, if you poured gallons of ink into a river every few seconds through a pipe, the river would quickly turn black. The chemicals in the ink could very quickly have an effect on the quality of the water. This, in turn, could affect the health of all the plants, animals, and humans whose lives depend on the river. Thus, water pollution is all about quantities–how much of a polluting substance is released and how big a volume of water it is released into. A small quantity of a toxic chemical may have little impact if it is spilled into the ocean from a ship. But the same amount of the same chemical can have a much bigger impact if pumped into a lake or river, where there is less clean water to disperse it. In 1969 the United Nations report defined ocean pollution as:"The introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality for use of sea water and reduction of amenities."

There are certain types of Water pollution: Firstly Surface Water the huge ocean, lake, river and other water bodies which cover 70% of the water body of Earth Surface are known as Surface Water which are affected by Water Pollution.Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in the freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertiliser runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. Secondly, Ocean water where eighty percent of ocean pollution (also called marine pollution) originates on land-either along the coast or far inland. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into our bays and estuaries; from there they travel out to sea. Meanwhile,

marine debris, particularly plastic, is blown in by the wind or washed in via storm drains and sewers. Our seas are also sometimes spoiled by oil spills and leaks, big and small, and are consistently soaking up carbon pollution from the air. The ocean absorbs as much as a quarter of man-made carbon emissions.For example, a spill from an oil tanker creates an oil slick that can affect a vast area of the ocean. Thirdly, Ground Water is held in underground rock structures known as aquifers, which we cannot see and seldom think about. Water is stored underground in aquifers. The aquifers feed our rivers and supply much of our drinking water. They too can become polluted, for example, when weed killers used in people's gardens drain into the ground. Ground water pollution is much less obvious than surface-water pollution, but is no less of a problem. Ground water gets polluted when contaminants, from pesticides, fertilisers wastes leached from landfills and septic systems make their way into an aquifer, rendering it unsafe for human use. Once polluted, an aquifer may be unusable for decades, or even thousands of years. Ground water can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans. In 1996, a study in Iowa in the United States found that over half the state's ground water wells were contaminated with weed killers. But since then, two decades on, all that has really changed is the name of the chemicals we're using. Today, numerous scientific studies are still finding weed killers in ground water in worrying quantities, In 2012, a study discovered glyphosate in 41 percent of 140 ground water samples from Catalonia, Spain. But scientific opinion differs on whether this is safe or not.Fourthly ,if pollution comes from a single location, such as a discharge pipe attached to a factory, it is known as point source pollution. Other examples of point source pollution include an oil spill from a tanker, a discharge from a smoke stack (factory chimney), or someone pouring oil from their car down a drain. A great deal of water pollution happens not from one single source but from many different scattered sources. This is called non-point source pollution. When point-source pollution enters the environment, the place most affected is usually the area immediately around the source. For example, when a tanker accident occurs, the oil slick is concentrated around the tanker itself and, in the right ocean conditions, the pollution disperses the further away from the tanker you go. This is less likely to happen with non-point source pollution, which, by definition, enters the environment from many different places at once. The EPA regulates point source pollution by establishing limits on what can be discharged by a facility directly into a body of water. While point source pollution originates from a specific place, it can affect miles of waterways and ocean. Non-point source pollution is the leading cause of water pollution in U.S. waters, but it's difficult to regulate, since there's no single, identifiable culprit. Fifthly, sometimes pollution that enters the environment in one place has an effect hundreds or even

thousands of miles away.The Transboundary pollution is the result of contaminated water from one country spilling into the waters of another. Contamination can result from a disaster like an oil spill or the slow, downriver creep of industrial, agricultural, or municipal discharge. This is known as transboundary pollution. One example is the way radioactive waste travels through the oceans from nuclear reprocessing plants in England and France to nearby countries such as Ireland and Norway.

II.14.3 Reasons for Water Pollution

In India, ground water pollution is one of the major problems affecting public life on a regular basis. The reasons of such problem are varied, ranging from natural causes, industrial causes, agricultural causes to anthropogenic or human-based causes. Natural phenomena like geological formations such as volcanos or metaphoric rocks may produce enough toxic substances that first affect the ground and then get submerged within it; and thus may lead to ground water pollution.

Industries often release toxic effluents through their seepage systems; these effluents then inflict severe damage on the purity of soil and ground water. Accidental underground gas tank leakages may also contaminate the water in a major way. Industrial substances like mercury, lead, cadmium, zinc etc. often either by accident or by design get mixed with soil and make it salty. When these chemicals seep into the ground water level ,it also becomes salty and poisonous. Disposal of slush and sludge material can also pollute ground water.

Unscientific agricultural practices like excessive use of chemical fertiliser, too, cause both soil and water pollution. Defective irrigational methods are also responsible for the problem. Of the human-based causes, most common are excessive drawing out of ground water for irrigation purposes and thus letting the seawater bulging into the empty spaces; and use of corrosive elements as landfills. Use of nuclear-based power generators often adversely affect first the soil and then the water.

II.14.4 Understanding of Ground Water Depletion.

Ground water is something that we need all over the world. Societies require much more clean water than we are accorded from precipitation and surface water, which is why ground water is used so frequently. If you were to see ground water moving, you'll likely find it interesting that so much water lies beneath us. From a bird's eye view, you may even feel that there is more than enough water to go around. While we know that ground water shortage is a serious issue, we should also know how water naturally finds its way into the aquifers we extract it from. Ground water comes from aquifers–spongelike gravel and sand-filled underground reservoirs, and we see

this water only when it flows from springs and wells. Ground water discharge is another key element in the water cycle, which includes loss of water from the aquifers to surface water and atmosphere as base flow into streams, springs, wetlands, and oceans and extraction for human needs. Discharge is driven by relative head levels between ground water and surface water, which are changed with pumping of ground water for agriculture and increased population. Ground water discharge continues till ground water level remains higher than surface-water level and vice versa. Due to this reason, base flow is maintained in permanent streams during periods of extended drought in semiarid and arid regions. Ground water depletion, a term often defined as long-term water-level declines caused by sustained ground-water pumping, is a key issue associated with ground water use. Ground water can be recharged (deposited) by infiltration of precipitation, surface water, or applied irrigation water; it can be kept in storage (saved); and it can be discharged naturally to streams, springs, or seeps, or transpired by plants (withdrawn). The depletion occurs when just as a bank account must be balanced, withdrawals from an aquifer by pumping must be balanced by some combination of increased recharge, decreased discharge, and removal from storage (or depletion).

In another way it can be said that humans may be adding large amounts of carbon dioxide to the atmosphere by using ground water faster than it is replenished, this process is known as ground water depletion .In a study it is estimated that ground water depletion in the United States could be responsible for releasing 1.7 million metric tons (3.8 billion pounds) of carbon dioxide to the atmosphere every year. Based on these figures, ground water depletion should rank among the top 20 sources of carbon emissions documented by the US Environmental Protection Agency (EPA) and the Intergovernmental Panel on Climate Change (IPCC). This would mean that the carbon dioxide emitted through ground water depletion is comparable to the carbon generated from aluminum, glass, and zinc production in the United States. Rain falling from the sky contains the same amount of carbon dioxide as it is present in the atmosphere. But soil carbon dioxide levels are up to 100 times greater than carbon dioxide levels in the atmosphere, because soil microbes degrade organic carbon compounds into carbon dioxide. When rainwater hits the ground and percolates through Earth's rocks and sediments, the water dissolves extra carbon dioxide produced by these microbes.

If left to its own devices, this carbon-rich water remains below ground for hundreds to thousands of years before surfacing in oceans or freshwater bodies. But humans are now extracting ground water at an unprecedented pace to sustain a growing population. The United States of America alone sucks up nearly 80 billion gallons (303 billion liters) of water from the earth every day to supply drinking water and

irrigate crops, enough water to fill Utah's Great Salt Lake five times every year. Hyndman and Wood estimated that U.S. releases approximately 1.7 million metric tons (3.8 billion pounds) of carbon dioxide a year into the atmosphere from groun dwater depletion. This is more than the amount of carbon dioxide produced by the generation of electricity used to power 2,50,000 households in the United States each year. Scientists know less about ground water depletion on a global scale, but Wood and Hyndman predict ground water depletion releases 9.7 to 13.5 million metric tons (21.4 to 29.8 billion pounds) of carbon dioxide to the atmosphere each year globally.

Water is uniquely vulnerable to pollution since as a "universal solvent," water is able to dissolve more substances than any other liquid on earth. Toxic substances from farms, towns, and factories readily dissolve into and mix with it causing water pollution. The reasons are stated below:

1. **Agricultural:** Agriculture has an impact on water pollution. Due to the use of chemicals such as fertilisers, pesticides, fungicides, herbicides or insecticides running off in the water, as well as livestock excrement, manure and methane (greenhouse effect). The aquaculture, pollution occurs directly in the water, as excess food and fertilisers are causing dystrophication. Insecticides are chemicals that are sprayed onto crops to kill the insects that eat crops is also another additional reason for pollution. One of the more controversial insecticides is DDT which was used on crops to control the malaria mosquito in South Africa. At certain levels (10 mg per kg) DDT can cause human poisoning with the following symptoms: dizziness, vomiting and convulsions. At lower levels, DDT can affect the development of babies and has been associated with cancer. DDT has been banned in South Africa. Insecticides are easily washed by the rain into streams and ground water where they poison fish and domestic animals. Many insecticides are stored for a long time in the bodies of animals and can end up in the meat, fish, egg and milk that one eats. Fruits and vegetables that have been sprayed with insecticides also remain poisonous for many days afterwards and must be washed very well before eating. In the United States, agricultural pollution is the top source of contamination in rivers and streams, the second biggest source in wetlands, and the third main source in lakes.

   The nutrient pollution is caused by excess nitrogen and phosphorus in water or air.It is an immense threat to water quality worldwide and can cause algal blooms, a toxic soup of blue-green algae that can be harmful to people and wildlife.Phosphorus and nitrogen are common pollutants generated from residential areas and agricultural runoff, and are usually associated with human and animal wastes or fertiliser. Nitrogen and phosphorus are plant nutrients required by plants to grow. They are spread on farmland in the form of fertilisers.

Rain washes these nutrients into rivers, streams and lakes. If the nutrients are present in large quantities, they can encourage excess plant growth in the water causing the phenomenon known as an algal bloom, which means a sudden increase in the population of microscopic algae. If a water body has high nutrient levels it is said to be eutrophic; the process is called eutrophication. The main problem of eutrophication is that the suddenly increased population of aquatic plants can die off equally quickly. The decay of the plant material by bacteria can cause deoxygenation of the water.

2. **Sewage and Wastewater:** Inadequate sewage collection and treatment are sources of water pollution. In case of wastewater, according to the United Nations, more than 80% of the worldwide wastewater goes back in the environment without being treated or reused. With billions of people on the planet, disposing of sewage waste is a major problem. According to 2015 figures from the World Health Organisation (the most recent available at the time this article was updated in 2019), some 2.1 billion people (28 percent of the world's population) do not have access to safe drinking water, while 2.3 billion (30 percent of the world's population) do not have proper sanitation (hygienic toilet facilities); although there have been great improvements in securing access to clean water, relatively little progress has been made in improving global sanitation in the last decade. Sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhoea. Sometimes sewage waste is pumped untreated into the sea. Until the early 1990s, around 5 million tons of sewage was dumped by barge from New York City each year. According to 2002 figures from the UK government's Department for the Environment, Food, and Rural Affairs (DEFRA), the sewers of Britain collect around 11 billion litres of wastewater every day; there are still 31,000 sewage overflow pipes through which, in certain circumstances, raw sewage is pumped untreated into the sea.In theory, sewage is a completely natural substance that should be broken down harmlessly in the environment. 90 percent of sewage is water. In practice, sewage contains all kinds of other chemicals, from the pharmaceutical drugs people take to the paper, plastic, and other wastes they flush down their toilets. When people are sick with viruses, the sewage they produce carries those viruses into the environment. It is possible to catch illnesses such as hepatitis, typhoid, and cholera from river and sea water. It often happens that micro-organisms may get into water with dust from the air as rain falls, and when water passes through soil which is polluted with human and animal wastes. The contamination of water supplies with raw sewage (human and domestic wastes generated from residential areas) is the most

common route for biological pollutants to enter water. When contaminated river water moves downstream it is possible that any pollutant will be diluted as more water flows in and so increases the total volume of water in the river. This dilution may be enough to reduce the contaminants sufficiently to minimise the possible health effects but this process may not work for all pathogens.

On the other hand each year, the world generates perhaps 5-10 billion tons of industrial waste, much of which is pumped untreated into rivers, oceans, and other waterways. In the United States alone, around 4,00,000 factories take clean water from rivers, and many pump polluted waters back in their place. However, there have been major improvements in waste water treatment recently. Since 1970, in the United States, the Environmental Protection Agency (EPA) has invested about $70 billion in improving water treatment plants that, as of 2015, served around 88 percent of the US population. Factories are point sources of water pollution, but quite a lot of water is polluted by ordinary people from nonpoint sources; this is how ordinary water becomes waste water in the first place. Virtually everyone pours chemicals of one sort or the other down their drains or toilets. Even detergents used in washing machines and dishwashers eventually end up in our rivers and oceans. So do the pesticides we use in our gardens. A lot of toxic pollution also enters waste water from highway runoff. Highways are typically covered with a cocktail of toxic chemicals–everything from spilled fuel and brake fluids to bits of worn tires (themselves made from chemical additives) and exhaust emissions.

3. **Oil Pollutant:** When we think of ocean pollution, huge black oil slicks often spring to mind, yet these spectacular accidents represent only a tiny fraction of all the pollution entering our oceans. Even considering oil by itself, tanker spills are not as significant as they might seem–only 12 percent of the oil that enters the oceans comes from tanker accidents; over 70 percent of oil pollution at sea comes from routine shipping and from the oil people pour down drains on land. However, what makes tanker spills so destructive is the sheer quantity of oil they release at once–in other words, the concentration of oil they produce in one very localised part of the marine environment. Every year there are about 3,000 pollution incidents involving oil and fuels in England and Wales. Oil spillages affect water quality in a number of ways. Oil can make drinking water unsafe to drink. A substantial amount of oil released into oceans and seas will destroy wildlife and the ecosystems that sustain them. Oil spills also reduce oxygen supplies within the water environment. The biggest oil spill occurred when the tanker Exxon Valdez broke up in Prince William Sound in Alaska in 1989. Around 12 million gallons (44 million liters) of oil were released into the pristine wilderness–enough to fill your living room 800 times over! Estimates

of the marine animals killed in the spill vary from approximately 1000 sea otters and 34,000 birds to as many as 2800 sea otters and 2,50,000 sea birds. Several billion salmon and herring eggs are also believed to have been destroyed.

4. **Radioactive Waste:** Radioactive waste is any pollution that emits radiation beyond what is naturally released by the environment. It's generated by uranium mining, nuclear power plants, and the production and testing of military weapons, as well as by universities and hospitals that use radioactive materials for research and medicine. Radioactive waste can persist in the environment for thousands of years, making disposal a major challenge.Sellafield on the north-west coast of Britain and Cap La Hague on the north coast of France, both discharge radioactive waste water into the sea, which ocean-currents then carry around the world. Countries such as Norway, which lie downstream from Britain, receive significant doses of radioactive pollution from Sellafield. The Norwegian government has repeatedly complained that Sellafield has increased radiation levels along its coast by 6-10 times. Both the Irish and Norwegian governments continue to press for the plant's closure.
5. **Marine Dumping:** Everyday, garbage such as plastic, paper, aluminum, food, glass, or rubber are deposited into the sea. These items take weeks to hundreds of years to decompose, and thus they are a major cause for water pollution. While plastics are not toxic in quite the same way as poisonous chemicals, they nevertheless present a major hazard to seabirds, fish, and other marine creatures. For example, plastic fishing lines and other debris can strangle or choke fish. (This is sometimes called ghost fishing.) About half of all the world's seabird species are known to have eaten plastic residues. In one study of 450 shearwaters in the North Pacific, over 80 percent of the birds were found to contain plastic residues in their stomachs. In the early 1990s, marine scientist Tim Benton collected debris from a 2km (1.5 mile) length of beach in the remote Pitcairn islands in the South Pacific. His study recorded approximately a thousand pieces of garbage including 268 pieces of plastic, 71 plastic bottles, and two doll’s heads.
6. **Industries and Chemical Waste:** Industries produce huge amount of waste which contains toxic chemicals and pollutants which can cause air pollution and damage to us and our environment. They contain pollutants such as lead, mercury, sulphur, asbestos, nitrates and many other harmful chemicals. Many industries do not have proper waste management system and drain the waste in the fresh water which goes into rivers, canals and later into sea. The highly toxic chemicals such as polychlorinated biphenyls (PCBs)were once widely used to manufacture electronic circuit boards, but their harmful effects have

now been recognised and their use is highly restricted in many countries. Nevertheless, an estimated half million tons of PCBs were discharged into the environment during the 20th century. In a classic example of transboundary pollution, traces of PCBs have even been found in birds and fish in the Arctic. They were carried there through the oceans, thousands of miles away from where they originally entered the environment. Although PCBs are widely banned, their effects will be felt for many decades because they last for a long time in the environment without breaking down. Another kind of toxic pollution comes from heavy metals, such as lead, cadmium, and mercury. Lead was once commonly used in gasoline (petrol), though its use is now restricted in some countries. Mercury and cadmium are still used in batteries (though some brands now use other metals instead).These metals are easily washed into streams and ground water. Copper and mercury are another two heavy metals, which are found in fungicides. Fungicides are sprayed on crops and easily washed into rivers. These heavy metals are toxic to biological life including the people who may have to drink from the polluted rivers. Crops that have been irrigated with polluted water can also be dangerous. In a similar way as DDT, heavy metals can also build up in the body causing symptoms of poisoning.The toxic chemicals have the capability to change the colour of water, increase the amount of minerals (also known as Eutrophication) change the temperature of water and pose serious hazard to water organisms.Until recently, a highly toxic chemical called tributyltin (TBT) was used in paints to protect boats from the ravaging effects of the oceans. Ironically, however, TBT was gradually recognised as a pollutant. Boats painted with it were doing as much damage to the oceans as the oceans were doing to the boats.The best known example of heavy metal pollution in the oceans took place in 1938 when a Japanese factory discharged a significant amount of mercury metal into Minamata Bay, contaminating the fish stocks there. It took a decade for the problem to come to light. By that time, many local people had eaten the fish and around 2000 were poisoned. Hundreds of people were left dead or disabled.

7. **Deforestation:** When trees are being removed, naturally, there is a loss of support on the soil as there is no longer presence of tree roots to hold the soils together. This leads to more loose soil particles, thereby causing higher rates of soil erosion, that seeps into the nearby lake, affecting the water quality of the lake since the soil particles can cause the river to have an decrease in pH since soil particles usually contains ammonium ions . With loose soil particles, other nutrients or ions can be released into the rivers and lakes around it, thereby causing water pollution problems. So deforestation for agriculture and

urban growth leads to water pollution. When soil is stripped of its protective vegetation it becomes prone to soil erosion. This leads to an increase in the murkiness of the water which can firsrt block the gills of fish. Secondly, bottom dwelling plants cannot photosynthesise as the sun's rays cannot reach them. Thirdly, there is an increase in disease as bacteria and viruses use the soil particles as a method of transportation.

As for the case of Amazon, deforestation of mercury rich soils has lead to the release of mercury ions into the Amazon river system. Furthermore, these mercury ions combine with hydrocarbons due to the presence of bacteria (microbes) that thrive in anaerobic conditions to form a more toxic compound known as methylmercury. There is a severe consequences of methylmercury on the nervous systems of animals and humans when there is too much of it accumulated in our body, as found in the Minamata case. As such, it is a serious problem when such harmful ions are released from the soils into the water bodies.

8. **Sediment:** Sediment is the loose sand, clay, silt and other soil particles that settle at the bottom of a body of water. Sediments can come from soil erosion or from the decomposition of plants and animals. Wind, water and ice help carry these particles to rivers, lakes and streams. Sedimentation activities can be land-based (i.e., agriculture, forestry, construction, urbanisation, recreation) and water-based (i.e., dams, navigation, port activities, drag fishing, channelisation, water diversions, wetlands loss, other large-scale hydrological modifications). It makes the water less transparent, blocking sunlight. The decreased light will impede the growth of aquatic plants, which provide essential habitat for many aquatic animals, including young fish. Another way sediments can be harmful is by smothering the gravel beds where fish lay their eggs. Gravel beds provide a perfect surface for trout or salmon eggs to be protected, while still allowing oxygen to reach the growing embryo. When silt covers eggs, it prevents this oxygen transfer.Aquatic invertebrates can suffer from damage to their fragile filtering systems, and if they are sessile (immobile) they can be buried by sediments. Fine particles can eventually be transported into coastal zones, where they affect marine invertebrates, fish and coral.Nutrients transported by sediment can activate blue-green algae that release toxins and can make swimmers sick. Sediments deposits in rivers can alter the flow of water and reduce water depth, which makes navigation and recreational use more difficult.
9. **Mining:** Modern mining is an industry that involves the exploration for and removal of minerals from the earth economically and with minimum damage to the environment. Water pollution problems caused by mining include acid

mine drainage, metal contamination, and increased sediment levels in streams. Sources can include active or abandoned surface and underground mines, processing plants, waste-disposal areas, haulage roads, or tailing ponds. Sediments, typically from increased soil erosion, cause siltation or the smothering of streambeds. This siltation affects fisheries, swimming, domestic water supply, irrigation, and other uses of streams.Acid mine drainage (AMD) is a potentially severe pollution hazard that can contaminate surrounding soil, ground water, and surface water. The formation of acid mine drainage is a function of the geology, hydrology, and mining technology employed at a mine site. The primary sources for acid generation are sulfide minerals, such as pyrite (iron sulfide), which decompose in air and water. Many of these sulfide minerals originate from waste rock removed from the mine or from tailings. If water infiltrates pyrite-laden rock in the presence of air, it can become acidified, often at a pH level of two or three. This increased acidity in the water can destroy living organisms, and corrode culverts, piers, boat hulls, pumps, and other metal equipments in contact with the acid waters and render the water unacceptable for drinking or recreational use.

Other important effects of mining is lowering of water-table whereby, the removal of water for mine workings can result in a drawdown. Drawdown can reduce the amount of water available for recharging wetlands and surface water, thereby affecting any organisms that depend on those waters. Water that percolates through waste piles and tailings can become contaminated with heavy metals. This water can contaminate both ground water and surface water. Additionally, the hydraulic head pressure of tailings ponds can cause hydraulic mounding underneath and adjacent to the pond, potentially altering the local ground water flow pattern. Besides ground water lowering, water quality implications (in the form of pollution) are a major impact issue of mining on environment globally. The pollutants (or traces of heavy metals) are released into the ground water by geogenic sources through the weathering of the geologic formations and anthropogenic sources. Contamination in ground water because of anthropogenic sources, for example, agricultural fields and use of fertiliser/pesticides, sewages and solid wastes, return flow due to irrigation, etc., is most often noticed and is far-far larger than the water-level lowering

II.14.5 Reasons for Ground Water Depletion

The necessity of Ground Water is as important as the Surface Water.It's very important for the environment and the whole planet to replenish wetlands, swamps, lakes, and rivers after periods of drought. When ground water is present, this water

can be used as a source of refill and recharge for these important ecosystems. However, when ground water is contaminated or not present at all, these parts of the environment suffer significantly. This can have major impacts around the world.In rural parts of the country, up to 99% of the water used for drinking is sourced from ground water. Although this number is smaller in cities and more built-up areas, the total amount of drinking water in the United States that comes from groun dwater sources is still 51%. This means that just over half of the water we drink comes from ground water, which in turn means that if this water gets contaminated, we will have fewer clean drinking water sources throughout the country. But the attaining of the ideal level of ground water is now being questioned with the increase in human activity which indeed is depleting the level of ground water:

i) **Excessive Pumping:** We pump the water more quickly than it can renew itself, leading to a dangerous shortage in the ground water supply. In a growing world with a population that continues to rise, the more we pump water from the ground at a rapid rate, the more difficult it is for the ground water to provide us with the amount of water that we need. Water flows freely through the saturated rocks known as aquifers. There are large and small aquifers, and they are the underground water reserves that absorb water and hold it, enabling us to pump it for use.The amount of water that aquifers hold is beyond impressive and can provide us with billions of gallons of water per day. While this amount of water seems plentiful, ground water is a major contributor to the Earth's freshwater supply and is responsible for providing up to 40% of freshwater in the world. Therefore, it does not have the ability to recollect quickly enough to be continually sourced for our use.

Ground water is often likened to a bank account, but perhaps a more apt metaphor is a trust fund you inherit-if you withdraw more money than the interest it earns, you are eating into your principal and will eventually have financial problems.In essence, this is what is happening in California, which pumps more ground water annually than any other state, and in many other parts of the United States and the world. Overpumping ground water can cause water tables to fall, as is happening in California, which means that some wells will no longer reach water. This forces wells to be drilled deeper, which costs more and requires more energy. It can cause land subsidence, because as water is removed from the soil, it collapses and drops. Since ground water that is very deep or below the oceans is saline, overpumping can cause the saltwater to move inland or upwards, resulting in saltwater intrusion, which can contaminate fresh drinking water. And when aquifers are overpumped, they can collapse, forever reducing their capacity to store water. (According to the Centre for Investigative Reporting, California has lost 6 trillion gallons of water capacity because of structural

damage to its aquifers.) Since much of the water in streams and rivers seeps up from ground water, ground water overpumping can also mean less water for lakes and rivers, which can affect vegetation and wildlife.

ii) **Agricultural Activity :** Growing food consumption across the globe and efforts by governments to boost agricultural trade in order to improve incomes of farmers has put increasing pressure on ground water sources. Much of increased food trade is in items such as rice, wheat, maize and sugarcane, all of which rely on irrigation. Higher production has led to greater demand of ground water, since the amount of water required is much greater than the global supply of water from rivers and lakes. Ground water accounts for 43 percent of the water used for irrigation globally. Rising food production has meant that farmers draw ground water deemed as non-renewable because the rate at which it is being extracted outstrips the rate at which the aquifer is recharged and replenished.A new study by researchers from the University College London, International Institute for Applied Systems Analysis, Columbia University's Climate Research Centre and NASA's Goddard Institute of Space Studies has found that the use of non non-renewable ground water has increased exponentially. In 2000, non-renewable ground water accounted for 20 percent of the world's irrigation. In the next ten years, ground water depletion increased by 22 per cent. This quantum jump in use of non-renewable ground water in the first decade of the 21st century was powered by China, which registered a 102 per cent increase in ground water depletion, along with the United States (31 per cent) and India (23 per cent).The continued high rate of depletion of the world's stock of underground freshwater threatens food production, water availability and food security. Water scarcity will impact food production, resulting in scarcities and rising global food prices. The environmental degradation resulting from the depletion of aquifers is significant–the researchers point to land subsidence and sea water intrusion.

Rodell's team mapped global trends in freshwater availability over a 14-year period from 2002 to 2016 based on data obtained from NASA's Gravity Recovery and Climate Experiment (GRACE)–a pair of satellites launched in 2002. Using information on precipitation, irrigation and ground water pumping, the team analysed the reasons for the trends. In addition, they predicted changes in precipitation by 2100 under the IPCC "business as usual" scenario where greenhouse gas emissions continue to rise.

Despite receiving one per cent higher than normal rainfall between 2003 and 2015, northern India experienced severe ground water depletion primarily due to widespread overextraction for irrigation of crops like rice and wheat. The semi-arid northern region boasts the highest irrigated area (54 per cent) among all 34 regions studied

worldwide. While the study projects rainfall to increase by 12 per cent by 2100, Rodell warned. ‘‘it will be too little, too late.’’

iii) **Global Warming:** Ground water plays a key role in sustaining ecosystems. Due to global warming, the threat of climate change is very much on the horizon. The fear is that by 2050, half of the world's population will be destroyed due to hunger, water and disease. Climate change accentuates water stress as it reduces usable ground water availability for agriculture globally.

A growing body of scientific research concludes that the increased temperatures and changing precipitation patterns are altering the timing and availability of water resources in the western United States. With longer and more severe droughts projected for the region, ground water will play an increasingly important role in both preparing for climate change and reducing the global warming emissions that are driving climate change in the first place. For example, snowpack is expected to continue to decrease over the coming decades, reducing surface water supplies in the Western US. In such a situation, ground water becomes particularly critical, providing a buffer during dry years that helps protect water supplies and ensures a reliable food supply

iv) **Deforestation:** Trees contribute in a large way in maintaining the water cycle. They draw up water via their roots, which is then released into the atmosphere. A large part of the water that circulates in the ecosystem of rainforests, for instance, remains inside the plants. When these trees are cut down it results in the climate getting drier in that area. The ground water, tables are affected and soon get depleted. The trees help in prevention of running off of water and help the soil absorb the flowing water. When there are no trees, water just runs off, leaving no chance for the ground water-tables to absorb more water. Thus, ultimately leading to reduction in water resources.

Trees hold the rain water and slowly drop it to the ground, absorbing up to 18 inches of precipitation before gradually releasing it to natural channels and recharging ground water. But the way the forests are being destroyed on the Earth, the problem of ground water depletion is becoming even graver. It is believed that for the last 150 years, the forest equivalent to the area of Greece has been disappearing from the Earth every year. And, the trees which are planted to compensate for this loss are too inadequate in number. It is estimated that 13 million hectares of forest are lost every year across the world.

iv) **Water trapping:** Unbridled tapping of ground water has made the situation even more alarming. Due to the uninterrupted exploitation of ground water

by deep wells and tube wells to meet the shortage of water, the level of ground water is continuously decreasing. In fact, whatever amount of water is recharged into the ground, even more of it is extracted.Extraction only results in further lowering of ground water level. The water-table dips after tubewells and borewells are dug up indiscriminately. As a result, the level of ground water goes down, and small wells, which are not deeply bored, dry up. Major rivers are gradually drying up with excessive tapping of water. Earlier, Yamuna's water reached Delhi all through the year, now due to the digging of deep tube-well near the river in Haryana and Uttar Pradesh, enough water is not able to reach Delhi. After releasing water from Hathinikund barrage, water is completely absorbed in the soil up to 20-25 km, impeding its flow.

v) **Pollution:** Sometimes, when surface water in the area becomes polluted, this can lead to those pollutants evaporating into atmospheric air and water. In turn, polluted air can drift into areas where humans are more present, and polluted rain can fall as acid rain. This damages the environment and can also cause serious health risks for people in the area, too. For example, diesel and gasoline are well-known indirect causes of ground water pollution. In some instances, these fuels, when kept in underground storage, can leak significantly and seep into the ground around them, leading to ground water contamination.

vi) **Chemical and Pesticides :** Road salts and chemicals used on roads, in lawns, and around the home are some of the leading man made causes of ground water pollution. When these products are used on land surfaces or homes, they are easily washed away by natural rainfall. From there, since there's nowhere else for them to go, they seep into the soil and reach the ground water quickly. When humans and animals drink this water, they are basically ingesting these chemicals, which can cause major health problems. Also, when ground water that has been affected by these chemicals that are used in agriculture or industry, it is unable to provide the proper nutrients and hydration required to get the job done. Much like chemicals and other man-made solutions, pesticide is prone to washing into the soil after heavy rainfalls, especially when it is used frequently by farmers and other members of the agricultural industry. The chemicals involved in pesticides are very dangerous for both human and animal consumption, and when they reach ground water, they can almost never be completely removed.

vii) **Natural:** Although animal waste is usually more of a problem for surface water contamination and often stays out of ground water, this is not always the case. In some situations, especially where animal life is very prevalent,

urine and feces left behind by animals seep into the ground and cause some pollution to the ground water there. When this happens, the type of pollution caused by these contaminants is usually easy to remove by water treatment facilities. However, it does make ground water unsafe to drink without treatment.In case of Arsenic it is naturally present in rocks. When ground water passes through or sits in these rocks for too long, it can cause arsenic to build up in the ground water to levels that are capable of poisining animals or people who drink it. This is rare, but it does occur, especially in areas where mining has been present and might have exposed these types of rocks.

viii) **Petroleum based Fuel:** One of the best known classes of ground water contaminants includes petroleum-based fuels such as gasoline and diesel. Nationally, the U.S. Environmental Protection Agency (EPA) has recorded that there have been over 400,000 confirmed releases of petroleum-based fuels from leaking underground storage tanks.

Gasoline consists of a mixture of various hydrocarbons (chemicals made up of carbon and hydrogen atoms) that evaporate easily, dissolve to some extent in water, and often are toxic. Benzene, a common component of gasoline, is considered to cause cancer in humans, whereas other gasoline components, such as toluene, ethylbenzene, and xylene, are not believed to cause cancer in humans but may be toxic in other ways. One interesting property of gasoline is that it is less dense than water, and so it tends to float on top of the water-table.Another common class of ground water contaminants includes chemicals known as chlorinated solvents. One example of a chlorinated solvent is dry-cleaning fluid, also known as perchloroethylene. These chemicals are similar to petroleum hydrocarbons in that they are made up of carbon and hydrogen atoms, but the molecules also have chlorine atoms in their structure.As a general rule, the chlorine present in chlorinated solvents makes this class of compounds more toxic than fuels. Unlike petroleum-based fuels, solvents are usually heavier than water, and thus tend to sink to the bottoms of aquifers. This makes solvent-contaminated aquifers much more difficult to clean up than those contaminated by fuels.

ix) **Septic System:** Across the world, septic systems has been one of the main cause of pollution of underground water. The pollutants outflow from privies, septic tanks and the cesspools. 25% of households in the USA, for instance, heavily depend on the septic systems to dispose of their waste. This huge number of users relying on the system makes it one of the main pollutants. Additionally, improperly designed and leaking septic systems release contaminants such as nitrates, oils, bacteria, chemicals, detergents and viruses

into underground water. Commercial septic tanks pose even a much bigger threat because they release organic chemicals such as trichloroethane. Laws in most countries require the septic tank to be constructed far from the water sources to prevent contamination but at times this is not usually the case.

II.14.6 Effects of Water Pollution and Ground Water Depletion

Every act is in response to a cause and which in turn brings down an effect along with it. The cause and effect relation of Water Pollution and Ground Water Depletion is stated below:

1. **On human health:** In 2015, according to a study published in The Lancet. Contaminated water can also make you ill where every year, unsafe water sickens about 1 billion people. The low-income communities are disproportionately at risk because their homes are often closest to the most polluting industries. Water-borne diseases are infectious diseases spread primarily through contaminated water. Though these diseases are spread either directly or through flies or filth, water is the chief medium for spread of these diseases and hence they are termed as water-borne diseases. Most intestinal (enteric) diseases are infectious and are transmitted through faecal waste. Pathogens–which include virus, bacteria, protozoa, and parasitic worms–are disease-producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfuses directly through persons handling food and water. Since these diseases are highly infectious, extreme care and hygiene should be maintained by people looking after an infected patient. Hepatitis, cholera, dysentery, and typhoid are the more common water-borne diseases that affect large populations in the tropical regions.

A large number of chemicals that either exist naturally in the land or are added due to human activity dissolve in the water, thereby contaminating it and leading to various diseases.For examples, in case of pesticides, the organophosphates and the carbonates present in pesticides affect and damage the nervous system and can cause cancer. Some of the pesticides contain carcinogens that exceed recommended levels. They contain chlorides that cause reproductive and endocrinal damage. Lead is also hazardous to health as it affects the central nervous system. Children and pregnant women are mostly at risk. Fluoride can cause yellowing of the teeth and damage to the spinal cord and other crippling diseases. Drinking water that gets contaminated with nitrates can prove fatal especially to infants that drink formula milk as it restricts the amount of oxygen that reaches the brain causing the 'blue baby' syndrome. It is also linked to digestive tract cancers. It causes algae to bloom resulting in eutrophication

in surface water. Benzene and other petrochemicals can cause cancer even at low exposure levels. Chlorinated solvents are linked to reproduction disorders and to some cancers. Arsenic poisoning through water can cause liver and nervous system damage, vascular diseases and also skin cancer. Untreated sewage, industrial effluents, and agricultural waste are often discharged into the water bodies such as the lakes, coastal areas and rivers endangering their use for recreational purposes such as swimming and canoeing.

So exposure to polluted water can cause diarrhoea, skin irritation, respiratory problems, and other diseases, depending on the pollutant that is in the water body. Stagnant water and other untreated water provide a habitat for the mosquito and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions. Among these, malaria is undoubtedly the most widely distributed and causes most damage to human health.

In case of ground water, dangerous illnesses like hepatitis and cholera are often linked to ground water pollution and poor water sanitation. Often this type of contamination goes unnoticed for long periods of time while it silently affects large communities. Often people only notice the effects of contaminated ground water when birth defects begin to be reported. One example of a serious condition caused by ground water pollution is the nitrate induced illness called Methemoglobinemia or "Blue Baby Syndrome". Pollution from Benzene has been known to cause cancer as well. Ground water pollution also has economic effects.The serious health effects of lead are well-known learning disabilities in children; nerve, kidney, and liver problems; and pregnancy risks. Concentrations in drinking water of these and other substances are regulated by federal and state laws. Poor water quality can harm any industry linked to its use. Fishermen, for example, suffer when their catch is affected by ground water pollution.Methemoglobinemia or ‘blue baby syndrome,’ an illness affecting infants, can be caused by drinking water that is high in nitrates. Benzene, a component of gasoline, is a known human carcinogen. Hundreds of other chemicals, however, are not yet regulated, and many of their health effects are unknown or not well understood. For example, One of the best known classes of ground water contaminants includes petroleum-based fuels such as gasoline and diesel.

2. **On the Ecosystem:** In order to thrive, healthy ecosystems rely on a complex web of animals, plants, bacteria, and fungi–all of which interact, directly or indirectly, with each other. The harm to any of these organisms can create a chain effect, imperiling entire aquatic environments.When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water killing fish species. This dearth of oxygen, known as eutrophication, suffocates plants

and animals and can create ‘dead zones,’ where waters are essentially devoid of life. In certain cases, these harmful algal blooms can also produce neurotoxins that affect wildlife, from whales to sea turtles.

Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life–most often reducing an organism's life span and ability to reproduce–and make their way up the food chain as predator eats prey. That's how tuna and other big fish accumulate high quantities of toxins, such as mercury. Polluted water reduces Dissolved Oxygen (DO) content, thereby, eliminates sensitive organisms like plankton, molluscs and fish etc.However a few tolerant species like Tubifex (annelid worm) and some insect larvae may survive in highly polluted water with low DO content. Such species are recognised as indicator species for polluted water.Biocides, polychlorinated biphenyls (PCBs) and heavy metals directly eliminate sensitive aquatic organisms.Hot waters discharged from industries, when added to water bodies, lowers its DO content.Oil pollution in seas and oceans can have large scale ramifications on the environment. Oil spills from tankers and discharge of oil from drains are killing thousands of aquatic animals and birds every year. The Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals. Much of this solid debris, such as plastic bags and soda cans, gets swept into sewers and storm drains and eventually out to sea, turning our oceans into trash soup and sometimes consolidating to form floating garbage patches. Discarded fishing gear and other types of debris are responsible for harming more than 200 different species of marine life. Meanwhile, ocean acidification is making it tougher for shellfish and coral to survive. Though they absorb about a quarter of the carbon pollution created each year by burning fossil fuels, oceans are becoming more acidic. This process makes it harder for shellfish and other species to build shells and may impact the nervous systems of sharks, clownfish, and other marine life. Suspended water contaminants reduce sunlight penetration in lakes which prevent the growth of aquatic plants and consequently affect the rest of the community which depend on these plants to survive. For example in Minamata, Japan, inorganic mercury was used in the industrial production of acetaldehyde. It was discharged into the nearby bay as waste water and was ingested by organisms in the bottom sediments. Fish and other creatures in the sea were soon contaminated and eventually residents of this area who consumed the fish suffered from MeHg (methyl mercury) intoxication, later known as the Minamata disease. The disease was first detected in 1956 but the mercury emissions continued until 1968. But even after the emission of mercury stopped, the bottom sediment of the polluted water contained high levels of this mercury.

In case of ground water the effects are: Firstly, it leads to Nutrient Pollution, which

can cause certain types of nutrients that are necessary in small amounts, to become far too abundant to sustain normal life in a given ecosystem. Fish might start dying off quickly because they are no longer able to process the water in their water supplies, and other animals might become sick from too much of certain types of nutrients in the water they drink. Plants might not be able to absorb water as easily, and the entire ecosystem will suffer. Secondly, it led to toxic water in ecosystem where, ground water that supplies lakes, rivers, streams, ponds, and swamps becomes contaminated, which slowly leads to more and more contamination of the surface water as well. When this happens, fish, birds, animals and plants that live in the area become sick and die off quickly. This is a huge factor in the destruction of the wetlands, which rely heavily on ground water to recharge their lakes and ponds after drought periods. In turn, people who use this land for hunting, fishing, and even for their own sources of clean water are affected by this type of pollution. Thirdly, it effects the water supply system where the consequences of contaminated ground water or degraded surface water are often serious. For example, estuaries that have been impacted by high nitrogen from ground water sources, have lost critical shellfish habitats. In terms of water supply, in some instances, ground water contamination is so severe that the water supply must be abandoned as a source of drinking water. In other cases, the ground water can be cleaned up and used again, if the contamination is not too severe and if the municipality is willing to spend a good deal of money. Follow-up water quality monitoring is often required for many years. Because ground water generally moves slowly, contamination often remains undetected for long periods of time. This makes clean up of a contaminated water supply difficult, if not impossible. If a clean up is undertaken, it can cost thousands to millions of dollars.

3. **On the Economy:** The financial implication of Water Pollution: Water pollution can cost a lot more to purify drinking water that takes its source from nutrient-polluted water bodies. Fishing stock is affected negatively when there is a depletion of oxygen. Consumers are also wary of fish from these sources and tend to stay away from them, costing fisheries to lose revenue. In places where there are water activities or sports, lots of money is spent to clean up the water from algal blooms and the like. The U.S. tourism industry loses close to $1 billion each year, mostly from losses in fishing and recreational activities because of nutrient-polluted water bodies. In Mississippi alone, tourism in the three counties that border the Gulf Coast accounts for about $1.6 billion in visitor expenditures, 32 per cent of state travel and tourism tax revenues, and 24,000 direct jobs.

In case of ground water, when it becomes more contaminated in a given area, that area becomes less capable of sustaining human, animal, and plant life. If the area is known for its natural beauty and nature begins to suffer the effects of pollution, the

chances of people wanting to live there decrease even more. Although it might not be an immediate result of ground water pollution, the depreciation of land value is definitely a potential side effect. Many industries rely on ground water to help produce their products and keep their factories running smoothly. Since the pH and quality of ground water from a given area rarely changes, it becomes a vital part of many industries that rely on water they do not have to constantly test. However, when ground water becomes polluted, this convenience is stripped away, and the industries are less capable of stable production. This, in turn, can affect the economy of any given area as industries are forced to move. Contamination of ground water sources renders the area incapable of sustaining plant, human, and animal life. The population in the area is reduce and the land value depreciates. Another effect is that it leads to less stability in industries relying on ground water to produce their goods. Therefore, the industries in affected areas will have to outsource for water from other regions which may turn out to be expensive. In addition, they may be forced to close down due to the poor quality of water.

II.14.7 Measures to Combat Water Pollution and Ground Water Depletion

The measures that can be framed up for working towards the improvement for reduction of Water Pollution and Ground Water Depletion are as follows:-

1. In 1972, the US Congress responded to public outrage over the deplorable condition of the nation's waters by enacting the Clean Water Act. Discharges of untreated wastewater from municipalities, industries, and commercial businesses caused widespread pollution of rivers, lakes, and coastal waters. Congress rejected these conditions and made a new commitment in the Clean Water Act to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The basic approach in the Clean Water Act (CWA) over the past 25 years has been greater control of ‘point sources’ of water pollution–primarily factories and city sewers, along with controls on activities that destroy wetlands. One of such programme is Watershed management that fosters the co-ordinated implementation of programms to control point source discharges, reduce polluted runoff, and protect drinking water and sensitive natural resources such as wetlands. A watershed approach highlights opportunities to go beyond reducing chemical contamination to think about ways to enhance the overall health of the aquatic system and preserve biodiversity. Watershed management also fosters greater interest and involvement of the public and provides a foundation for partnerships among government, the public, and the private sector. Another notable act is National Pollutant Discharge Elimination System (NPDES) Permit Program is

now being focussed on storm water management including control of combined sewer and sanitary sewer overflows. Under the Clean Water Action Plan, the storm water programme promotes the use of best management practices, such as eliminating illicit connections in municipalities to minimise flow of untreated sewage and other contaminants to the nations waterways. This programme also controls runoff from developed areas and from new construction to ensure reduction in flow and movement of sediment, so as to reduce stream bank erosion, stream channelling and massive modifications of stream habitat. In addition to this, the Office of Wastewater Management (OWM) along with the Department of Agriculture is developing and administering a unified strategy to ensure that animal feeding operation (AFO) wastes are managed to minimise environmental and public health effects.

2. Water treatment plant is another method of controlling water pollution. The water pollution treatment in industry-dense areas will enhance pollution treatment in industrial clusters such as economic and technological development zones, high-tech development zones and export processing zones. The wastewater in the industrial clusters must be pre-treated before it is transferred to the central treatment facility. Wastewater and garbage treatment facilities should be planned in the construction and upgrading of industrial clusters. It has been done in Beijing-Tianjin-Hebei region, the Pearl River Delta and the Yangtze River Delta. Along with this the strengthening of municipal wastewater treatment will accelerate development and upgrading of urban wastewater treatment and the facilities according to local conditions.The handling of industrial wastes is more specialised than the treatment of domestic wastes; however, where amenable to biological reduction, they are usually treated using methods similar to those previously described (secondary/tertiary biological treatment approaches) for municipal systems. Waste stabilisation ponds are a common method of organic wastewater treatment where sufficient land area is available. Flow-through ponds are generally classified according to their bacterial activity as aerobic, facultative or anaerobic. Aerated ponds are supplied with oxygen by diffused or mechanical aeration systems. When industrial waste in-plant operations and processes are analysed at their source, they often can be controlled so as to prevent significant polluting discharges. Recirculation techniques are important approaches in pollution prevention programmes. A case study example is a recycling plan for a leather tannery wastewater effluent, published by Preul (1981), which included chrome recovery/reuse along with the complete recirculation of all tannery wastewaters with no effluent to any stream except in emergencies.

For example, the Action Plan for Water Pollution Prevention (Published by The State Council of the People's Republic of China on 2 April 2015), undertaken by the EU–China Environmental Governance Programme it is stated that under the National

New Urbanisation Plan, by 2020, all counties and key towns should have wastewater collection and treatment capacity; the wastewater treatment ratio in counties and cities will reach 85% and 95% respectively.The strengthening the construction of sewage supporting pipe networks. We will enhance wastewater closure and collection in urban villages, old towns and urban fringe areas. The existing combined drainage system should be transformed into separate drainage systems; if they are difficult to transform, the actions such as closure, storage and treatment should be taken. The supporting pipelines should be designed, constructed and put into operation simultaneously with the wastewater treatment facilities. New towns, except those in deserts, should adopt the separate drainage method. Areas with proper conditions should promote preliminary rainwater collection, treatment and resource utilisation. By 2017, municipalities, provincial capitals and municipalities with independent planning status should be able to collect and treat all wastewater; other build-up areas of prefecture-level cities should be able to do so by 2020.

3. **Sewage Treatment and Water Treatment:** Sewage treatment is the process of removing contaminants from municipal wastewater, containing mainly household sewage plus some industrial wastewater. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment. A by-product of sewage treatment is a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land. Sewage treatment may also be referred to as wastewater treatment. It mainly involves three stages. Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment. Some sewage treatment plants that are connected to a combined sewer system have a bypass arrangement after the primary treatment unit. This means that during very heavy rainfall events, the secondary and tertiary treatment systems can be bypassed to protect them from hydraulic overloading, and the mixture of sewage and stormwater only receives primary treatment. Secondary treatment removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.Tertiary treatment is sometimes defined as anything more than primary and secondary treatment in order to allow ejection into a highly sensitive or fragile ecosystem (estuaries, low-flow rivers, coral reefs,...). Treated water is sometimes disinfected chemically or physically (for example, by lagoons and microfiltration)

prior to discharge into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, green way or park. If it is sufficiently clean, it can also be used for ground water recharge or agricultural purposes. Every adult human excretes between 200 and 1,000 grams (7.1 and 35.3 oz) of phosphorus annually. Studies of United States sewage in the late 1960s estimated mean per capita contributions of 500 grams (18 oz) in urine and faeces, 1,000 grams (35 oz) in synthetic detergents, and lesser variable amounts used as corrosion and scale control chemicals in water supplies.Source control via alternative detergent formulations has subsequently reduced the largest contribution, but the content of urine and faeces will remain unchanged. Phosphorus removal is important as it is a limiting nutrient for algae growth in many fresh water systems. Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. In this process, specific bacteria, called polyphosphate-accumulating organisms (PAOs), are selectively enriched and accumulate large quantities of phosphorus within their cells (up to 20 per cent of their mass). When the biomass enriched in these bacteria is separated from the treated water, these biosolids have a high fertiliser value. The purpose of disinfection in the treatment of waste water is to substantially reduce the number of micro-organisms in the water to be discharged back into the environment for the later use of drinking, bathing, irrigation, etc. The effectiveness of disinfection depends on the quality of the water being treated (e.g., cloudiness, pH, etc.), the type of disinfectant on being used, the disinfectant dosage (concentration and time), and other environmental variables. Another method is Septic tanks treat sewage at the place where it is located, rather than transporting the waste through a treatment plant or sewage system. Septic tanks are usually used to collectt sewage from an individual building. Here the untreated sewage from a property flows into the septic tank and the solids are separated from the liquid.Solid material is separated depending on their density. Heavier particles settle at the bottom of the tank whereas lighter particles, such as soap scum, will form a layer at the top of the tank.Biological processes are used to help degrade the solid materials. The liquid then flows out of the tank into a land drainage system and the remaining solids are filtered out.

4. **Industrial Waste Water treatment:** Industrial wastewater treatment describes the processes used for treating wastewater that is produced by industries as an undesirable by-product. After treatment, the treated industrial wastewater (or effluent) may be reused or released to a sanitary sewer or to a surface water in the environment. The treatments are first brine treatment, which involves removing dissolved salt ions from the waste stream. In brine treatment the systems are typically optimised to either reduce the volume of the final discharge for more economical disposal (as disposal costs are often based on volume) or to maximise the recovery of fresh water or salts.

Brine treatment systems may also be optimised to reduce electricity consumption, chemical usage, or physical footprint. Secondly, Solid Removal where most solids can be removed using simple sedimentation techniques with the solids recovered as slurry or sludge. Very fine solids and solids with densities close to the density of water pose special problems. In such case filtration or ultrafiltration may be required. Although, flocculation may be used, using alum salts or the addition of polyelectrolytes. Wastewater from industrial food processing often requires on-site treatment before it can be discharged to prevent or reduce sewer surcharge fees. The type of industry and specific operational practices determine what types of wastewater is generated and what type of treatment is required. Reducing solids such as waste product, organic materials, and sand is often a goal of industrial wastewater treatment. Thirdly, Oil and Grease Removal is done by skimming devices. Considered a dependable and cheap way to remove oil, grease and other hydrocarbons from water, oil skimmers can sometimes achieve the desired level of water purity. At other times, skimming is also a cost-efficient method to remove most of the oil before using membrane filters and chemical processes. Skimmers will prevent filters from blinding prematurely and keep chemical costs down because there is less oil to process. Fourthly, Activated Sludge process, is a biochemical process for treating sewage and industrial wastewater that uses air (or oxygen) and micro-organisms to biologically oxidise organic pollutants, producing a waste sludge (or floc) containing the oxidised material. Toxic materials including many organic materials, metals (such as zinc, silver, cadmium, thallium, etc.) acids, alkalis, non-metallic elements (such as arsenic or selenium) are generally resistant to biological processes unless very dilute. Metals can often be precipitated out by changing the pH or by treatment with other chemicals. Many, however, are resistant to treatment or mitigation and may require concentration followed by landfilling or recycling. Dissolved organics can be incinerated within the wastewater by the advanced oxidation process.

5. Ozone wastewater treatment is a method that is increasing in popularity. An ozone generator is used to break down pollutants in the water source.The generators convert oxygen into ozone by using ultraviolet radiation or by an electric discharge field.Ozone is a very reactive gas that can oxidise bacteria, moulds, organic material and other pollutants found in water. Using ozone to treat wastewater has many benefits :

- Kills bacteria effectively.
- Oxidises substances such as iron and sulphur so that they can be filtered out of the solution.
- There are no nasty odours or residues produced from the treatment.
- Ozone converts back into oxygen quickly, and leaves no trace once it has

been used.

6. **Protecting water resources:** This, done in a scientific manner, will optimise the assessment system of water resource protection, enhance supervision and management of water functional areas and evaluate the pollutant carrying capacity of waters. Enhancing water dispatching management of rivers and lakes. The improved dispatching management plans take measures such as joint dispatching of gates and dams and ecological water compensation, reasonably arrange released water quantity and drainage periods, meet the basic ecological water demand of rivers and lakes and pay special attention to ensuring the basic ecological flow during dry seasons. This work also lies on our part where basic activities in our daily life can sustain the aim of combating Water pollution. The activities like:-

- We should treat the poisonous substances and discharge materials and toxic substances coming out of the homes and factories before discharging them into the rivers and ponds.
- We should not mix petroleum substances in the water.
- There are some algae and water plants available which are helpful in keeping the water clean, they should be grown all over in the water.
- Garbage in the cities and towns should be classified and thrown into the designated dustbins only. The biodegradable garbage can be used as compost in the fields and thus these can help in the production of the crops.
- Dead bodies should not be thrown in the river.
- All cities and towns must have sewer facilities.
- Water should neither be abused nor be wasted.
- We should not put excreta and sewage flowing from cities and towns into water, but dump them in garbage pits outside the city so that they turn into compost later on and which can be used in the fields.
- We should not encourage the use of materials such as plastic as it does not destroy biologically.
- We should initiate scientific experiments that can convert pollutants into useful items. For example, Roorkee-based Central Building Research Institute has successfully tried to transform the ash from the thermal power stations into bricks.
- In homes, water should be made germ-free by chlorine tablets, iodine, etc. Nowadays, there is a variety of good quality filters available in the market that should be used.
- Effective steps should be taken to outlaw dumping of wastes into a river or

other water sources.

- The oxidation of organic materials should be done prior to their disposal.
- To destroy bacteria in the water, chemical substances such as bleaching powder, etc should be used.
- We should not tamper with public water distribution.
- Immersion of idols during religious ceremonies to be done at the appointed place only.
- Do not waste even a single drop of water.
- At the international level, there should be ban on nuclear tests in the ocean.
- Awareness should be created in society about the risk of water pollution.
- Pollutants can be converted into non-toxic substances by treatment.
- The presence of radioactive wastes in the water can be removed by oxidation of ponds.
- One must avoid the large ponds as sunlight combined with organic nutrients may lead to the larger growth of bacteria which break the waste matter.
- The reclaimed polluted water can be used in making fertilisers as it is rich in phosphorous, potassium and nitrogen. It can also be used for the irrigation and factory purposes.
- We should set more and more sewage treatment plants that play a crucial role in the reclaimed polluted water.
- Laws must be enforced to ensure that the industries do treatment of wastes before the water is discharged into the rivers and seas.
- We can plant water hyacinth which is also referred as kaloli to treat the polluted water. It deals with the biological and chemical waste. The heavy metals are also removed by it.
- Natural fertilisers such as peat, compost, manure should be preferred while gardening and farming. Indigenous plants–that are native to your location–help in reducing water use and are economical as well.
- Erosion from construction sites can be maintained by mulching. It is a process of layering the surface of soil with a permanent or temporary material to improve soil quality. Sediment can be controlled by installing sediment basins that capture washed off soil and consequently prevent pollution of nearby water resources.
- Stormwater runoff is created when water from rainfall and snow flow over ground and are not absorbed. As the stormwater runoff flows over impervious

surfaces, it collects debris, sediments, chemicals and other pollutants which can have negative effects on the quality of water if the runoff is left untreated. Stormwater runoff can be controlled by applying management practices such as washing automobiles at car wash instead of streets, removing impervious surfaces such as cement around homes etc.

7. **Ground water Managment:** The analysis of ground water contamination travel is a specialised field often requiring the use of computer models to better understand the ground water dynamics and to make predictions under various constraints. The preferred approach for the protection of ground water resources is pollution prevention. Although drinking water standards generally apply to the use of ground water supplies, the raw water supplies require protection from contamination. Pollution prevention requires land-use controls in the form of zoning and certain regulations. Laws may apply to the prevention of specific functions as particularly applicable to point sources or actions which potentially may cause pollution. Control by land-use zoning is a ground water protection tool which is most effective at the municipal or county level of government. Aquifer and wellhead protection programmes as discussed below are leading examples of pollution prevention.

An aquifer protection programme requires establishing the boundaries of the aquifer and its recharge areas. Aquifers may be of an unconfined or confined type, and therefore need to be analysed by a hydrologist to make this determination. Most major aquifers are generally well known in developed countries, but other areas may require field investigations and hydrogeologic analysis. The key element of the programme in the protection of the aquifer from water quality degradation is control of land use over the aquifer and its recharge areas. The collection of storm water runoff is an underutilided, but highly effective method of offsetting ground water depletion. Water can be stored and dispersed as needed for irrigation by diverting storm water runoff into cisterns. Both phases of our project are a direct application of this solution. Not only will utilising stored rainwater for irrigation offset the use of municipal ground water, it will also increase the amount of water reintroduced into the ground water supply instead of the rainwater becoming runoff. The city of Madison alone uses 1.19 million gallons of water per day for irrigation purposes during the watering season, so rainwater catchment systems have the potential to make a huge positive impact on the future availability of clean water as well as the health of aquatic ecosystems in the Madison area.

Rain Water harvesting has been set forth as a mechanism to replenish the Ground Water. Rainwater forms a crucial source of freshwater, particularly in areas with saline ground water. Here, rainwater is the only local source of potable water but its availability

is limited. Thus, while assessing the available technologies to create a localised source of potable water in these conditions, roof water harvesting was prioritised over others. Conventionally, harvested rainwater is either stored in tanks or recharged into the aquifer. In case of storing rainwater for direct use, the capacity of storage tanks can be a limitation. The rain water percolated can be used for recharging the ground water. Usually, in this case, recharging is done at a depth under the ground, leaving safe distance above the ground water table to avoid chances of contamination of ground water. The recharged water percolates into the ground and being of lighter density, it starts collecting over the existing denser saline ground water. But this recharged fresh water does not remain in a consolidated mass and spreads out over time. Eventually, in order to maintain hydraulic equilibrium, the recharged freshwater forms a thin layer over the existing saline ground water Exploiting this thin layer of fresh ground water separately is practically difficult as it mixes with the existing saline ground water in the process. In order to exploit the harvested rainwater separately, it should form a sizeable pool or pocket instead of a thin layer spread over a larger area. There are certain methods that are being structured up for recharding Ground Water. Some of them are

1. **Recharge Shaft:** This is the most efficient and cost effective technique to recharge unconfined aquifer overlain by poorly permeable strata. It is seen that in rainy season village tanks are fully filled up but water from these tanks does not percolate down due to siltation and tubewell and dugwells located nearby remains dried up. The water from village tanks get evaporated and is not available for the beneficial use.By constructing recharge shaft in tanks, surplus water can be recharged to ground water.Through this technique all the accumulated water in village tank above 50% full supply level would be recharged to ground water. Sufficient water will continue to remain in tank for domestic use after recharge.

2. **Recharge Pit:** In alluvial areas where permeable rocks are exposed on the land surface or are located at very shallow depth, rain water harvesting can be done through recharge pits.The technique is suitable for buildings having a roof area of 100 sq.m. These are constructed for recharging the shallow aquifers. In case of dug well, existing dug wells may be utilised as recharge structure and water should pass through filter media before putting into dug well. In addition to that the existing hand pumps may be used for recharging the shallow/deep aquifers, if the availability of water is limited. Water should pass through filter media before diverting it into hand pumps.

3. **Trench with Recharge Well :** In areas where the surface soil is impervious and large quantities of roof water or surface runoff is available within a very short period of heavy rainfall, the use of trench/ pits is made to store the water in a filter media

and subsequently recharge to ground water through specially constructed recharge wells.This technique is ideally suited for area where permeable horizon is within 3m below ground level. For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m. wide & 10 to 30 m. long depending upon availability of water with one or two bore wells are constructed. The lateral shafts is back filled with boulders, gravels & coarse sand.

4. Ground water quality monitoring programs have been implemented regularly in many countries around the world. They are important components to understand the hydrogeological system, and for the development of conceptual models and aquifer vulnerability maps. Ground water quality must be regularly monitored across the aquifer to determine trends. Effective ground water monitoring should be driven by a specific objective, for example, a specific contaminant of concern.[3] Contaminant levels can be compared to the World Health Organization (WHO) guidelines for drinking-water quality.[55] It is not rare that limits of contaminants are reduced as more medical experience is gained.

On the part of individuals certain activities are necessitated to conserve the ground water. The activities are :

1. As individuals, one of the things we can do to make a difference is to use less water for luxury purposes. We must all address the issue of ground water depletion. Considering the impending crisis of a mass water shortage, everyone should do his/her part to use less water whenever possible. Water is used so freely that it is often part of outdoor decor ideas and used for major attractions, such as amusement parks. Throughout countless neighbourhoods, large amounts of water is used for swimming pools while water hoses are kept running to wash cars and for other miscellaneous reasons. We conserve water when we turn off the faucet and reduce our usage of washing machines, dishwashers and similar appliances. Also, we save a massive amount of water by deciding not to use water for decorative and unnecessary reasons at home.
2. We should reduce our use of chemicals and dispose them properly. Many people are not paying attention and are simply unaware of how important it is to prevent pollution from occurring beneath the ground. The water from businesses and private residences that run into the streets and sewage systems are commonly laden with chemicals. These chemicals find their way into larger bodies of water and absorb into the ground, poisoning animals and the soil. By using less chemicals and discarding them carefully, we restrict them from adding toxic materials into our water supply.
3. One of the most effective ways to address the issue of ground water depletion

is to find alternative sources of water. Alternative water sources can be used to help replenish aquifers. Deriving water from other sources would also give aquifers time to refill instead of pumping too much water from them at once.

4. Change in crop-patterns: Ground water can be preserved by the determination of crop cycle. Low-water-consuming crops should be grown in not so water-rich areas and where there is high intake of water, high-water-consuming crops should be cultivated. Crop should be allowed to grow as per the availability of water in the given area.
5. The pumping of ground water should be regulated. If we don't have a better understanding of our ground water supply, then we can easily use much more than we should. Understandably, more funding should be granted towards researching our ground water supply instead of just pumping the water, so that we can set limits and better pace our usage.

II.14.8 Case study on Water Pollution and Ground Water Depletion

In case of Water Pollution we will highlight a short case study of Ganga Water-the Holy River of India citing out the sections on water pollution, its reasons, and the action plan and programme that were undertaken to combat it.

Ganga Water: The Ganga rises from the Gangotri glacier located on the southern slopes of the Himalayan ranges, at 4,000 m above the mean sea level. It flows swiftly for 250 km in the mountains, descending steeply to an elevation of 288 m above mean sea level. In the Himalayan region the Bhagirathi is joined by the tributaries Alaknanda and Mandakini to form the Ganga. After entering the plains at Haridwar, it winds its way to the Bay of Bengal, covering 2,500 km through the provinces of Uttar Pradesh, Bihar and West Bengal. In the plains it is joined by Ramganga, Yamuna, Sai, Gomti, Ghaghara, Sone, Gandak, Kosi and Damodar along with many other smaller rivers. The purity of the water depends on the velocity and the dilution capacity of the river. A large part of the flow of the Ganga is abstracted for irrigation just as it enters the plains at Haridwar. From there it flows as a trickle for a few hundred kilometres until Allahabad, from where it is recharged by its tributaries. The Ganga receives over 60 per cent of its discharge from its tributaries. The Gangetic Plains formed by Ganges River is one of the most fertile lands on the earth and almost 10% of world population lives here and earn their livelihood and generates nearly 40% of GDP of India.

Throughout its length, the river flows through some of the biggest cities of India and these cities contribute heavily to the pollution of the Ganges River. As per World Bank Sponsored Study (State of Environment Report), high pollution level in the Ganges Water contributes 9-12% of total disease in Uttar Pradesh (U.P.). Also, Ganges

River was ranked among the five most polluted rivers of the world in the year 2007. The cities located on its bank include Kanpur, Varanasi, Allahabad, Patna, Rishikesh, Haridwar, Farrukhabad, Kannauj and Kolkata. All these cities are directly or indirectly dependent on the river for their daily needs and in return, they dump their everyday wastes into the Ganges River without any treatment. A large proportion of solid and liquid wastes from domestic usage (bathing, laundry, and public defecation), sewage wastes, unburnt dead bodies are dumped into the Ganges River. Another important thing to note here is that 80% of pollution in the Ganges River is caused by the sewage. At several places (especially in Uttar Pradesh) water is pumped out from the river for irrigation. In addition to this degradation of the river is visible due to the encroachment of river bed, sand mining, active netting of fish and open defecation. 6 million tons of fertilisers and 9,000 tonnes of pesticides are used in agriculture within the basin. Thousands of animal carcasses and human corpses are being released into the river every day. In many places, solid wastes is dumped which includes flowers and materials used for religious purposes. The excessive amounts of human waste and toxic effluents that find their way into the Ganga river are not only polluting the water but also causing deficit of dissolved oxygen in the riverbeds in some of the most polluted stretches of the river, a new study has found. Dissolved oxygen is an important parameter that determines health and rejuvenation capacity of any riverine ecosystem. The amount of dissolved oxygen in a river depends on atmospheric supply of oxygen, photosynthetic process, and oxygen-consuming metabolic and chemical processes. If dissolved oxygen falls below the threshold of 2 milligram per litre, it can lead to mass killing of fish and harm other aquatic life.

The Central Pollution Control Board (CPCB), which is India's national body for monitoring environmental pollution, undertook a comprehensive scientific survey in 1981-82 in order to classify river waters according to their designated best uses. This report was the first systematic document that formed the basis of the Ganga Action Plan (GAP). It detailed land-use patterns, domestic and industrial pollution loads, fertiliser and pesticide use, hydrological aspects and river classifications. This inventory of pollution was used by the Department of Environment in 1984 when formulating a policy document. In 1985, M.C. Mehta filed a writ petition in the nature of mandamus to prevent these leather tanneries from disposing of domestic and industrial waste and effluents in the Ganga river. This writ petition was bifurcated by the Supreme Court into two parts known as Mehta I and Mehta II. In Mehta I [M.C. Mehta v. Union of India, [1987] 4 SCC 463]–filed a writ petition in the Supreme Court charging that, despite the strides made in the legal code, government authorities had not taken effective steps to prevent environmental pollution. Mehta issued a writ of mandamus to restrain leather tanneries of the Jajmau district of Kanpur to stop discharging their

untreated effluent into the river. In the final judgement the Court stated that despite the above-stated provisions in the Water (Prevention and Control of Pollution) Act, as per the 1974 Act no effective steps were taken by the State Board to prevent the discharge of effluents into the river Ganga. Also, despite the provisions in the Environment Protection Act, no effective steps were taken by the Central Government to prevent the public nuisance caused by the tanneries at Kanpur. The Court ordered the tanneries to establish primary treatment plants, if not secondary treatment plants. That is the minimum which the tanneries should do in the circumstances of the case. The Court further held that the financial capacity of the tanneries should be considered as irrelevant while requiring them to establish primary treatment plants. Just like an industry which cannot pay minimum wages to its workers, cannot be allowed to exist, a tannery which cannot set up a primary treatment plant cannot be permitted to continue to be in existence becasue the adverse effect on the public at large which is likely to ensue by the discharging of the trade effluents from the tannery to the river Ganga would be immense and it would outweigh any inconvenience that might be caused to the management and the labour employed by it on account of its closure. The Mehta II (M.C. Mehta v. Union of India decided on 12th January, 1988): This petition was taken up by the Court against the municipal body, the Kanpur Nagar Mahapalika in this case. The Supreme Court noted that the Kanpur Nagar Mahapalika was established under the Uttar Pradesh Nagar Mahapalika Adhiniyam, 1959.The duties and powers of the Mahapalika and Mahapalika authorities are set out in Chapter V of the Adhiniyam. Clauses (iii) (vii) and (viii) of Section 114 of the Adhiniyam, incorporate the obligatory duties of the Mahapalika.

Section 114 of the Adhiniyam states, "It shall be incumbent on the Mahapalika to make reasonable an adequate provision, by any means (sic) which it is lawfully competent to it to use or to take, for each of the following matters, namely :

(iii) the collection and removal of sewage, offensive matter and rubbish and treatment and disposal thereof including establishing and maintaining farm or factory.

(vii) the management and maintenance of all Mahapalika waterworks and the construction or acquisition of new works necessary for a sufficient supply of water for public and private purposes.

(viii) guarding from pollution water used for human consumption and preventing polluted water from being so used."

In the final judgement the Court directed the Kanpur Nagar Mahapalika to take appropriate action under the provisions of the Adhiniyam for the prevention of water pollution in the river. It was noted that a large number of dairies in Kanpur were also polluting the water of the river by disposing waste in it. The Supreme Court ordered

the Kanpur Nagar Mahapalika to direct the dairies to either shift to any other place outside the city or dispose wastes outside the city area. Kanpur Nagar Mahapalika was ordered to increase the size of sewers in the labour colonies and increase the number of public latrines and urinals for the use of poor people. Whenever applications for licences to establish new industries are made in future, such applications shall be refused unless adequate provision has been made for the treatment of trade effluents flowing out of the factories.

In addition to this, the Supreme Court further relied on Article 52A (g) of the Constitution of India, which imposes a fundamental duty of protecting and improving the natural environment. The Court ordered that–

1) It is the duty of the Central Government to direct all the educational institutions through out India to teach at least for one hour in a week lessons relating to the protection and the improvement of the natural environment including forests, lakes, rivers and wildlife in the first ten classes.

2) The Central Government shall get text books written for the said purpose and distribute them to the educational institutions free of cost. Children should be taught about the need for maintaining cleanliness commencing with the cleanliness of the house both inside and outside, and of the streets in which they live. Clean surroundings lead to healthy body and healthy mind. Training of teachers who teach this subject, by the introduction of short term courses for such training, shall also be considered. This should be done through out India.

Following this legal action the Ganga action plan was launched by Shri Rajeev Gandhi, the then Prime Minister of India on 14 Jan. 1986 with the main objective of pollution abatement, to improve the water quality by interception, diversion and treatment of domestic sewage and present toxic and industrial chemical wastes from identified, grossly polluting units entering into the river. The other objectives of the Ganga Action Plan are as under :

- Control of non-point pollution from agricultural run off, human defecation, cattle wallowing and throwing of unburnt and half burnt bodies into the river.
- Research and Development to conserve the biotic, diversity of the river to augment its productivity.
- New technology of sewage treatment like Up-flow Anaerobic Sludge Blanket (UASB) and sewage treatment through afforestation has been successfully developed.
- Rehabilitation of soft-shelled turtles for pollution abatement of river have been demonstrated and found useful.

- Resource recovery options like production of methane for energy generation and use of aquaculture for revenue generation have been demonstrated.
- To act as trend setter for taking up similar action plans in other grossly polluted stretches of other rivers.

The ultimate objective of the GAP is to have an approach of integrated river basin management considering the various dynamic interactions between abiotic and biotic ecosystem.Notwithstanding some delay in the completion of the first phase of GAP it has generated considerable interest and set the scene for evolving a national approach towards replicating this programme for the other polluted rivers of the country. The Government of India proposed to extend this model with suitable modifications to the national level through a National River Action Plan (NRAP). The NRAP mainly draws upon the lessons learnt and the experience gained from the GAP besides seeking the views of the State Governments and the other concerned Departments/ Agencies.The choice of technology for the GAP was largely conventional, based on available options and local considerations. Consequently, the sewers and pumping stations and all similar municipal and conservancy works were executed in each province by its own implementing agencies, according to their customary practices but within the commonly prescribed specifications, fiscal controls and time frames. The choice of technology for most of the large domestic wastewater treatment plants was carefully decided by a panel of experts, in close consultation with those external aid agencies which were supporting that particular project. A parallel procedure was adopted in-house for all other similar projects. For all the larger sewage treatment plants the unanimous choice was to adopt the well-accepted activated sludge process. For other plants trickling filters were considered more appropriate. In smaller towns where land was available and the quantity of wastewater was small, other options such as oxidation ponds were chosen. However, unconventional technologies like the rope bound rotating biological contactors (RBRC), sewage irrigated afforestation, upflow anaerobic sludge blanket (UASB) technology and plants for chromium recovery from tannery waste-water were tried out with a fair degree of success. Some of these new and simpler technologies, with their low-cost advantages, will emerge as the large-scale future solution to India's sanitation problems. It had conducted river basin studies and had identified 19 grossly polluted stretches and 14 less polluted stretches along 19 rivers, which include 11 stretches situated along 7 rivers of M.P. Right from its inception in 1986, the GAP started a very comprehensive water quality monitoring programme by obtaining data from 27 monitoring stations. Most of these river water quality monitoring stations already existed under other programmes and only required strengthening. Technical help was also received for a small part of this programme from the Overseas Development Agency (ODA) of the UK in the form of some

automatic water quality monitoring stations, the associated modelling software, training and some hardware. The monitoring programme is being run on a permanent basis using the infrastructure of other agencies such as the CPCB and the Central Water Commission (CWC) to monitor data from 16 stations. Some research institutions like the Industrial Toxicology Research Centre (ITRC) are also included for specialised monitoring of toxic substances. Along with this The Ganga Project Directorate (GPD) was established in June 1985 as a national body operating within the National Ministry of Environment and Forest. The GPD was intended to serve as the secretariat to the CGA (Central Ganga Authority) and also as the Apex Nodal Agency for implementation. The execution of the works and the subsequent operation and management (O&M) were the responsibility of the state governments, under the supervision of the GPD. The GPD was to remain in place until the GAP was completed.

Apart from the visible improvement in the water quality, the awareness generated by the project is an indicator of its success. It has resulted in the expansion of the programme over the entire Ganga basin to cover the other polluted tributaries. The GAP has further evolved to cover all the polluted stretches of the major national rivers, and a few lakes. Considering the huge costs involved the central and state governments have agreed in principle to each share half of the costs of the projects under the "National Rivers Action Plan".

But the problem GAP faced was the fact that GAP was mistakenly assumed to be a city improvement plan. This led to an initial rise in general expectations followed by disappointments when the GAP was found to limit itself only to river pollution abatement without pursuing popular measures. This could have been one of the main reasons why it attracted some sharp criticism. In spite of close co-ordination with the Ministry of Urban Development at the central and state government levels, this communication gap still remains because future planning is still based on narrow considerations and short-term objectives (solely due to resource constraints), without addressing the root causes which were also being overlooked earlier for precisely the same reasons. Thus the river pollution plan being "action" orientated, avoids involvement in long-term town planning which continues to remain deficient with respect to environmental sanitation. This is due to the lack of overview by any stakeholding agency to the blinkered foresight of the already beleaguered city authorities who remain perpetually short of funds for their daily crisis management. The most important lesson learned was the need for control of pathogenic contamination in treated effluent. This could not be tackled before because of a lack of safe and suitable technology but is now being attempted through research and by developing a suitable indigenous technology, which should not impart traces of any harmful residues in the treated effluent which may be detrimental to the aquatic life. This is an aspect difficult

to control in surface waters in tropical areas, but it is very important for the Ganga because the river water is used directly by millions of devout individuals for drinking and bathing.

In conclusion the Action Plan, started as a "cleanliness drive", and continues in the same noble spirit with the same zeal and enthusiasm on other major rivers and freshwater bodies. Its effectiveness could however be enhanced if these efforts could be integrated and well accepted within the long-term objectives and master plans of the cities which are constantly under preparation without adequate attention to the disposal of wastes. More information on polluted ground water resources in the respective river basins will prove useful, because the existing levels of depletion and contamination of ground water resources, which are already overex ploited and fairly contaminated, will increase the dependency on the rivers in future, as the only economical source of drinking water. This aspect has not been seriously considered in any long-term planning.

In case of ground water depletion a defined Case study of Telengana State is undertaken. According to the data released by the Food and Agricultural Organisation's AQUASTAT in 2010, at 250 billion m^3 per year, India is one of the countries that uses ground water the most. As high as 80 percent of its water is used for irrigation of which 65 percent is ground water.

This Bi-decadal ground water level trends in the semi-arid south Indian region. ‘The declines, causes and management’, published in the Journal of Hydrology Regional Studies says that the large-scale ground water withdrawal is due to the increase in number of irrigation wells with diesel or electric pumps in the country. There has been a 130-fold rise in irrigation wells--from 0.15 million in 1960 to nearly 20 million by 2000. This over-extraction of ground water is leading to extreme ground water depletion and many other related environmental problems in many parts of the country.

Although states like Punjab, Haryana and Telangana have high levels of ground water use, the aquifers in these regions are different. The deep alluvial aquifers found in Punjab and Haryana have more water-holding capacity than those in Telangana. So while the declining water table may not affect the water availability in Punjab, at least not in the short run, the situation is different in Telangana due to the shallow nature of the aquifers. One of the reasons for the ground water depletion in Punjab and Telangana is speculated to be the free electricity provided to the farmers. The former state of Andhra Pradesh, divided into two states namely Telangana and Andhra Pradesh on June 2, 2014, had the free electricity policy for farmers implemented in May 2004. Although it has been argued that free electricity has triggered extensive well drilling in Telangana, there is very little evidence to support this claim. The three districts in

Telangana--Rangareddy, Medak and Nalgonda--spanning 22 years that examined the correlation between free electricity provision in Telangana and its implications on the ground water security in the state was taken into account. It was found that the area irrigated by ground water has increased by 110 percent in a 22-year-period from 1990 to 2012 which includes 90 per cent of Rangareddy and Medak districts and 65 per cent of the Nalgonda district. This is mainly due to a 30-fold increase in the use of tube wells for irrigation purpose and an accompanying decrease in the use of water from the reservoirs and open wells. Reliability is a major factor contributing to the popularity of drilled wells in the region.

Free electricity, which the state began to provide in 2004 is one of the important reasons for this steady increase in ground water-irrigated areas. More than 98 percent of the tube wells in the study area were found to use electric pumps as of 2006-2007. Telangana state provides five to seven hours of daily free electricity for pumping. However, this electricity is often very unreliable and low in quality. Untimely and low quality electricity causes wasteful ground water extraction and use, high electricity consumption and increased pump repair costs-a lose-lose situation for both farmers and electricity boards. Two to three hours of uninterrupted quality power supply could help reduce the wastage of electricity and reduce ground water withdrawals.

Free electricity has been found to have benefited medium and large-scale farming more although it was meant to help small-holder farmers. Ninety percent of small and marginal farmers in the state do not own an irrigation well and their financial capacity to dig a new well with a pump is limited. This is because drilled wells become unproductive in a short span of time and digging deeper and frequently is not possible because of the financial limitations of the small farmers. Climate change has been predicted to increase the intensity of rainfall in the future. The paper argues that in the case of Telangana, this is not good news for ground water recharge because of the poor water retention capacity of its aquifers resulting in runoffs. This will further deplete the ground water in the state. Faulty cropping patterns, such as an increase in irrigation-intensive crops like paddy, are another reason for ground water depletion.

In response to this The Andhra Pradesh Water, Land and Trees Act was enacted in 2002 for the integrated management of surface and ground water resources. This Act needs farmers to register the existing borewells and receive permission to dig new irrigation tube wells. Although the Act has been successful in registering existing borewells, few farmers have complied with the permit requirement for drilling new tube wells. Under this Act, only 2500 wells were given permission in 2005-06 but the Transmission Corporation of Andhra Pradesh Limited reported 66,000 individual agricultural electrical service connections during this time for drilling tube wells indicating that more number of tube wells were actually drilled during this time. The

Telangana government has already put out tenders for the Palamuru project, expected to cost over Rs 35,000 crore. The project, by lifting 90 TMC (thousand million cubic feet) of excess water from the Srisailam reservoir during the flood season, will irrigate 10 lakh acres, provide drinking water to Hyderabad and supply water for industrial use to Mahabubnagar, Nalgonda and Rangareddy districts. The project is expected to be completed in 30 months. The Rs 10,000 crore Dindi project, which was approved in 2007 and whose source is again the Srisailam reservoir, will irrigate 3.5 lakh acres and provide drinking water in fluoride-affected Nalgonda. The district is often cited as a case study of India's worsening water crisis. With fluoride content in its ground water many times higher than permissible levels and three-fourths of its 25 lakh borewells running dry, Nalgonda is in dire need of water.Telangana has set aside over Rs 24,000 for irrigation in 2016-17 in its budget. It is a fifth of the total planned expenditure and a 170% jump over the previous year's allocation for irrigation. Drinking water and industry will account for 10% each of water from irrigation projects.

Two of the government's other marquee projects are also to do with water. Mission Kakatiya aims to revive 46,500 minor irrigation tanks, most of which have fallen into disuse, by 2020, at a cost of Rs 20,000 crore. This will help irrigate an additional 0 lakh acres. Around a third of those tanks are likely to be operational by the time rains arrive this year. Of the Rs 20,000 crore, around `11,500 crore will be met through state budgetary resources, and the rest through loans and grants from the Centre and development institutions.The other, more ambitious project is Mission Bhagiratha, which will provide piped drinking water to each of the 84 lakh households in the state by 2018. The project will cost twice as much as Kakatiya, and KCR has publicly said that his party would not fight the 2019 assembly polls if this project was not completed. So in both the cases politics did take an upper hold in framing the crisis and the necessity to resolve it.

II.14.9 Conclusion

If statistics is true to its words then by the report by World Economic Forum states that the 4th biggest crisis that will impact the society is the water crisis and even sates might recourse to war to convalesce from such crisis. According to the Composite Water Management Index (CWMI) report released by the Niti Aayog in 2018, 21 major cities (Delhi, Bengaluru, Chennai, Hyderabad and others) are racing to reach zero ground water levels by 2020, affecting access for 100 million people. In fact in 2019, the late arrival of Monsoon has pushed farmers in Uttar Pradesh to change the cropping pattern. Along with that regional political party AIADMK member R Vaithilingam spoke about the problems faced by Tamil Nadu due to water shortage.

Rangarajan said Chennai is the first Indian city "to have gone dry" with the Central Water Commission reporting a rainfall deficit of 41 per cent in Tamil Nadu till June 13 this year. "Most of the Chennai population today depends on water tankers, municipal supply and private supply for drinking water. A tank of private water costs more than one gram of gold. Now gold is cheaper in Chennai than water. This is the truth," Rangarajan said. If such is the situation, then along with reducing the Global Warming, it is equally important to preserve through the frame of Sustainable development, the sources we have in our possession. So this whole discussion boils down to the fact that water being one of the potent potion of life, and its pollution itself questions the basic survival of human life.

II.14.10 Model Questions.

A. Answer in brief (5 Marks):

a. Explain how mining affects the Water sources.

b. Write a short note on Industrial Waste Water treatment.

B. Answer in detail (10 Marks):

a. Write about the interlinkage between Water Pollution and Ground Water Pollution.

b. What do you understand by Ground Water Depletion?

c. What are the major ways to combat Water Pollution?

d. What is Ground Water Management?

II.14.11 Suggested Readings.

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III : DEFORESTATION

Structure

III.14.0 Objectives

III.14.1 Introduction

III.14.2 Terminological Understanding

III.14.3 Historical Evolution of Deforestation.

III.14.4 Causes of Deforestation

III.14.5 Effects of Deforestation

III.14.6 Methods to Combat Deforestation

III.14.7 Case Study on Deforestation

III.14.8 Conclusion

III.14.9 Model Questions

III.14.10 Suggested Readings.

III.14.0 Objectives

- To have a comprehensive understanding about the nature of Deforestation
- To use factual data to understand the effects of Deforestation
- To understand the methods that can be used to combat Deforestation
- A comprehensive case study is undertaken to understand the whole frame of Deforestation and the method to comprehend the crisis.

III.14.1 Introduction

Climate changes are real and it is the most urgent threat challenging the entire species. The work needs a collective effort to stop procrastinating it. We should not take this planet for granted. Deforestation is an act of reducing what this Planet holds for us to breathe, leading to an unnatural change in the climatic condition of the Nature. As it is a man-made disaster, mostly done in the name of development and enhanced profit in business, we need to have a rethink on the issues involved. This whole discussion is an attempt to delineate the graveness of the crisis.

III.14.2 Terminological Understanding

Deforestation means the clearing or thinning of forests by humans. It represents one of the largest issues in global land use. Estimates of deforestation traditionally are based on the area of forest cleared for human use, including removal of the trees for wood products and for croplands and grazing lands. In the practice of clear-cutting, all the trees are removed from the land, which completely destroys the forest. In some cases, however, even partial logging and accidental fires thin out the trees enough to change the forest structure dramatically. So deforestation occurs when forests are converted to non-forest uses, such as agriculture and road construction. With forest degradation the forest ecosystems lose their capacity to provide important goods and services to people and nature.

III.14.3 Historical Evolution of Deforestation

The process of Deforestation was not an act of 1950s or an act that was started down with the industrial revolution . Rather, it is an act which human took to build its own survival and well being. Civilisation somewhere tattered the Environment to suit its own benefit. For example in Europe Mesolithic cultures (c. 9000-5000 BC) did not avoid forests but actively engaged with them by clearing their edges for cultivation, and using fire for game hunting. On the upland fringes of the Pennines, North York Moors and Dartmoor, successive clearings are accompanied by pollens of plants such as sorrel and ribwort plantain, which can only flourish as a result of less tree cover.The subsequent 2,500 years of Neolithic agriculture (c. 4500-2000 BC) was far more sedentary and stable than once thought: the conventional archaeological wisdom of the Neolithics practising a `swidden' agriculture (rotational burning and clearing for cropping) as they spread across Europe from east to west. In an elaborated form this whole act of Human Development and Deforestation will be discussed below in the light of more an historical account.

The fact that the density of Population has always been one of the major factor that resulted in Deforestation. First in Greece (roughly 1000 BC to 300 BC) and several centuries later in Italy (roughly 300 BC to AD 200), the Classical Greek and Roman civilisations left their mark on the landscape, depicted in our model as high forest clearance within these regions during these periods. Williams (2000) provides recorded descriptions of extensive deforestation in these regions by Greek author Homer (9th century BC) and Roman author Lucretius (1st century BC), thus qualitatively verifying our model results. The fall of both the Greek and Roman empires were marked by a periods of afforestation, as populations declined and land

was abandoned . The Roman Empire was particularly widespread throughout Europe, it simulated a slight rise in deforestation throughout Europe (except for some parts of Eastern Europe) through the forth century AD. In most regions of Europe, this period is marked by stable forest cover or afforestation. China experienced increasing population and declining forest area for many centuries. Four thousand years ago, China's population was about 1.4 million people, and forests covered more than 60 percent of the land area. As the land's population started to increase, the forest cover of the land started to decrease drastically. At the foundation of the People's Republic of China (1949), forest cover had decreased to its historically lowest point - less than 10 percent of the land area - and population had increased to more than 541 million.

This scale of Deforestation decreased with the onset of the collapse of the Roman Empire, the beginning of the Migration Period, and the transition to medieval times. During the period from AD 400 to roughly AD 750, war, plagues, invasions from the East, and climate deterioration resulted in stagnating or declining populations across much of Europe. The era of Genghis Khan's Mongol invasion in the 13th and 14th centuries was so vast that it may have been the first instance in history of a single culture causing man-made climate change, according to new research out of the Carnegie Institution's Department of Global Ecology. However, the Mongol invasion cooled the planet, effectively scrubbing around 700 million tons of carbon from the atmosphere with a high body count. Over the course of the century and a half run of the Mongol Empire, about 22 percent of the world's total land area had been conquered and an estimated 40 million people were slaughtered by the horse-driven, bow-wielding hordes. Depopulation over such a large swathe of land meant that countless numbers of cultivated fields eventually returned to carbon- absorbing forests.

The gradual decline in forest cover coincided with the development of feudal societies, the emergence of western European nation states in Spain, France and England by the 11th century, the establishment of cities across Europe, and climatic amelioration that marked the end of the Migration Period. This period is known for its extensive deforestation in central and western European regions .The Renaissance and the Ages of Discovery and Enlightenment brought about an advancement of ideas, science, trade, and religion throughout Europe. This period leading up to the Industrial Revolution witnessed a generally uniform decrease in forest cover throughout Europe. The highest rates of deforestation were on the land best suited for farming, especially in France, Germany and the United Kingdom of Great Britain and Northern Ireland; intense deforestation coincided with periods of high economic activity. Trees were felled when grain prices rose and forest lands were converted to cropland. The use of wood for construction and shipbuilding also contributed to forest degradation and eventual deforestation in France, Portugal and Spain. The rise of Colonialism in parts

of Asia and Africa was one major cause of Deforestation. The production of commercial crops like jute, sugar, wheat and cotton were directly encouraged by the British. As in the 19th century, the demand for these crops had increased substantially in Europe forests were considered to be really unproductive.Due to this, the cultivated area rose by 6.7 million hectares between 1880 and 1920. Along with that the rise in demand for Sleepers on the Railway track and the need for regular supply of timber for ship-building Oak forests in England were eventually disappearing.. In order to get the large oak supply, the British started to explore the forests in India on a grand scale. With the expansion of railways, the growing demand for timber became one of the primary causes of deforestation.

III.14.4 Causes of Deforestation

Deforestation has certain causes for its occurrence, where a large share of the responsibility lies with Human Activities. The reasons for its occurrence are stated below.

a) **Agricultural Practices :** The most prevailing cause of deforestation rests on the ever growing demand for food security and consumer crops. In this sense, man persistently cleared trees and vegetation to convert the regions into agricultural production farms. Increased demands of consumer crops like soya beans and corn among other grains has seen the rate of deforestation rise at a very fast rate. Farmers clear forests to create space for grazing livestock and planting more crops. Often, small-scale farmers utilise what is known as slash and burn techniques. It involves cutting down trees and burning them to create the space required for farming and livestock production.

As a norm, migratory farmers clear a forest area and utilise it until the soil is unfit for crop production, and then they proceed to new forest regions. The situation worsenes because the practice continues while the lands left behind take hundreds of years to return to their original state. This whole act of Industrial agriculture, along with subsistence agriculture, is the most significant driver of deforestation in tropical and subtropical countries, accounting for 80% of deforestation from 2000-2010. The current contribution of agriculture to deforestation varies by region, with industrial agriculture being responsible for 30% of deforestation in Africa and Asia, but close to 70% in Latin America. The majority of industrial agriculture activities affecting forestland typically take place in developing countries that produce commodities for global markets. Recent studies have shown,more than the increase in rural population or of smallscale farming,the growth of urban centers and global commodity markets are the stronger drivers of deforestation.

Conversion of forest to intensive agriculture can have profound impacts on forest health. Monoculture plantings quickly exhaust the thin layer of nutrients in tropical soils. Runoff from agricultural land often contains elevated nutrient levels and can cause problems with water pollution. Large farms provide little wildlife habitat and can contain almost zero plants in the understory. Fragmentation from farms can have negative impacts on surrounding forests by isolating animal populations and altering microclimates at forest edges. In Brazil, forest clearing for intensive agriculture normally involves larger clearings than pasture. Finally, farm biomass and soil sequesters a fraction of the carbon as forests. Along with that in the humid tropics, indigenous people clear forests by cutting down trees and burning them, called slash-and-burn practices. They plant crops in the cleared land and farm for a few years, and when the land becomes unproductive, it is abandoned and the process repeats. Since the 1960s, the Amazon rain forest has seen increased use of this technique. A 1994 study cited in 'Slash-and-Burn Agriculture' attributes 30 percent of South America's deforestation to this practice.

b) **Logging :** Logging refers to the cutting down of trees, trimming of the cut trees into logs, and transportation of these to sawmills for processing. More broadly, logging may refer to the clearing of forested areas for subsistence farming, commercial farming, grazing, or other uses. Land clearance may be done in many ways, including slash-and-burn clearing, clearcutting (also called clearfelling) selective logging, and salvage logging. Road building in forest areas is an important part of logging operations to fight against forest fires. However, environmentalists argue that road building not only destroys habitat but also may increase the danger of forest fires by letting in more light, which consequently helps dry out the forest floor, and by creating forest openings that serve as wind tunnels that fan flames once a fire begins. In Brazil, roads opened in the rainforest for selective logging paved the way for increased land clearing and settlement, and ultimately, for the deforestation of the affected forest areas.

Deforestation with clearcut logging is highly disruptive to biodiversity. Due to the removal of seed sources, clearcut logging prevents the natural regrowth of endemic species. However, clearcut logging of natural forests in the tropics also occurs when farmers and ranchers are expanding cropland and pastures without any consideration for sustained timber harvesting. With selective logging, only high-value species are felled for timber, but many smaller trees are damaged in the process contributing to large scale forest fragmentation, altering forest micro-climates and making forests more vulnerable to fires, as well as affecting plant and animal species composition. The development of transportation infrastructure for logging also increases the degree of forest fragmentation, and allows for easier access to unlogged forests. However,

the impacts of logging on natural forests are different from those on planted forests that are more vulnerable to fires and diseases. Poor harvesting and silviculture practices may lead to long term declines in timber yields and regeneration capacity, due to adverse effects on soil quality. In 2010, the global total for reported or official wood removal was 3.4 billion m3,According to World's Forests Report in 2011, the amount of sawn logs removed was 853 million m3, pulpwood amounted to 527 m3, while other industrial roundwood amounted to 157 million m3. Energy wood and household fuelwood accounted for 1.87 billion m3.

China is now the world's second largest consumer and importer of wood products, according to the United Nations. Considering her limited forest resources and booming domestic demand, most of its timber for export and domestic use has to be imported. Unfortunately, illegal logging is rampant in the Paradise Forests of Indonesia and Papua New Guinea, as well as of Congo, it is very likely that much of China's imported timber comes from illegal sources. Industrial logging for timber and pulp and paper has devastated much of the world's rainforests. Whole swathes of Indonesian rainforests and peatlands have been turned into paper pulp for toilet paper, tissues, magazines, and copy and print paper.The global demand for palm oil (widely used in cosmetics and as a vegetable oil in food products), soy, and beef also drives massive rainforest destruction. Much of the Amazon has been burned to make way for cattle ranches and soya plantations, while Indonesian rainforests are cleared for palm oil. Irreplaceable rainforests are, thus, destroyed to make toothpaste, chocolate and animal feed. Along with that in Brazil, the combined effects of commercial logging and land clearance for subsistence and commercial agriculture have reduced the tropical rainforest to 10% of its original size. It has been estimated that 20,000 acres of the Amazon Rainforest are being destroyed every year. East Asia contains 17% of the world's forests but has lost almost 90% of its original forest area, mostly due to illegal logging over the past 20 years. In the Philippines alone, the total forest area has been reduced from 39.5 million acres to 1.72 million acres. In Cambodia, 40% of the land has been granted to Southeast Asian companies for large-scale, unregulated timber logging.Russia contains more than 20% of the world's total forested land area,but more than 20,000 square kilometers of its forest is lost every year, mostly due to illegal logging. In Ethiopia, 98% of native forest has been destroyed during the last 50 years. In Central Africa, industrial logging is now the main form of land exploitation, with 30% of forest land leased to the logging industry.

c) **Mining :** Mining causes deforestation both within and beyond lease boundaries. Within leases, forests are cleared for mineral extraction, processing, and infrastructure development; but impacts of off-lease or illegal mining are potentially more extensive and more complex. Deforestation for mining is harmful due to the combined effects

of land use displacement, urban expansion, development of commodity supply chain, and concerns over mine waste discharge and spills.

In Brazilian Amazon mining caused major deforestation within leased forest area of 6,880 km^2 in 2005, of which 14% (983 km^2) were cleared by 2015. Mining also caused deforestation off-lease.Oil, coal, gas, and minerals extraction reduce forest cover, but also lead to more long term impacts such as pollution, infrastructure development and increased human activity. Extractive industries produce toxic water and chemicals as byproducts that can contaminate groundwater and kill flora and fauna. Weak regulation in policy and practice has hindered effective monitoring and accountability processes in developing countries. Even in advanced economies like Canada or the United States, the development of oil pipelines always entails risks of leakage, which can lead to surface contamination. Small-scale mining of gold is responsible for 1/3 of the total mercury released into the environment, as mercury is used to separate gold from its ores. Acid mine drainage methods, and tailings pools, which hold mine waste products such as sediments and minerals, present further risks. The release of such waste has disastrous consequences, as exemplified by the collapse of the tailings dam of Ok Tedi mine in Papua New Guinea in 1984 that caused the deposition of copper-heavy waste over 10,000 ha of forestland. The forest die-off has extended beyond this immediate area over the course of 30 years, as mine waste continued to be discharged into the river system. This type of pollution can impact entire ecosystems, as metals are cycled over long time spans.

Some studies have also shown that over 25% of metal mines worldwide can be found within 10 km of a protected area's boundaries. In some regions like the Congo Basin, small-scale and artisanal mining takes place within protected area boundaries. Land concessions to mining companies often overlap with indigenous territories, such as in the Amazon, 15% of which is covered by active or planned oil concessions and 8% of which is covered by minerals extraction concessions. With the growth of fossil fuels and minerals extraction in developing countries, the threat of pollution from oil spills and mining waste will continue to rise. Increases in the prices of oil, gas, and minerals are predicted to continue, spurring further growth of the extractive industries in developing countries, in temperate, tropical, and boreal regions.

d) **Forest Fire :** Fires, both man-made and natural, contribute to forest loss. Fire is the oldest method used to clear land for farming and other uses, and it is still widely used in many countries. This is a concern because of its threat to biodiversity and other natural systems; at the same time deforestation by fire-is also a key emitter of carbon dioxide. Wildfires are a natural occurrance and serve important ecosystem functions. Many tree species have evolved to take advantage of fire, and periodic burns can contribute to detoriate the overall forest health. Fires typically move through

burning lower branches and clearing dead wood from the forest floor which kick-starts regeneration by providing ideal growing conditions. It also improves floor habitat for many species that prefer relatively open spaces.

Wildfires in the Amazon are not natural events, but are instead caused by a combination of droughts and human activities. Both anthropogenic climate change and regional deforestation are linked to increases in the intensity and frequency of droughts over Amazonia. This kicks off a nasty cycle: as trees have less water during such droughts, their growth slows and they're less able to remove CO_2 from the atmosphere through photosynthesis. Trees then shed extra leaves or even die, which means more wood and leaves are ready to burn on the forest floor and, without a dense canopy to retain moisture, the forest loses some of the humidity which acted as natural fire prevention. These changes are exacerbated by "selective logging" of specific tree species, which opens up the canopy and further dries out the understory and forest edges, which are drier than the interiors. The result: normally fire-proof rainforests become flammable. The Amazon has already experienced three ‘droughts of the century’, in 2005, 2010, 2015-2016. The Amazon rainforest is described as the planet's lungs for good reason and so, protecting the forest is a must if we want to do something about global warming. However, reducing the CO_2 that is emitted when a tropical forest is destroyed depends not only on stopping the actual deforestation, but also on fighting wildfires within the forest. In a new study published in Nature Communications we see that forest fires are responsible for a huge portion of the carbon emitted from the Brazilian Amazon. During drought years, these fires can emit around a billion tonnes of CO_2, almost double the amount of carbon effectively emitted through deforestation in the Amazon.As one of the signatories to the Paris agreement on climate change, Brazil is committed to reducing its emissions to 37% below 2005 levels by 2025. It now needs urgently to focus on incorporating CO_2 losses from wildfires into its estimates. In early 1998, some 13,200 square miles (34,000 square km) of Roraima state in northern Brazil burned as the fires, started by subsistence farmers, spread rapidly across the dry savanna and advanced into rainforest usually too humid to burn. As many as 3,800 square miles (10,000 sq km) of intact rainforest were damaged or destroyed by these fires. The government firefighting efforts had virtually no effect and it was only freak heavy showers that extinguished the flames.

In 2005 the Amazon experienced the worst drought in recorded history. As rivers went dry and communities were left stranded, tens of thousands of fires burned. Again, in 2010 an even worse drought affected a million square kilometers of Amazon forest. In both the cases dry conditions were linked to warm temperatures in the tropical Atlantic Ocean, raising fears that climate change could worsen droughts in

the Amazon. Besides destroying the rainforest ecosystem and killing wildlife, these fires also release thousands of tons of carbon into the atmosphere and the smoke causes local airport closings and hospitalisations for smoke inhalation. These fires are significant sources of greenhouse gases. For example, in a four-month period (July-October) in 1987, about 19,300 square miles (50,000 sq. km) of the Brazilian Amazon burned in the states of Para, Rondonia, MatoGrosso, and Acre. The burning produced carbon dioxide containing more than 500 million tons of carbon, 44 million tons of carbon monoxide, and millions of tons of other particles and nitrogen oxides. In 1997/98, Indonesia had the most severe fires worldwide, and smoke haze pollution recurs yearly. The fire-related policy problems are defined as smoke haze pollution, forest degradation and deforestation, and impacts on the rural sector. Some of the apparent major causes of the problems are identified. The estimate of area affected by fires in 1997/98 is revised from 9.7 million hectares to 11.7 million hectares. The fires that resulted in forest degradation and deforestation caused economic costs in the range of $1.62-2.7 billion. The costs of smoke haze pollution were in the range of $674-799 million, and probably higher because estimates for the economic impacts on Indonesian business activities were not available. The valuation of costs associated with carbon emissions indicates that these may amount to as much as $2.8 billion.

e) **Cattle ranching :** Cattle ranching is now the biggest cause of deforestation in the Amazon, and nearly 80 per cent of deforested areas in Brazil are now used for pasture. Since the 1970s, Brazil is the largest commercial cattle herd in the world and since 2003, the country is the world's foremost beef exporter.The government plans to double its share of the market by 2018.The impact of this on the forest is huge because between 1996 and 2006, an area the size of Portugal was carved out for cattle ranching. As with the soya industry, a host of social ills have followed the wave of expansion. Cattle ranching has the highest rates of slave labour in Brazil - just over 3,000 people held as slaves were freed from ranches last year. Now, with the Brazilian government pushing for the industry to expand on such a massive scale, it throws their targets announced last month for reducing deforestation into serious doubt. It also poses a significant threat to efforts to combat climate change. Deforestation is largely responsible for making Brazil the fourth largest greenhouse gas emitter, and the cattle industry contributes a significant quantity of emissions in the form of bovine methane emissions.In 2009, Greenpeace exposed the role of cattle breeding and ranching as a driver of deforestation in the Amazon. It uncovered illegal practices linked to slaughterhouses, such as forest destruction and modern slavery.

The new cattle footprint maps of Brazilian team have produced focus on MatoGrosso, a state which has the largest cattle herd in Brazil and seen large areas of forest lost in favour of pasture, and an innovative process has been used to analyse satellite

imagery.Production of beef is without question the biggest cause of deforestation in the Amazon, with figures ranging from 65 to 70 percent of all deforestation in the area from 2000 to 2005. While more recent figures from 2014 show that overall deforestation is down, the percentages have stayed fairly constant, showing that beef is still the primary reason for cutting down the forest. However these numbers account only for the areas cleared for the creation of pastures, and they fail to include the food being produced for cattle consumption. The Yale School of Forestry and Environmental Studies stipulates that Brazil alone has 24 to 25 million hectares devoted to the production of soy, 80 percent of which would end up as animal feed. These numbers all contribute to the consensus that the primary reason for rainforest deforestation in the Amazon can be attributed to the beef industry. only been increasing, which has in part led to Brazil's investment into its cattle industry.

A combination of factors led to a considerable decrease in deforestation in the Brazilian Amazon between 2006 and 2013. Impactful actions included: the 2006 Soy Moratorium, a voluntary agreement between civil society organisations, authorities, soy traders and buyers; credit restrictions imposed by Resolution 3545 by the National Monetary Council, and slaughterhouses signing the G4 and TACs. As a result of the above requirements, the registration of properties in the Rural Environmental Register (CadastroAmbiental Rural, CAR) increased rapidly after 2009. The CAR is a type of identification card for a property and its owner required under the Brazilian Forest Code. In Pará, the share among suppliers of the four large slaughterhouses that signed both supply chain agreements increased from two percent in 2009 to 96 percent by the end of 2013. But again from 2014 The influential agri-business lobby in the Brazilian Congress, has initiated legislative and administrative changes that enable the further conversion of native forest to pasture and cropland.. Obtaining property rights for illegally occupied and cleared lands became easier while the government weakened land rights for indigenous peoples. Even though 95 percent of fines imposed by the environmental agency IBAMA were never paid, president Temer in October 2017 implemented an amnesty of USD 2.1 billion in fines for illegal deforestation. Meanwhile, the government also cut budgets of the environmental agencies (IBAMA and ICM-BIO) and the National Indian Foundation (FUNAI), further undermining their ability to achieve deforestation-related duties.

III.18.5 The Effects of Deforestation

The effects of deforestation on environment is vast and varied. Therefore, it needs discussion in detail.

a) **Loss of Biodiversity :** One of the most dangerous and unsettling effects of

deforestation is the loss of animal and plant species due to their loss of habitat. Seventy percent of the world's plants and animals live in forests and are losing their habitats to deforestation, leading to species extinction according to National Geographic. It also has negative consequences for medicinal research and local populations that rely on the animals and plants in the forests for food and medicine. As low land topical forests are prime locations for deforestation due to its ease of navigations and rich in timber sources, the Orangutan habitat in North Sumatra is being lost at an extremely high rate. To clear the land for the palm plantations, firms often set fire to these forests. Not only do the fire destroy the Orangutan habitat, but thousands of these slow-moving apes are thought to have burned to death as they were unable to escape the flames.

This species is classified as critically endangered by IUCN as well and it is considered as one of the world's 25 most endangered primates. Only about 6,000 Sumatran Orangutans is estimated to still live in the wild as about 40% of their habitat is destroyed by the 1997 forest fires. Along with that The Javan tiger became extinct in the mid-1970s, as a result of the clearing of its habitat due to deforestation. Due to the large population, there was a shortage of rice to meet the needs of the growing population. Hence, more land was cleared to cultivate rice. By 1975, only 8% of the initial forest area remained, limiting the amount of food available for the tigers, and inevitably driving these Javan Tigers closer to human civilisation. In addition, the Rusa deer, Javan tigers' most important prey species, went extinct due to diseases in the 1960s. As a result, these tigers were forced to prey on farm animals and in rare cases, humans. This resulted in the eradication of these majestic creatures, which ultimately led to its extinction in the 1970s.

Rainforests, arguably the biggest victims of deforestation, cover only about 7 percent of the world's surface. However, within this 7 percent live almost half of all plant and animal species on earth. Some of these species only live in small specific areas, which makes them especially vulnerable to extinction. As the landscape changes, some plants and animals are simply unable to survive. Species from the tiniest flower to large orangutans are becoming endangered or even extinct. Biologists believe that the key to curing many diseases resides within the biology of these rare plants and animals, and preservation is crucial

b) **Climate Change :** In addition to the loss of habitat, the lack of trees also allows a greater amount of greenhouse gases to be released into the atmosphere. Presently, the tropical rainforests of South America are responsible for 20% of Earth's oxygen and they are disappearing at a rate of 4 hectares a decade.According to Michael Daley, an associate professor of environmental science at Lasell College in Newton, Massachusetts, the No. 1 problem caused by deforestation is the impact on the global

carbon cycle. Gas molecules that absorb thermal infrared radiation are called greenhouse gases. If greenhouse gases are in large enough quantity, they can force climate change, according to Daley. While oxygen (O_2) is the second most abundant gas in our atmosphere, it does not absorb thermal infrared radiation, as greenhouse gases do. Carbon dioxide (CO_2) is the most prevalent greenhouse gas. CO_2 accounts for about 82.2 percent of all U.S. greenhouse gas, according to the Environmental Protection Agency (EPA). Trees can help, though. About 300 billion tons of carbon, 40 times the annual greenhouse gas emissions from fossil fuels, is stored in trees, according to Greenpeace.

The deforestation of trees not only lessens the amount of carbon stored, it also releases carbon dioxide into the air. This is because when trees die, they release the stored carbon. According to the 2010 Global Forest Resources Assessment, deforestation releases nearly a billion tons of carbon into the atmosphere per year, though the numbers are not as high as the ones recorded in the previous decade. Deforestation is the second largest anthropogenic (human-caused) source of carbon dioxide to the atmosphere (after fossil fuel combustion), ranging between 6 percent and 17 percent, according to a study published in 2009 in Nature. Carbon isn't the only greenhouse gas that is affected by deforestation. Water vapour is also considered a greenhouse gas. "The impact of deforestation on the exchange of water vapour and carbon dioxide between the atmosphere and the terrestrial land surface is the biggest concern with regard to the climate system," said Daley. Changes in their atmospheric concentration will have a direct effect on climate. Deforestation has decreased global vapour flows from land by 4 percent, according to an article published by the journal National Academy of Sciences. Even this slight change in vapour flows can disrupt natural weather patterns and change current climate models.

The new research in Australia suggests that if it were not for human influences-specifically widespread agricultural fires–the dry outback might be a wetter, more hospitable place than it is today. The effect of vegetation change from forests that favour rainfall to grassland and bush, can impact precipitation patterns. Colombia, once second in the world with freshwater reserves, has fallen to 24th due to its extensive deforestation over the past 30 years. Excessive deforestation around the Malaysian capital of Kuala Lumpur, combined with the dry conditions created by el Niño, triggered strict water rationing in 1998, and for the first time the city had to import water. In the 1998 global climate treaty conference in Buenos Aires, Britain, citing a disturbing study at the Institute of Ecology in Edinburgh, it was suggested the Amazon rainforest could be lost in 50 years due to shifts in rainfall patterns induced by global warming and land conversion.With the Paris climate agreement in 2016, for the first time ever, reducing deforestation and promoting forest conservation

is prominently included in a global climate agreement. REDD+ (Reduce Emissions from Deforestation and forest Degradation) sets forth a pathway to achieve net-zero emissions in the second half of this century, cutting emissions by providing financial incentives, backed by international funds-to reduce deforestation and forest degradation, promote forest conservation and sustainable management, and enhance forest carbon stocks in developing countries. With the Paris Accord, REDD+ became permanent Article 5 of the Agreement, politically protecting and mobilising local and global action around forests.

The situation has worsened to such a state that an imprint of Water War in the near future is quite inevitable. The losses of freshwater resources are considered one of the most immediate threats to national security in many countries. Freshwater-required for human consumption, agriculture, and industrial operations-or the lack thereof can have a tremendous effect on the social, economic, and political climate of a country. Realising the importance of water, politicians of the future may try to secure their existing freshwater supplies or wage war to acquire other sources of water. Demand for water increases as the standard of living improves, so politicians of the future will look to guarantee freshwater supplies. Developing countries, where political and social conditions are often tense, will likely experience the most pressure from shrinking water supplies. In the future, wars may be fought over water, not oil. In the 1990s Egypt made it known to its upstream neighbors-Sudan and Ethiopia-that it is willing to go to war over the Nile's water.

c) **Water Cycle and Soil Erosion :** The water cycle is very important for not only us, but for species of animal and plant all over the globe. Trees contribute a great deal to the water cycle, and forests are particularly useful for regulating the way that rain is recycled back into the atmosphere to be rained down once again many miles away. By chopping down hundreds of thousands of trees every year and never replacing them, we are affecting the natural water cycle of the world, which means an increase in the pollution present in the water that now rains down on places all over the world.The forest adds to local humidity through transpiration (the process by which plants release water through their leaves), and thus adds to local rainfall. For example, 50-80 percent of the moisture in the central and western Amazon remains in the ecosystem water cycle. In the water cycle, moisture is transpired and evaporated into the atmosphere, forming rain clouds before being precipitated as rain back onto the forest. When the forests are cut down, less moisture is evapotranspired into the atmosphere resulting in the formation of fewer rain clouds. Subsequently there is a decline in rainfall, subjecting the area to drought. If rains stop falling, within a few years the area can become arid with the strong tropical sun baking down on the scrub-land. Today Madagascar is largely a red, treeless desert from generations of forest

clearing with fire. River flows decline and smaller amounts of quality water reach cities and agricultural lands. The declining rainfall in interior West African countries has in part been attributed to excessive clearing of the coastal rainforests. Along with that healthy forests release a range of volatile organic compounds that "have an overall cooling effect on our climate," mostly by blocking incoming solar energy, says Dominick Spracklen of Leeds University in England. Removing forests eliminates this cooling effect and adds to warming the environment. The tropical deforestation could add 1.5 degrees Celsius (2.7°Fahrenheit) to global temperatures by 2100 - even if we shut down fossil fuel emissions tomorrow, calculates Natalie Mahowald of Cornell University.

Forests moderate local climate by keeping their local environments cool. They do this partly by shading the land, but also by releasing moisture from their leaves. The transpiration, requires energy, which is extracted from the surrounding air, thus cooling it. A single tree can transpire hundreds of liters of water in a day. Each hundred liters has a cooling effect equivalent to two domestic air conditioners for a day, calculates Ellison. Monitoring of rapidly deforesting regions of the tropics has recently shown the effect of losing this arboreal air conditioning. Take the Indonesian island of Sumatra, which has been losing forests to palm oil cultivation faster than almost anywhere else on the planet. A study last year found that since 2000, surface temperatures there have on average increased by 1.05 degrees Celsius (1.8°F), compared with 0.45 degrees in forested parts. Clifton Sabajo at the University of Gottingen, Germany, found temperature differences between forest and clear-cut land of up to 10 degrees Celsius (18°F) in parts of Sumatra. The Brazilian megacities of Rio de Janeiro and Sao Paulo and Argentina's Buenos Aires could also be vulnerable because much of their rainfall originates in the MatoGrosso region, where forests and grassland are rapidly being replaced by corn and soy fields. In fact the recent research has highlighted the threat posed by deforestation to the Nile River, the world's longest river, and the 300 million people who depend on it. Most of the Nile's flow begins in the Ethiopian highlands, a small rain-drenched part of the river's catchment. But recent research suggests that much of the rainfall in the Ethiopian highlands comes courtesy of moisture recycled by the forests of West Africa and, especially, the jungles of the Congo basin in the continent's heart. These rainforests provide as much as 30 to 40 percent of the total annual rainfall in the Ethiopian highlands. The future loss of the Congo jungle can empty the river further. Egypt and Ethiopia have spent years working toward an agreement on managing water flows in the Nile. But a deal on sharing the water will be pointless if rains falter in the Ethiopian highlands because of deforestation in the distant Congo basin.

In case of Soil Erosion when trees are cut down, it means that the surrounding soil

becomes loosened from the ground, and can be blown away by wind, or washed away by rain. This becomes an issue for farmers who deforested the land to plant crops. This problem can become very serious, as ‘‘The WWF states that scientists estimate that one third of the world's arable land has been lost to deforestation since 1960. After a clear cutting, cash crops like coffee, soy and palm oil are planted. Planting these types of trees can cause further soil erosion because their roots cannot hold onto the soil.’’ The loss of trees is the primary cause of soil erosion due to deforestation, and land-use practices in many cases exacerbates the soil erosion issue. Soil erosion can cause many issues not only for the environment, but also the health and wellbeing of people who live in the area. ‘‘The situation in Haiti compared to the Dominican Republic is a great example of the important role forests play in the water cycle,’’ Daley said. Both countries share the same island, but Haiti has much less forest cover than the Dominican Republic. As a result, Haiti has endured more extreme soil erosion, flooding and landslide issues.Costa Rica loses about 860 million tons of valuable topsoil every year, while the Great Red Island, Madagascar, loses so much soil to erosion (400 tons/ha) that its rivers run blood-red, staining the surrounding Indian Ocean. Astronauts have remarked that it looks like Madagascar is bleeding to death, an apt description of a country with grave environmental degradation and an agriculture-reliant economy that depends on its soils. The rate of increase for soil loss after forest clearing is astonishing; a study in Ivory Coast (Cote d'Ivoire) found that forested slope areas lost 0.03 tons of soil per year per hectare; cultivated slopes annually lost 90 tons per hectare, while bare slopes lost 138 tons per hectare.It is also necessary to state that when forests are cut down, this regulation of the flow of water is disrupted, which leads to alternating periods of flood and then drought in the affected area. Thus, leading to disruption of human settlements and loss of life in thousands.

After heavy tropical rains fall on cleared forest lands, the run-off carries soil into local creeks and rivers. The rivers carry the eroded soils downstream, causing significant problems. The increased sediment load of rivers smothers fish eggs, causing lower hatch rates. As the suspended particles reach the ocean, the water becomes cloudy, causing regional declines in coral reefs, and affecting coastal fisheries. The loss of coral reefs worldwide, often labeled the rainforests of the sea, is especially distressing to scientists because of their tremendous diversity and the important services they provide. Coastal fisheries are affected not just by the loss of coral reefs and their communities, but by the damage inflicted on mangrove forests by heavy siltation. Besides damaging the fisheries industry, deforestation-induced erosion can undermine roads and highways that cross through the forest. Erosion is extremely costly for developing countries. Besides the damage to infrastructure, fisheries, and property,

erosion of precious topsoils which costs tens of billions of dollars worldwide each year. For example, in the late 1980s the Indonesian island of Java was losing 770 million metric tons of topsoil every year at an estimated cost of 1.5 million tons of rice, enough to fulfill the needs of 11.5-15 million people.

The effects of soil erosion go beyond the loss of fertile land. It has led to increased pollution and sedimentation in streams and rivers, clogging these waterways and causing declines in fish and other species. And degraded lands are also often less able to hold onto water, which can worsen flooding. Sustainable land use can help to reduce the impacts of agriculture and livestock, preventing soil degradation and erosion and the loss of valuable land to desertification. The health of soil is a primary concern to farmers and the global community whose livelihoods depend on well managed agriculture that starts with the dirt beneath our feet. While there are many challenges to maintaining healthy soil, there are also solutions and a dedicated group of people, including WWF, who work to innovate and maintain the fragile skin from which biodiversity springs.

d) **Destruction of Homeland :** Many native tribes live in the rainforests of the world, and their destruction is the destruction of these peoples' homes and way of life. For example, the film "Under the Canopy" takes a look at the Amazon rainforest and the people who live there, including an indigenous guide named Kamanja Panashekung. "Kamanja's community is one of over 350 indigenous communities throughout Amazonia that depend on the rainforest, as we all do, for the air we breathe and the water we drink," M. Sanjayan, Conservation International's executive vice president and senior scientist said in an interview. Three to six million indigenous people lived in the Amazon basin at the time of Columbus, but fewer than 500,000 remain today. Worldwide, there are five to ten million such people, but their numbers are falling as they are driven out of forests by government decree, resettlement, or deforestation. As they disappear, we lose their extensive knowledge of the ecology of their areas. Many of these people practice subsistence shifting cultivation and hunting, and often represent the last bastions of traditional forest management systems. For their survival and the persistence of their way of life, large tracts of diverse forest are required. Population densities must be very low; otherwise resources will be overexploited and exhausted.

The Yanomami of Brazil are hunters, fishers, and collectors, and practice shifting cultivation of bananas, plantains, manioc and other tubers. The Kayapo, also of Brazil, live similarly, cultivating 250 varieties of fruits, numerous kinds of nuts and tubers, and many medicinal plants in forest openings and small fields. They grow 13 different types of bananas, 11 of cassava, and 17 of yams (a diversity unknown to countries like the United States, where agribusiness has reduced the varieties of corn raised

commercially to six, for example). They raise bees, and have semi-domesticated some forest plants and animals. The government has carried out actions to force these people into more urban settings, and/or logged the forests they require for sustenance. In Borneo, the expansion of the logging industry into the interior of the island has similarly destroyed traditional life patterns. The indigenous groups receive very few of the proceeds of the timber industry (usually only a few percent), although many indigenous men now work at low-paying logging jobs. Because their salaries are so low, agriculture must provide a substantial portion of their livelihood. Therefore, many people have moved into locations where they can be employed, buy goods and market agricultural products. The new access to markets has encouraged many to expand their jungle swiddens for raising cash crops, with corresponding ecological damage. Many of these areas are unsuitable for the introduced crops. For example, many wetlands reclaimed for rice culture have become acidic. As many immigrants from other parts of Southeast Asia move into Borneo, attracted by jobs, they engage in environmentally destructive activities in the interior as shifting cultivators, timber concessionaires, unlicensed logging workers, and pepper farmers. Although some have been integrated into a cash economy, there are substantial areas of poverty; few farmers can make a good living, and hired labour is poorly paid.

Another group that are also affected by deforestation are the indigenous peoples of Central and South America. When Christopher Columbus arrived in the New World there were an estimated 1.5-2 million indigenous people in the Amazon alone, now there are approximately 940,00 remaining, having been wiped out by the diseases and abuse of the Europeans. There still remain roughly 215 distinct tribes in just Brazil, 53 of which are labelled as uncontacted because they have no communication or interaction with those outside of indigenous communities or the government of Brazil. Not only are they losing their homes as the other species are, they are losing their culture.When indigenous people lose their rainforest refuge, they do not die out, in the physical sense, nor can they just be relocate, as some animals are able to do. They do lose their culture and their ways of life that have lasted for many generations. They lose their traditional beliefs and sustenance patterns that allowed them to live in harmony within the rainforest for so many generations. Their great knowledge of the rainforest, how it works and awareness of medicinal plant species is also lost. The indigenous peoples of Central and South America are so threatened that reserves are created for these people, usually this requires relocation because traditional land has already been destroyed or may greatly condense tribal lands. This is done in hopes that all the wisdom of these people who have in the past been considered ÒsavagesÓ or sub human, is not lost and that they will share some of this extensive knowledge with us.

A fatal flaw of these governments is that many of these preserve and reserves created to protect all indigenous peoples, do not give autonomous control of the land to the indigenous that inhabit it. They do not even have the basic rights allotted by law to squatters in terms of property control. If better economic prospects arise for use of the land, the governments sign documents that go against previous treaties and laws. In Brazil, an agreement was signed with Venezuela in 1998 to share energy, and construction on power towers through pristine rainforest considered holy by the indigenous of the area was to make this possible. When it was protested and earlier treaties that ensured the rights of these people over their land were brought out, they were ignored and discounted. So, the local tribe decided to bring the towers down themselves, costing Brazil $3 million and their deal with Venezuela. Even if the governments do not officially allow or acknowledge these things still occur, with no repercussions to those who commit these acts. Strip mining, poaching and logging are common upon the land reserves and preserves, which due to inadequate numbers of government officials to patrol the area, may go unnoticed until serious irreversible damage is done. Even then, it is hard to stop the logging or mining when it is discovered and it can possibly continue for a long time after with little or no punishment received by the offenders, although much harm comes to the habitat and all the species involved. The loggers and miners hunt for their food in the rainforest and there is a long history of massacres and intimidation, starting with the arrival of the Europeans, of indigenous people for nothing more than their land and everything upon it. The Guarani tribe of southern Brazil has the highest suicide rate of any other group of people on the planet, yet many of the suicide victims have been found with defense wounds on their hands. The government wants their land, as do several powerful corporations, so scare tactics and massacres are used upon these indigenous people to pressure them to give up their land. Despite the fact this has been documented little is being done about it, and if something major is not done soon there will not be any more Guarani to commit suicide.

III.14.6 Methods to Combat Deforestation

Ending deforestation is our best chance to conserve wildlife and defend the rights of forest communities. On top of that, it's one of the quickest and most cost effective ways to curb global warming. That's why we're campaigning for a deforestation-free future. Some of the methods that can secure the call for a Deforestation free future are:

i) **Managing Forest Resources :** Global efforts are being made to stop or reduce deforestation for many centuries, because for a long time it is known that cutting forests destroys the environment and in some cases it becomes the cause of a country's downfall. In Tonga, a group of more than 170 islands spread over an area of the South

Pacific, the government made appropriate policies to prevent conflicts between short-term benefits that resulted from turning forest into agricultural land and long-term problems it caused. During the 17th and 18th centuries, in Japan, the shoguns evolved a hi-tech system in order to prevent deforestation in the next centuries, and to develop forests again. It was done by using some product other than wood and by effective use of the land being used for agriculture for centuries.The forestry industry in Canada's boreal forest not only provides local and international markets with valuable forest products, but also employs thousands of people in local communities across the country. Some paper producers take seriously their responsibility to carefully and sustainably manage, harvest in, and source from these forests, while also supporting local economies. Greenpeace works in collaboration every day with nations, governments, other forest products companies, and unions to foster a responsible forest products industry and healthy local communities. Numerous global companies and household brands have embraced Greenpeace's critiques and ultimately adopted more sustainable practices.

If corporations have the power to destroy the world's forests, they also have the ability to help save them.Companies can make an impact by introducing ‘zero deforestatio’ policies that clean up their supply chains. That means holding their suppliers accountable for producing commodities like timber, beef, soy, palm oil and paper in a way that does not fuel deforestation and has a minimal impact on our climate.Companies should set ambitious targets to maximise the use of recycled wood, pulp, paper and fiber in their products. For the non-recycled products they buy, they should ensure that any virgin fiber used is certified by a third party certification system such as the Forest Stewardship Council.

The most straightforward personal strategy to fight against deforestation is to plant a tree. Planting a tree could be considered a lifelong investment into the environment and your good mental health. The cutting down of trees causes billions of tons of carbon dioxide (a greenhouse gas) to be released into the air. By planting trees, you are helping to combat global warming because trees absorb carbon dioxide. You are also helping to reduce run off water from the hills. Tree roots prevent landslides and rock slides that sometimes can harm animals, people or damage buildings. Planting and caring for trees is essential for the overall health and quality of life of the community. Trees are known for their mind soothing and healing properties. Just walking through a forest and looking at the trees calms our mind, alleviates worries and helps tired eyes recover from strain.The 'Forest Man of India,' as Jadav was titled by the country's former president, has planted a whole forest with his own hands - one tree a day for over 40 years. The resulting 1,400 acres of forest inhabited by rhinos, tigers and elephants are astonishing. Trees also protect the island community

from seasonal flooding and land erosion. So, this man has created a whole ecosystem from scratch, sustaining many lives through his consistent effort. Along with that Globally, 40 percent of all timber is used to make paper products, and the demand for paper increases by two to three percent every year. This means that the paper industry is still consuming more and more trees. Since the industry has such a high need for wood, it should come as no surprise that some part of the timber originates from illegal logging. If 2,000 pounds of paper put to recycle prevents the cutting of 17 trees? These 17 trees then sequester around 250 pounds of carbon dioxide from the air every single year. If just 10 percent of all the paper used by the average American in one year were recycled, 25 million trees would be saved. That makes 367 million pounds of carbon dioxide absorbed by these trees in one year.

ii) **Innovative Methods :** In those areas where 'slash-and-burn' process (which is not environmentally sustainable) is adopted, adopting slash-and-char method prevents acute deforestation and the fall in the quality of soil also stops as it alleviates some of the negative ecological implications of traditional slash-and-burn techniques. Thus, the biochar produced is again put into the soil, it is not only a durable carbon sequestration method, but it is also very beneficial in terms of soil amendment. By mixing with biomass, it produces terra preta, the best known soil on the planet. It is the only known soil type that revives the soil.In many parts of the world, especially in East Asian countries, tree plantation is increasing the area of forest land. In 22 of the world's 50 countries with largest forest cover; there has been appreciable increase in the area of forests. In Asia, there has been an increase in 1 million hectares of forest between 2000 and 2005. Tropical forests in El Salvador increased by 20 percent between 1992 and 2001. Based on these trends, the global forest cover is expected to grow by 10 percent by 2050.

Green business concerns re-use and recycling. Green methods of production and utilisation of resources can immeasurably reduce deforestation. Particularly, it's the focus on re-using items, reducing the use of artificial items, and recycling more items. Paper, plastics, and wood are linked to the destruction of forests and other natural resources. By focusing on recycling paper, plastics, and wood products as well as adopting responsible consumerism, it means there will be less dependence on the natural resources and trees. It will also reduce government and company imports of raw-materials from forest regions in other parts of the world.

Commodity producers pledging zero-deforestation can also take advantage of recent technological breakthroughs in forest monitoring and satellite technologies. These technologies can boost transparency throughout corporate supply chains. Tools such as the Forest Cover Analyser, Eyes on the Forest, and the soon-to-be-launched Global Forest Watch 2.0 enable anyone with an Internet connection to see when and where

forest cover change occurs in a given area. The Indonesian government also has various forest monitoring initiatives in different agencies. During the smog haze, for example, WRI published data suggesting that Indonesia's fires may be linked to land-clearing by the country's biggest commodities, wood pulp and palm oil. This is not a new trend - there is a growing global demand for both substances, and in the past, production has often come at the expense of forests. Estimates show that 57 percent of Indonesia's deforestation is attributable to clearing for palm oil plantations, with another 20 percent comes from pulp and paper. The ability to rapidly pinpoint exactly when and where forest fires happened and determine who is responsible is unprecedented. These innovations help governments, companies, and civil society quickly and effectively measure and reduce deforestation.

UK-based start-up BioCarbon Engineering has sought to harness cutting-edge technology to revolutionise the planting process, and thus help to replenish precious habitats and ensure a sustainable supply of forest-based materials. This fits with the EU's objective of moving Europe away from the traditional linear 'take, make and dispose of' model of production and consumption, towards a sustainable circular economy. The company received an EU grant designed to boost the potential of small businesses for eco-innovation and a sustainable supply of raw materials. This helped to fund a phase 1 project that focused on establishing a complete supply chain, a sound business model and a commercialisation strategy. The project also involved planning a large scale pilot for the automated planting solution, to be demonstrated in different ecosystems throughout Europe. The four-month project was completed at the end of March 2016. The new planting system consists of a mapping unmanned aerial vehicle (UAV), a planting UAV and machine learning software. The technique is fully automated and promises to be a significantly cheaper and faster means of reforestation. The company estimates that ten seeds can be planted per UAV per minute. Once scaled up, the company aims to plant one billion seeds a year.

In addition to cost and speed, the new technique offers a number of other advantages. Mapping technology is used to increase uptake rates and the likelihood of healthy forest development. Given that the planting is carried out by an aerial vehicle, terrain normally inaccessible by land-based approaches can now be reached. Pods are then fired into the ground by the drone, enabling the planting of a large number of trees in a short period of time. Each pod can be loaded with pre-germinated seeds and a nutritious hydro-gel, giving it all the minerals and moisture it needs to get started. The technology represents a significant departure from current tree-planting techniques, which include planting by hand and delivering dry seeds by air. Hand-planting is slow and expensive, while spreading dry seeds results in low uptake rates. It also presents an opportunity to help countries meet their environmental obligations. At the UN

Climate Summit in Paris, a commitment was made to restore 350million hectares of degraded and deforested land by 2030, and it is clear that traditional planting techniques will not be enough.

Eco-forestry is a move on saving the worlds forest. It acknowledges that sometimes, the use of trees for various human activities or reasons can be inevitable. But the eco-forestry underscores the need of cutting down trees in an environmentally friendly manner. It is where only cautiously selected trees are fell and transported with the least possible damage to the area. Also, eco-forestry not only calls for the preservation of the forest regions ecosystem but also allows for controlled and green timber extraction.

iii) **Community Forestry :** Community forestry is whereby local communities together with their local government and other local organisations such as schools, corporate, and universities join hands to start localised tree planting programs and management of their local forests. On various occasions such as public holidays, opening ceremonies, environment days, or other periodic localised activities, concerned local citizens can create awareness and plant trees. This can be done within the surrounding areas as a method of boosting environmental sustainability and keeping the local forests viable. All local learning institutions, hospitals, local government headquarters, and the rest of the community can ensure trees are planted and the local forests are protected against damage as a way of finding solutions to the deforestation menace.Replanting or tree planting utilises almost the same aspect as community forestry. However, it entirely focuses of replanting, a feature commonly known as reforestation. Reforestation is the restoration or replanting of forests that have been reduced by fire or felling. It requires an ongoing process and should not be viewed as a onetime thing.People, communities, governments, and organisations are all active actors. It involves selecting and dedicating large tracts of land mainly for the purpose of cultivating forests. For instance, in local communities and urban centers, it can be done around market areas, in game/wildlife reserves, or within city parks. Replanting, therefore, qualifies restorative measure of deforestation.

Community forest management is currently often championed as a way to benefit both local livelihoods and forest conservation. This is especially relevant in Indonesia, which still has some of the highest deforestation rates in the world, but is also increasingly recognising community forest rights. A 2012 decision of Indonesia's Constitutional Court and subsequent ministerial regulations in late 2014, oblige local governments to reallocate 12.7 million hectares of state forest to forest-dependent communities. To put this in perspective, this equals about 7 percent of the total land area of Indonesia, which makes it one of the largest social and environmental experiments in recent history. Two major assumptions underlie this Indonesian

experiment. The first assumption is that integrating communities into forest management will increase their social welfare. The second assumption is that communities are better land managers than the industrial operators that would otherwise log or clear forests. Both assumptions combined result in the untested premise that community-managed forests in Indonesia will have lower deforestation rates than forests under government or company management. To assist the Indonesian government in its decision-making, these assumptions are currently being tested through the Monitoring and Evaluation of Social Forestry program - MonitoringdanEvaluasiPerhutananSosial (MEPS). This program is funded by the UK-based Darwin Initiative and the Woodspring Trust, and implemented by a consortium of organisations, including the Durrell Institute of Conservation and Ecology at the University of Kent, Flora and Fauna International (FFI), The University of Queensland, the Indonesian Institute of Sciences (LIPI), and Borneo Futures.

UNDP-GEF (UNDP Global Environmental Finance) supports 69 countries through 89 projects in safeguarding forest biodiversity and ecosystems with financing exceeding US$449 million. The UNDP GEF Small Grants Programme (SGP) has supported more than 20,500 community based projects with an estimated 35 per cent of those (approximately 7,200 community projects) related to the protection, rehabilitation and sustainable use of forests ecosystems across the world. This portfolio comprises of US $200 million in grants and 268 million in co-financing. Agricultural commodity production is the leading cause of deforestation. UNDP's Green Commodities Programme (GCP) supports governments in key producer countries to rally stakeholders, including the private sector, around a common agenda aimed at placing sustainability at the heart of commodity production. GCP is now also linking these national sustainably efforts with global ones by leading the Good Growth Partnership, financed by GEF, which convenes a wide range of stakeholders and initiatives to create lasting, transformative change throughout three key global commodity supply chains: soy, beef and palm oil.

To reduce emissions from deforestation and forest degradation, UNDP assists countries to enact and implement policies and measures for REDD+, putting special emphasis on land, policy and governance reforms, on green commodities, as well as on the full and effective engagement of indigenous peoples and forest communities. UNDP manages a US$400 million portfolio of national REDD+ projects, working through a diverse network of institutions and partners, including: with FAO and UN Environment, the UN-REDD Programme in 64 countries; serving as delivery partner for the World Bank's Forest Carbon Partnership Facility in 7 countries; supporting bilateral investment programmes for REDD+ in 5 countries; managing the Community-Based REDD+ initiative in 6 countries; and hosting the Secretariat of the Central

African Forest Initiative (a financial platform with five donors) in 6 forest countries. UNDP also supports pioneer countries with leveraging REDD+ investments and finance - including through the Green Climate Fund. To help advance the global forest policy agenda, UNDP hosts the secretariat for the New York Declaration on Forests, and the United Nations Inter-Agency Task Force on Illicit Trade in Wildlife and Forest Products. UNDP's overall work in forests supports indigenous peoples and local communities to participate in global policy-making processes

iv) **Awareness Program :** The international community is working toward REDD+ (Reducing Emissions from Deforestation and Forest Degradation) in the United Nations Framework Convention on Climate Change, an effort to create a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development.

However, there are many concerns about REDD+ efforts, such as the possible negative impacts on economic growth, loss of national sovereignty and environmental integrity and the potential for large money flows to lead to misuse, corruption and displacement of people. In addition, the role of indigenous peoples in developing and applying REDD+ methodologies remain unresolved. It is critical that the REDD+ effort goes beyond deforestation and forest degradation to include the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks and biodiversity. With millions of community-based education initiatives and schools around the world, school and indigenous forest community involvement in reforestation and climate change education is an important way that the global education community can make a contribution to climate change mitigation efforts.

In the Dapaong region of northern Togo, the Earth Child Institute is working with community-based organisations to develop school-based tree nurseries that integrate education into the sub-national reforestation and agroforestry initiative. Teachers and students are empowered through these school-based nurseries to care for saplings for an initial three to five year period until they can be planted in the forest. In doing so, schools simultaneously function as a platform for reforestation and REDD+ efforts while instilling participatory learning, which fosters confidence and competence among children and youth. School-grown saplings sold to REDD+ projects can generate a sustainable source of funds for schools that can be used to improve learning environments and increase availability of scholarship funds. Moreover, by using strategic planting methods that correspond to the region, ecosystem-derived benefits such as the prevention of flooding and erosion and the promotion of biodiversity can be enhanced.

Similar programs in schools in Peru, Brazil, Ethiopia, Malawi and Fiji not only serve to combat climate change and improve livelihoods, but they also create an environmental consciousness in young people that will have future benefits. Students gain an understanding and appreciation for conservation and they also develop practical life-skills that promote sustainable development within their communities. The 2.2 billion young people under the age of 18 worldwide will be the ones that have to cope with the impacts of climate change. They can be powerful agents of change and research has shown that relevant education on climate change and disasters in a school environment can reduce their vulnerability and their community's vulnerability to disaster risk and contribute to sustainable development. The knowledge and actions of educated young people can go beyond the classroom to help their parents and communities. Children and youth can play a pivotal role here because the important school lessons they learn on climate change and disaster risk reduction is often shared with their communities.

By 2002 the pressure on Chilean forestry companies had mounted. The environmental NGO ForestEthics put advertisements in the New York Times that exhorted customers and retailers to pay attention to where their lumber and paper products were coming from. This featured a photo of a house amid a graveyard of stumps and fallen trunks. Underneath, it noted the beauty of "Chile's magical siempreverde (forever green) forests" - and the danger they faced. "Many of these forests are being destroyed and replaced with legions of non-native plantation trees to produce cheap wood products for American homes. The forever green forest may soon be forever gone." The campaign worked. "The Chilean timber industry got really terrified of what the ramifications might be for them," Heilmayr said. "And it shifted the conversation.".Feeling the pressure, retail giant Home Depot brought a few of the major Chilean timber producers together with environmental NGOs at its headquarters in Atlanta. The discussions culminated in what was called the Joint Solutions Project (JSP) in 2003. The logging companies agreed not to clear-cut natural forest for plantations on their properties.

v) **International Laws and Regulations :** Some of the international Regulations regarding deforestation are :

a) ‘‘The International Conference on Working across Sectors to Halt Deforestation and Increase Forest Area - from Aspiration to Action’’ is the first major technical conference on forests since the adoption of the 2030 Agenda for Sustainable Development and the first-ever United Nations Strategic Plan for Forests 2017-2030.As most of the drivers of deforestation lie outside the forest sector, the conference brings together officials from ministries from different sectors, including forestry, agriculture, livestock and environment, as well as the private sector, small producer organisations,

civil society, and indigenous peoples associations.The three-day event aims to promote dialogue across sectors and stakeholder groups on how to collectively achieve the globally agreed targets of halting deforestation and increasing forest cover.

Prior to the 2030 Agenda for Sustainable Development, the outcome document of the Rio+20 Conference, the Future We Want, in its paragraphs 193- 196 stress the importance of improving the livelihoods of people and communities by creating the conditions required to sustainably manage forests. It also recognises the role of the UN Forum on Forests in addressing forest-related issues in a holistic and integrated manner, and in promoting international policy coordination and cooperation in order to achieve forest management. Paragraph 196 calls for the mainstreaming of sustainable forest management and practises into economic policy and decision-making. Chapter 11 of Agenda 21 is entitled 'Combating Deforestation' and is devoted to sustain the multiple roles and functions of all types of forests, forest lands and woodlands.

On one side, the Agenda highlights the major weaknesses in the policies, methods and mechanisms adopted to support trees, forests and forest lands and the multiple ecological, economic, social and cultural roles.Therefore, on the other side, it identifies, among its objectives, the strengthening of forest-related national institutions, the enhancement of the scope and effectiveness of activities related to the management, conservation and sustainable development of forests, and the sustainable utilisation and production of forests' goods and services in both the developed and the developing countries. The Agenda also mentions the importance to improve human, technical and professional skills, as well as expertise and capabilities to effectively formulate and implement policies, plans, programmes, research and projects on management, conservation and sustainable development of all types of forests and forest-based resources, and forest lands inclusive, as well as other areas from which forest benefits can be derived.

b) The United Nations Strategic Plan for Forests 2017-2030 (UNSPF) provides a global framework for actions at all levels to sustainably manage all types of forests and trees outside forests and halt deforestation and forest degradation. The UNSPF also provides a framework for forest-related contributions to the implementation of the 2030 Agenda for Sustainable Development, the Paris Agreement adopted under the UN Framework Convention on Climate Change, the Convention on Biological Diversity, the UN Convention to Combat Desertification, the United Nations Forest Instrument (UNFI). Sustainable management of forests and trees outside forests is vital to integrated implementation of the 2030 Agenda for Sustainable Development, including achieving the Sustainable Development Goals (SDGs), especially SDG15 ("Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss"). The IAF (International Arrangment on Forest) is composed

of the United Nations Forum on Forests (UNFF), a functional commission of the UN Economic and Social Council, and its 197 Member States, the secretariat of the Forum, the Collaborative Partnership on Forests (CPF), the Global Forest Financing Facilitation Network (GFFFN) and the trust fund for the UNFF. The Forum is the UN body mandated to address forest-related issues in an integrated and holistic manner and oversees implementation of the UNSPF and the UNFI, as well as operation of the GFFFN. The objective of IAF is to promote the implementation of sustainable management of all types of forests, in particular the implementation of the UNFI and Forest Governance in order to achieve Sustainable Forest Management.

c) The forest-related goals proposed by the UN Forum on Forests and adopted by the UN General Assembly are:

1. **Global Forest Goal 1 :** Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change.
2. **Global Forest Goal 2 :** Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest dependent people.
3. **Global Forest Goal 3 :** Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products from sustainably managed forests.
4. **Global Forest Goal 4 :** Mobilise significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management and strengthen scientific and technical cooperation and partnerships.
5. **Global Forest Goal 5 :** Promote governance frameworks to implement sustainable forest management, including through the UN Forest Instrument, and enhance the contribution of forests to the 2030 Agenda.
6. **Global Forest Goal 6 :** Enhance cooperation, coordination, coherence and synergies on forest-related issues at all levels, including within the UN System and across Collaborative Partnership on Forests member organisations, as well as across sectors and relevant stakeholders.

d) The EU has many different types of forests, reflecting its geoclimatic diversity (boreal forests, alpine forests with conifers, etc.). Their distribution is mainly determined by climate, soil type, altitude and topography. Only 4% of the forested area has not been modified by human intervention. 8% consists of plantations, while the remainder falls into the category of 'semi-natural' forests, i.e. ones shaped by man. What is more, the majority of European forests are privately owned (approximately 60% of forested

land) rather than publicly owned (40%). In September 2013, the Commission adopted a new EU Forest Strategy {COM(2013) 0659}, proposing an EU reference framework to be used when drawing up sectoral policies that will have an impact on forests. The strategy's guiding principles are sustainable forest management and promotion of their multifunctional role, resource efficiency and the EU's global forest responsibility. It also sets out a strategic approach governing action by the Commission and the Member States. To give just one example, the Commission has undertaken to develop sustainable forest management criteria. In September 2015, it adopted the accompanying multi-annual implementation plan of the EU forest strategy {SWD(2013) 0343}. This so-called 'Forest MAP' draws up a list of the actions that are to be taken in response to challenges in the European timber sector. Some 90% of EU funding for forests comes from the European Agricultural Fund for Rural Development (EAFRD). During the last programming period, 2007-2013, approximately EUR 5.4 billion was allocated from the EAFRD budget to co-finance forestry measures. Following the most recent reform of the CAP, the new regulation on support for rural development by the EAFRD was published in December 2013 {Regulation (EU) No 1305/2013 3.2.6}. In the interests of simplification, over the period 2015-2020 a single specific measure includes all types of support for investment in forests. The measure covers investment in the development of forested areas and improvement of the viability of forests: afforestation and creation of woodland, establishment of agro-forestry systems, prevention and restoration of damage to forests from forest fires, natural disasters and catastrophic events, investment to improve the resilience and environmental value of forest ecosystems and investment in forestry technologies and in the processing, promotion and marketing of forest products. Another measure is intended to provide rewards for forestry, environmental and climate services and the conservation of forests. Provision has also been made for other measures not specific to forestry (Natura 2000 and Water Framework Directive payments, for example). It is up to Member States to select which forestry measures to implement, and to decide on the financing to be provided for them, as part of their rural development programmes. Some EUR 8.2 billion has been earmarked for the 2015-2020 period (27% for reforestation, 18% to make forests more resilient and 18% for damage prevention).

The marketing of forest reproductive material is regulated at EU level by Directive 1999/105/EC. The European plant health regime aims to prevent harmful organisms spreading to forests (Directive 2000/29/EC). The EU also helps fund forest research, in particular under the Horizon 2020 programme. It is also funding projects under the REDD+ Programme to reduce emissions linked to deforestation and forest degradation in Asia, Africa and Latin America. Finally, the Neighbourhood Policy can also be put to use: the FLEG II programme had EUR 9 million available for the period 2012-

2016 to promote good forestry governance, sustainable management of forests and forest protection in countries to the east of the EU. In response to the report on the implementation of the EU Forestry Strategy {COM(2005) 0084} for the period 1999-2004, Parliament re-emphasised the importance of this strategy and reiterated its support through its resolution of 16 February 2006 on the implementation of a European Union forestry strategy . In the same resolution, Parliament backed the implementation of an 'EU action plan for sustainable forest management' proposed by the Commission, suggesting a series of coherent and concrete objectives and measures in the various policy fields linked to forests. On 20 September 2013 the Commission presented its communication entitled 'A new EU Forest Strategy: for forests and the forest-based sector' , thus responding not only to increasing demands placed on forests, but also to significant societal and political changes. This recast was backed by the Council with its conclusions of 19 May 2014 and also by Parliament with its resolution of 28 April 2015 entitled 'A new EU Forest Strategy: for forests and the forest-based sector' . In this resolution, Parliament calls on the Commission to supplement the strategy with a robust action plan containing specific measures and to report back to it annually on the progress made in the implementation of specific actions under the strategy. Parliament also stressed that the implementation of the EU Forest Strategy should be a multiannual coordinated process. In Parliament's view, priority should be given to promoting the competitiveness and sustainability of the forest sector, supporting both rural and urban areas, expanding the knowledge base, protecting forests and preserving their ecosystems, improving coordination and communication and increasing the sustainable use of wood and non-wood forest products. The resulting 'Multi-annual Implementation Plan of the new EU Forest Strategy' (SWD(2015) 0164) was issued by the Commission on 3 September 2015. It lists a number of actions to ensure a coherent, coordinated approach to the various policies and initiatives relating to the forest sector, with the particular involvement of stakeholders. The so-called 'Forest MAP' provides a framework within which all new policies in any of the various areas relating to forests can be considered. The following eight priority areas cover the three pillars of sustainable forest management, namely social, economic and environmental: (1) supporting our rural and urban communities; (2) fostering the competitiveness and sustainability of forest-based industries, bioenergy and the wider green economy; (3) forests in a changing climate; (4) protecting forests and enhancing ecosystem services; (5) forest information and monitoring; (6) research and innovation; (7) working together; and (8) forests from a global perspective. It includes an annex with the concrete list of actions for the period 2014-2020, the actors, and the timing of the different activities, as well as the expected outcomes. The Commission also committed itself

to regularly informing Parliament and the Council on the progress being made under the EU Forest Strategy

e) Southeast Asia is known for its vast rainforests which constitute about almost 20 percent of forest cover with the richest biodiversity in the world. What the region is also known for is its alarming rate of deforestation. The region has the highest rate of deforestation of any major tropical region followed by Latin America and Africa. Deforestation is a major problem in the region with Indonesia leading the charts for forests clearing, followed by other hotspots such as Malaysia, Vietnam, Cambodia and Thailand. The forests in Southeast Asia are known to be a rich source of timber suitable for a variety of purposes, seeing as it is filled with tropical rainforests and diverse ecosystems. These forest resources are used as materials in the form of lumber products such as furniture, plywood, paper and pulp, or are used for energy in the form of wood fuel. Due to this, Southeast Asian countries are now faced with the problem of depleting their natural forest resources to meet global demands for timber. The ASEAN members have committed to the SDG (Sustainable Development Goals) and the UN Framework Convention on Climate Change to recognise the importance of forests in mitigating climate change. Some of the countries - Cambodia, Indonesia, Philippines and Vietnam are already REDD+ (Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries) partner countries. Hanoi Action Plan (1997-2004) and Vientiane Action Programme (2004-2010) guided the ASEAN co-operation in forestry with the mandate to enhance global competitiveness of ASEAN?s forestry products and to promote intra- and extra-ASEAN trade, and greater private sector investment in the forestry sector. In its Vision and Strategic Plan for ASEAN Co-operation in Food, Agriculture and Forestry (2016-2025), it has placed 7 Strategic Thrust areas. The are :

1. **Strategic Thrust 1 :** Enhance quantity and quality of production with sustainable, ‘‘green” technologies, resource management systems, and minimise pre- and post-harvest losses and waste;
2. **Strategic Thrust 2 :** Enhance trade facilitation, economic integration and market access;
3. **Strategic Thrust 3 :** Ensure food security, food safety, better nutrition and equitable distribution;
4. **Strategic Thrust 4 :** Increase resilience to climate change, natural disasters and other shocks;
5. **Strategic Thrust 5 :** Assist resource constrained small producers and SMEs to improve productivity, technology and product quality, to meet global market

standards and increase competitiveness in line with the ASEAN Policy Blueprint on SME Development;

6. **Strategic Thrust 6 :** Strengthen ASEAN joint approaches on international and regional issues; and
7. **Strategic Thrust 7 :** Promote sustainable forest management.

Indonesian Ministry of Forestry estimates that in recent years Indonesia has been losing 1.6-2.8 million hectares annually (equivalent to 3-5 hectares a minute) to illegal logging and land conversion due to a lack of effective management and law enforcement. This in turn has been contributing majorly to the greenhouse gas emissions affecting global climate change. Indonesia today is committed to implement a new regime to reduce emissions from deforestation and forest degradation (REDD), and is preparing for a fair, equitable and transparent REDD+ architecture. However, there are several risks and uncertainties that could undermine the REDD national response, such as corruption, fraud, crime and weak law enforcement response. UNODC in Indonesia is responding in several ways to assist Indonesia in preserving its forests. Below we have listed resource material on our work to protect the lungs of the world. Although Indonesia's forest law stipulates a penalty of up to 15 years in jail for buying, selling, or receiving illegal timber, offenders are more likely to receive light jail sentences or small fines. But still the Arrests of perpetrators have been carried out from time to time, but only a very small percentage of illegal logging cases have been effectively prosecuted.

f) SAARC : Environmental issues first found prominence in 1988 when a regional plan - "SAARC-2000-A Basic Needs Perspective" - was launched. It was to "supplement national, bilateral, regional and global efforts to deal with the increasingly serious problems being faced by the region" . While this was considered significant, nothing remarkable happened in terms of meaningful action with a wide regional focus. Internal tensions resulting from "geopolitical imbalances" among some member countries (India vs Pakistan, in particular) retarded progress and it took twenty years for the leaders to approve the "SAARC Convention on Cooperation on Environment" to tackle problems of climate change. Action plans and "expert" group proposals stressed policy direction and steering at the regional level and aimed at creating opportunities through cooperation of member states, technology and knowledge transfer from other developing countries and supporting the work of the United Nations on climate change. The critical importance of regular consultations among environmental management and pollution control agencies for a concerted response to the challenges of climate change and the integration of climate change adaptation (CCA) with disaster risk reduction (DRR) have been highlighted. Despite these, lack of progress

in meeting targets to maintain biodiversity in the region remains because of technical and financial constraints.

III.14.7 Case Study on Deforestation

Indonesia is located in Southeast Asia, with around 17,000 islands, and has many diverse forests there. In the 1900s, Indonesia used to have 84% of forests covering their land. However, in the 1970s, deforestation kept accelerating. From 170 million hectares of forest cover in 1900 to 98 million hectares of forests left in the 20th century, Indonesia has been rapidly losing much of its forests. Indonesia is ranked as one of the countries with the highest rate of deforestation in the world.

Around 1970, Indonesia used valuable resources from forests to benefit their economy. The country was developing a wood-processing industry. Since the 1980s, Indonesia has increased their production of pulp and paper industry by 700%. It is the 9th largest pulp producer, and 11th largest paper producer. Their success was because they used resources found in forests. However, because the demand kept increasing, getting the resources from the forests were getting more and more difficult. Because of this, cutting down forests kept increasing, resulting in the high rate of deforestation. Also, there are many plantations in Indonesia dedicated to palm oil and mining.

Illegal logging is a big contributor to deforestation in Indonesia. However, millions of people depend on that in order to receive income. Illegal logging is estimated to represent 73% of log production in Indonesia. It exists there because of political corruption. When President Suharto was ruling there for 30 years, forest resources were divided among families and business partners. This led to organised crime syndicates who were assisted by the military or police.

In addition to that, palm oil is also a factor of deforestation. When planted, it can produce fruit for up to 30 years, and provides jobs for many people. Indonesia is a top supplier of this oil. It is used for cooking, cosmetics and biofuel. However, it still causes the end of many forests there. Oil palm in Indonesia is a rapidly expanding industry for many agricultural smallholders. Since 1961, the area of agricultural landdedicated to oil palm plantations has increased from 3.6 million hectares to 8.1 million hectare , with many companies and members of the population realising the potential profits that can be gained from the product's high demand. Both state and private companies are investing in oil palm plantations, as well as local farmers who set up small holdings of the crop.The associated costs of palm oil production have huge negative implications on the environment, biodiversity and for indigenous peoples, and all of these costs manifest themselves in the plantations of Indonesia. Here, the

driver that links all of these affected areas is deforestation. Indonesia and Malaysia contain 80% of Southeast Asian forest . and 11% of the World's tropical rainforest, but as demand for palm oil continues to grow the amount of forest is decreasing. In Indonesia between 1990 and 2005 forest area declined by 28,072,000 hectares and 56% of this decline was the clearing of forests for conversion to oil palm plantations . This deforestation is a concern not only to the population of the country, but to a worldwide audience who are increasingly concerned about climate change issues and biodiversity decline.

With the clearing of tropical rainforests for the creation of oil palm plantations, comes a loss of a vital carbon sink. Tropical rainforests are responsible for storing 235 tons of Carbon per hectare, one of the most important carbon stores on the planet, whereas the palm oil plantations only amass 48 tons of carbon per hectare, a net loss of 187 tons of carbon per hectare which makes its way into the atmosphere accelerating the greenhouse effect . Not only is the clearing affecting atmospheric carbon concentrations in this way, but the slash and burn techniques to clear the tropical forests also contribute to greenhouse gas emissions. By burning the felled areas, high concentrations of carbon dioxide and methane are emitted. A study of these techniques in Brazil revealed an estimated 1,700 megatons of Carbon dioxide and 10 megatons of methane released into the atmosphere in 1987 alone . These are alarming figures considering the increase of oil palm production in Indonesia and a concern for the global population. Moreover, Indonesia is one of the most vulnerable countries to the associated outcomes of global climatic change: sea level rise could affect 94 million people by 2100; delayed monsoon could increase the frequency of drought in the country and with rising temperatures increases the amount of vector-borne diseases that could increasingly affect the Indonesian population. However, as the global demand for the product increases, Indonesia maintains the clearing of its forests to supply a global demand vital to boosting the country's economy.

Deforestation threatens ecosystems and biodiversity in Indonesia. Carbon emissions come out from deforestation, and is held accountable for 10%-30% of global carbon emissions. This can lead to climate change. Climate change can lead to serious, environmental changes. There will be a low water supply and more pollution. Deforestation also affects biodiversity. Biodiversity refers to different organisms in an area. When people cut down all these forests, they are also cutting down the homes to many animals living there. The orangutan is an animal that is at a high risk of becoming extinct. Already, this type of animal is already endangered. Over the last decade, there has been a 50% decline of the number of orangutans and rhinos in Indonesia. Because of human activity (logging, illegal logging, conversion of forests into plantations, etc.), the orangutan has been faced with the problem of survival.

Additionally, soil erosion is an effect of deforestation. Soil erosion is prevented by the roots of trees because they keep the topsoil in place. The roots of the trees hold the topsoil to the bedrock which helps prevent wind and water from blowing it away. Yet, because of deforestation, the roots of trees die and cannot hold the soil it could have held before. Because the soil is by itself, it is vulnerable to different substances. When soil is mixed with water, it creates mud which can lead to mudslides. In addition, loose soil cannot absorb as much water because there are no roots to absorb it which can increase flooding. So in a crux, a number of exogenic factors created the endogenic effect of Deforestation in Indonesia. The case study might have highlighted the crisis only in case of Indonesia, but such similar debacle is being faced by different countries all over the world in their own frame. So Deforestation is not a country or regional specific crisis, rather it is marked as a Global crisis.

14.8 Conclusion

The conclusion of crisis named Deforetstation can only be summarised as something which is not only increasing at an alarming rate. But this procasting disaster needs a Global attention in order to safeguard our own continued existence. J. R. R. Tolkein in his Lord of the Rings, used the sign of Tree to signify Life, which indeed signified the existence of wisdom, truth, life and a guardian. In one of its part the Eldest of Trees is a symbol of the throne of kings, and stands in the courtyard of the king in Gondor. The tree in the courtyard is dead-a symbol of evil times and the absence of the king from his seat. When Aragorn assumes the kingship he discovers a sapling of the ancient line of trees that was thought to be extinct, and uproots the dead tree and replaces it with the sapling. The prominence of Chipko Movement in 1973, when a group of women from Mandal village in the Himalayas in India ‘hugged’ trees in order to prevent them from being felled. When the loggers came, the women, led by Gaura Devi, surrounded the trees and chanted: "This forest is our mother's home; we will protect it with all our might". They told the loggers: "If the forest is cut, the soil will be washed away. Landslides and soil erosion will bring floods, which will destroy our fields and homes, our water sources will dry up, and all the other benefits we get from the forest will be finished". Their act against the State was imbuded with a belief for conservation of Tree, of an permanent economy and a symbiotic relation between Man and Nature.

III.14.9 Model Questions.

A. Answer in brief (5 Marks) :

a. What do you understand by Community Forest?

b. What is Slash and Burn process?

c. Who is known as Eco warrior by the Carnegie Institution's Department of Global Energy?

B. Answer in detail (10 Marks) :

d. Discuss the reason that results in claiming Deforestation as a Global crisis?

e. Discuss how Palm oil production, act as a catalyst of Deforestation in Indonesia?

f. Do you think that International platform can be used to foster the act of Conservation of Forest?

III.14.10 Suggested Readings

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IV : PLASTIC AND E-WASTE

Structure

IV.14.0 Objectives
IV.14.1 Introduction
IV.14.2 What is Plastic?
IV.14.3 Different Types of Plastic
IV.14.4 Plastic Pollution
IV.14.5 Effects of Plastic Pollution
IV.14.5.1 Impact on Marine Environment
IV.14.5.2 Health Effect
IV.14.5.3 Pollution of Different Types
IV.14.5.4 Beaches, Coasts, Sea Floor, Shorelines
IV.14.5.5 Effects on Economy
IV.14.6 Methods to Combat Plastic Pollution
IV.14.7 What is E-Waste
IV.14.8 Methods to Combat E-Waste
19.8.1 Leadership for E- Cycling
IV.14.9 Conclusion
IV.14.10 Model Questions
IV.14.11 Suggested Readings

IV.14.0 Objectives

- To have a detail understanding about Plastic as a cause of Pollution
- To understand what is E Waste in the world of E technology
- To understand this specific situation of Pollution through a case study, which emphasises both the aspect of pollution and the methods emphasising the legal methods to combat E-waste pollution.
- To have a comprehensive understanding of the methods to combat such pollution

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Unit 14\ 1sr Proof (12/03/2025)

IV.14.1 Introduction

This study is essentially an attempt to understand how Palstic and E-waste act as a catalyst in increasing Pollution. Plastic is synthetic or semisynthetic organic polymer. In other words, while other elements might be present, plastics always include carbon and hydrogen. While plastics may be made from just about any organic polymer, most industrial plastic is made from petrochemicals. Thermoplastics and thermosetting polymers are the two types of plastic. The name plastic refers to the property of plasticity, the ability to deform without breaking. While E-waste primarily means obsolete electronic devices. This two material at present compose a large share of the Pollution on the Earth surface. The UN data states that a staggering rate of 8 million plastic end up in the World Ocean every year. Along with that the expanding and improvising digitial world, is making disposal of E-waste a Global and public health issue. In 2009, discarded TVs, computers, peripherals (including printers, scanners, fax machines) mice, keyboards, and cell phones totaled about 2.37 million short tons. In a nutshell a change from the conventional method of creating Pollution is seen forth under the heading of Plastic and E-waste.

IV.14.2 What is Plastic?

The term ‘plastic’ is derived from the Greek word ‘plastikos’, meaning fit for moulding. This refers to the material's malleability, or plasticity during manufacture, which allows it to be cast, pressed, or extruded into a variety of shapes - such as films, fibres, plates, tubes, bottles, boxes, and much more. Plastics includes materials composed of various elements such as carbon, hydrogen, oxygen, nitrogen, chlorine, and sulfur. Plastics typically have high molecular weight, meaning each molecule can have thousands of atoms bound together. Naturally occurring materials, such as wood, horn and rosin, are also composed of molecules of high molecular weight. So basically Plastic is synthetic or semisynthetic organic polymer. In other words, while other elements may be present, plastics always include carbon and hydrogen. While plastics may be made from just about any organic polymer, most industrial plastic is made from petrochemicals.

The first synthetic polymer was invented in 1869 by John Wesley Hyatt, who was inspired by a New York firm's offer of $10,000 for anyone who could provide a substitute for ivory. The growing popularity of billiards had put a strain on the supply of natural ivory, obtained through the slaughter of wild elephants. By treating cellulose, derived from cotton fiber, with camphor, Hyatt discovered a plastic that could be crafted into a variety of shapes and made to imitate natural substances like tortoise shell, horn, linen, and ivory. This discovery was revolutionary. For the first time

human manufacturing was not constrained by the limits of nature. Nature only supplied so much wood, metal, stone, bone, tusk, and horn. But now humans could create new materials. This development helped not only people but also the environment. Advertisements praised celluloid as the savior of the elephant and the tortoise.

In 1907 Leo Baekeland invented Bakelite, the first fully synthetic plastic, meaning it contained no molecules found in nature. Baekeland had been searching for a synthetic substitute for shellac, a natural electrical insulator, to meet the needs of the rapidly electrifying United States. Bakelite was not only a good insulator; it was also durable, heat resistant, and, unlike celluloid, ideally suited for mechanical mass production. Marketed as ‘the material of a thousand uses,’ Bakelite could be shaped or moulded into almost anything, providing endless possibilities.Hyatt's and Baekeland's successes led major chemical companies to invest in the research and development of new polymers, and new plastics soon joined celluloid and Bakelite. While Hyatt and Baekeland had been searching for materials with specific properties, the new research programs sought new plastics for their own sake and worried about finding uses for them later.

World War II necessitated a great expansion of the plastics industry in the United States, as industrial might proved as important to victory as military success. The need to preserve scarce natural resources made the production of synthetic alternatives a priority and Plastics provided those substitutes. Nylon was invented by Wallace Carothers in 1935 as a synthetic silk, was used during the war for parachutes, ropes, body armour, helmet liners, and more. Plexiglas provided an alternative to glass for aircraft windows. A Time magazine article noted that because of the war, "plastics have been turned to new uses and the adaptability of plastics demonstrated all over again." During World War II plastic production in the United States increased by 300%.

The surge in plastic production continued after the war ended. After experiencing the Great Depression and then World War II, Americans were ready to spend again, and much of what they bought was made of plastic. According to author Susan Freinkel, "In product after product, market after market, plastics challenged traditional materials and won, taking the place of steel in cars, paper and glass in packaging, and wood in furniture." The possibilities of plastics gave some observers an almost utopian vision of a future with abundant material wealth thanks to an inexpensive, safe, sanitary substance that could be shaped by humans to their every whim.

The unblemished optimism about plastics didn't last. In the postwar years there was a shift in American perceptions as plastics were no longer seen as unambiguously positive. Plastic debris in the oceans was first observed in the 1960s, a decade in which Americans became increasingly aware of environmental problems. Rachel

Carson's 1962 book, Silent Spring, exposed the dangers of chemical pesticides. In 1969 a major oil spill occurred off the California coast and the polluted Cuyahoga River in Ohio caught fire, raising concerns about pollution. As awareness about environmental issues spread, the persistence of plastic waste began to trouble observers.Plastic also gradually became a word used to describe that which was cheap, flimsy, or fake. In one of the top movies of 1968, Dustin Hoffman's character was urged by an older acquaintance to make a career in plastics. Audiences cringed along with Hoffman at what they saw as misplaced enthusiasm for an industry that, rather than being full of possibilities, was a symbol of cheap conformity and superficiality.

IV.14.3 Different Type of Plastic

The properties of plastics depend on the chemical composition of the subunits, the arrangement of these subunits, and the processing method.

All plastics are polymers, but not all polymers are plastic. Plastic polymers consist of chains of linked subunits, called monomers. If identical monomers are joined, it forms a homopolymer. Different monomers link to form copolymers. Homopolymers and copolymers may be either straight chains or branched chains.

- Plastics are usually solids. They may be amorphous solids, crystalline solids, or semicrystalline solids (crystallites).
- Plastics are usually poor conductors of heat and electricity. Most are insulators with a high dielectric strength.
- Glassy polymers tend to be stiff (e.g., polystyrene). However, thin sheets of these polymers may be used as films (e.g., polyethylene).
- Nearly all plastics display elongation when they are stressed that is not recovered after the stress is removed. This is called "creep."
- Plastics tend to be durable, with a slow rate of degradation.

Plastic is any synthetic or semisynthetic organic polymer. In other words, while other elements may be present, plastics always include carbon and hydrogen. While plastics may be made from just about any organic polymer, most industrial plastic is made from petrochemicals. Thermoplastics and thermosetting polymers are the two types of plastic. The name ‘plastic’ refers to the property of plasticity, which is the ability to deform without breaking.

The polymer used to make a plastic is almost always mixed with additives, including colorants, plasticisers, stabilisers, fillers, and reinforcements. These additives affect the chemical composition, chemical properties, and mechanical properties of a plastic and also affect its cost.

Thermoplastics, can be heated and remoulded over and over again. Some thermoplastics are amorphous, while some have a partially crystalline structure. Thermoplastics typically have a molecular weight between 20,000 to 500,000 amu. You can make something like a plastic bottle by injecting hot, molten plastic into a mold, then letting it cool down. Your bottle stays solid, but if you heat it up again later, it'll soften and melt. We say it's made from a thermoplastic: something that becomes plastic (soft and flexible) when it meets thermal energy (heat). In a thermoplastic, the long polymer molecules are joined to one another by very weak bonds, which easily break apart when we heat them, and quickly reform again when we take the heat away. That's why thermoplastics are easy to melt down and recycle. Some everyday examples you will have come across are polyethylene/polythene (plastic bottles and sheets), polystyrene (crumbly white packaging material), polypropylene (plastic ropes), polyvinylchloride/PVC (toys and credit cards), polycarbonate (hard plastic windows and car headlamps), and polyamide (nylon-used in everything from stockings and swimming shorts to toothbrushes and umbrellas).

Thermosetting polymers is also known as thermosets, which solidify into a permanent shape. They are amorphous and considered to have infinite molecular weight. Thermosets are usually made from much much bigger polymer chains than thermoplastics. When they are initially manufactured, they are heated or compressed to form a dense, hard, structure with strong cross-links binding each of these long molecular chains to its neighbors. That's very different from thermoplastics, where the polymer chains are held to one another only by very weak bonds. And that is why we can not simply heat thermosets to remould or reform them. Once they're "set" (cured) during manufacture, they stay that way. You will be less familiar with thermosets than with thermoplastics; even so, you may have come across examples like polyurethane (insulating material in buildings), polytetrafluoroethylene/PTFE (nonstick coatings on cooking pots and pans), melamine (hard plastic crockery), and epoxy resin (a tough plastic used in strong adhesives and woodfillers).

Apart from this we can split them into natural (ones easily obtained from plants and animals) and synthetic (ones artificially made by complex chemical processes in a factory or lab). Cellulose is a natural polymer used for making sticky tape (among other things), whereas nylon is a synthetic polymer made in a factory. When it comes to recycling, we need to separate plastics into different kinds that can be processed together without causing contamination. That depends on their chemical properties, physical properties, and the polymer types from which they're made, and gives us seven main kinds. (You've probably noticed seven different recycling symbols numbered 1-6 and ‘null’ on plastic packaging, if you've looked carefully.

IV.14.4 Plastic Pollution

Plastic is polymeric material, that is, a material whose molecules are very large, often resembling long chains made up of a seemingly endless series of interconnected links. Natural polymers such as rubber and silk exist in abundance, but nature's "plastics" have not been implicated in environmental pollution, because they do not persist in the environment. Today, however, the average consumer comes into daily contact with all kinds of plastic materials that have been developed specifically to defeat natural decay processes-materials derived mainly from petroleum that can be moulded, cast, spun, or applied as a coating. Since synthetic plastics are largely nonbiodegradable, they tend to persist in natural environments. Moreover, many lightweight single-use plastic products and packaging materials, which account for approximately 50 percent of all plastics produced, are not deposited in containers for subsequent removal to landfills, recycling centres, or incinerators. Instead, they are improperly disposed of at or near the location where they end their usefulness to the consumer.

On the same lineage researchers estimated that more than 8.3 billion tonnes of plastic has been produced since the early 1950s. About 60% of that plastic has ended up in either a landfill or the natural environment. Since the 1950s, the rate of plastic production has grown faster than that of any other material. We have also seen a shift away from the production of durable plastic, and towards plastics that are meant to be thrown away after a single use. More than 99% of plastics are produced from chemicals derived from oil, natural gas and coal - all of which are dirty, non-renewable resources. If current trends continue, by 2050 the plastic industry could account for 20% of the world's total oil consumption.

These single-use plastic products are everywhere and for many of us, they have become integral to our daily lives. Only 9% of all plastic waste ever produced has been recycled. About 12% has been incinerated, while the rest - 79% - has accumulated in landfills, dumps or the natural environment. Cigarette butts - whose filters contain tiny plastic fibres - were the most common type of plastic waste found in the environment in a recent global survey. Drink bottles, bottle caps, food wrappers, grocery bags, drink lids, straws and stirrers were the next most common items. Many of us use these products every day, without even thinking about where they might end up.

The United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution estimates that land-based sources account for up to 80% of the world's marine pollution and that anywhere from 60% to 95% of ocean debris is made of plastic. The sources of land-based plastic pollution are extremely diverse-but the

majority enters as large pieces of plastic trash such as bottles and caps, bags, containers, and packaging. And the smaller pieces, called micro plastics, come from many sources including synthetic textiles, personal care products, and vehicle tyre dust.Plastic never goes away, even biodegradable plastic. Rather, it breaks down into smaller and smaller pieces through exposure to the elements. It is the smaller pieces and micro plastics that may pose the most risk to wildlife as they are easily mistaken for food by fish and birds. Researchers in Australia estimate that nearly all seabirds have eaten plastic at some point. There are certain causes that can be highlighted which make Plastic one of the central cause of Pollution.

a) **Usage :** Plastic is everywhere, even on those items you may not expect it to be. Milk cartons are lined with plastic, water bottles are handed out everywhere, and some products may even contain tiny plastic beads. Every time one of these items gets thrown away or washed down a sink, the toxic pollutants have more of a chance to enter the environment and do harm.

Commercial fishing is an economic necessity for many parts of the world, and tons of people eat fish for their daily survival. However, this industry has helped contribute to the problem of plastics pollution in the oceans in several ways. The nets used for certain large-scale trolling operations are usually made of plastic. First, these spend long times submerged in water, leaking toxins at will, but they also often get broken up or lost, left to remain wherever they fall. This not only kills and harms local wildlife, but also ensures that pollutants enter the water and fish of the area.

b) **Photodegradation Vs. Biodegradation :** Plastic is generally a durable material. Its durability has made the culprit of the problem since it is considered resistant to natural biodegradation processes, i.e. the microbes that break down other substances do not recognise plastic as food. Yet plastic can be fragmented with the effects of UV, being broken down by light in smaller and smaller debris over time.

Biodegradation, the breaking down of organic substances by natural means, happens all the time in nature. All plant-based, animal-based, or natural mineral-based substances will over time biodegrade. In its natural state raw crude oil will biodegrade, but man-made petrochemical compounds made from oil, such as plastic, will not. Why not? Because plastic is a combination of elements extracted from crude oil then re-mixed up by men in white coats. Because these combinations are man made they are unknown to nature. Consequently, it has been thought that there is no natural system to break them down. The enzymes and the micro organisms responsible for breaking down organic materials that occur naturally such as plants, dead animals, rocks and minerals, do not recognise them. This means that plastic products are said indestructible, in a biodegradable sense at least. In sum, as time passes, we know that plastic will eventually photo-degrade, i.e. break down into smaller and smaller fragments by

exposure to the sun. The photo-degradation process continues down to the molecular level, yet photo-degraded plastic remains a polymer. No matter how small the pieces, they are still and always will be plastic, i.e. they are not absorbed into or changed by natural processes. At sea, the plastic fragmentation process occurs as well, due to wave, sand action, and oxidation. Estimates for plastic degradation at sea has been ranged from 450 to 1,000 years.

Of particular concern are the floating small plastic fragments often referred in the media to as mermaids' tears, which are tiny nurdles of raw plastic resin that form the building material of every manufactured plastic product, or are granules of domestic waste that have fragmented over the years.Dr Richard Thompson of the University of Plymouth, UK has identified plastic particles thinner than the diameter of a human hair. But while they cannot be seen, those pieces are still there and are still plastic. Not absorbed into the natural system, they just float around within it. He estimates that there are 100,000 particles of plastic per sq km of seabed and 300,000 items of plastic per sq km of sea surface.

c) **Toxic Sponge :** Plastic resin pellets are round, shiny and tiny, mostly less than 5mm in diameter. The very structure of the plastic material is oily and greasy (basically plastics are solid oil) therefore promoting the accumulation of hydrophobic contaminants (ones that tend to repel and not absorb water) from the surrounding seawater. Chemicals like PCB's and DDE are very hydrophobic. It was shown that plastic pellets suck up these dangerous persistent organic pollutants (POPs) and toxins with a concentration factor that's almost 1 million times greater compared to the overall concentration of the chemicals in seawater. In other words, waterborne hydrophobic pollutants do collect and magnify on the surface of plastic debris, thus making plastic far more deadly in the ocean than it would be on land.

These findings, published in the Marine Pollution Bulletin, were based on samples gathered from 30 beaches in 17 countries. PCB (Polychlorinated biphenyls) pollutant concentrations on plastic pellet were highest on US coasts, followed by Western Europe and Japan. The highest concentrations of DDT (Dichlorodiphenyltrichloroethane), the most toxic of all pesticides, were found on the US west coast and Vietnam.Plastic marine debris, thought to be "indestructible", "lasting forever", has been shown to decompose faster than previously thought, under unexpected conditions (in the water and at sea temperature) and, most importantly, releasing toxic substances not found in the natural element: seawater.

d) **Decompose :** Since plastics belong to a chemical family of high polymers, they are essentially made up of a long chain of molecules containing repeated units of carbon atoms. Because of this inherent molecular stability (high molecular weight), plastics do not easily breakdown into simpler components. Plastics do decompose,

though not fully, over a very long period of time (in average 100 to 500 years). Commercially available plastics (polyolefins like polyethylene, polypropylene, etc.) have been further made resistant to decomposition by means of additional stabilizers like antioxidants. Thus, unless the plastic is specially designed to decompose in the soil, such materials can last a very long time because the chemical bonds that hold the molecules together are often stronger than nature's power to take them apart. This means that soil microorganisms that can easily attack and decompose things like wood and other formerly living materials cannot break the various kinds of strong bonds that are common to most plastics. This depends upon the plastic (polymer) and the environment to which it is exposed. Until Dr. Saido's report, no studies had been conducted on plastic decomposition at low temperature in the marine environment, owing to the mistaken conception that plastic does practically not decompose in such condition. In the first study to look at what happens over the years to the billions of pounds of plastic waste drifting in the world's oceans, researchers, lead by Katsuhiko Saido, PhD, reported that plastic does "decompose with surprising speed (as little as a year) and release potentially toxic substances into the water."

These findings were reported on August 19, 2009, at the 238th National Meeting of the American Chemical Society (ACS). The scientists there termed the discovery "surprising."Dr. Saido described a new method to simulate the breakdown of plastic products at low temperatures (30º Celsius, 86º F), such as those found in some oceans. David Barnes, marine ecologist from the British Antarctic Survey, expressed that the Japanese's team lab results cannot be applied uniformly across the ocean. However, even though the decomposition process would not occur in much cooler seawater as Barnes mentioned, the oceans are vast, currents are constant and permanent, nothing stays static and furthermore, it seems that garbage patches where plastics accumulate, are to be found in even greater dimension in the South Gyres, in the tropical and sub tropical zones with very warm waters. One of the researchers stated: "Even at 30 degrees Celsius, the plastic decomposes. In natural conditions, the tide comes in and sunlight heats the plastics [which increases decomposition]."Plastics are not metabolised subsequent to ingestion since they are polymers. On the other hand, low molecular compounds such as PS oligomer or BPA from plastic decomposition are toxic and can be metabolised!

Samples of sea sand and seawater collected from Europe, India, Japan and the Pacific Ocean were found to be contaminated, with up to 150 parts per million of some of these components of plastic decomposition.

"Plastics in daily use are generally assumed to be quite stable," said study lead researcher Katsuhiko Saido, Ph.D. "We found that plastic in the ocean actually decomposes as it is exposed to the rain and sun and other environmental conditions,

giving rise to yet another source of global contamination that will continue into the future."This latest study clearly shows new micro-pollution by compounds generated by plastic decomposition to be taking place out of sight in the ocean, leaching toxic chemicals such as BisphenolA (BPA) and derivatives of polystyrene.Even though present in seawater and sands, the pollutants are found in highest concentration in areas heavily littered with plastic debris, such as ocean vortices, which bring us to define more specifically the notion of gyres and "garbage patches".

IV.14.5 Effects of Plastic Pollution

IV.14.5.1 Impact on Marine Environment

The most visible and disturbing impacts of marine plastics are the ingestion, suffocation and entanglement of hundreds of marine species. Marine wildlife such as seabirds, whales, fishes and turtles, mistake plastic waste for prey, and most die of starvation as their stomachs are filled with plastic debris. They also suffer from lacerations, infections, reduced ability to swim, and internal injuries. Floating plastics also contribute to the spread of invasive marine organisms and bacteria, which disrupt ecosystems. Invisible plastic has been identified in tap water, beer, salt and are present in all samples collected in the world's oceans, including the Arctic. Several chemicals used in the production of plastic materials are known to be carcinogenic and to interfere with the body's endocrine system, causing developmental, reproductive, neurological, and immune disorders in both humans and wildlife.

Toxic contaminants also accumulate on the surface of plastic materials as a result of prolonged exposure to seawater. When marine organisms ingest plastic debris, these contaminants enter their digestive systems, and overtime accumulate in the food web. The transfer of contaminants between marine species and humans through consumption of seafood has been identified as a health hazard, but has not yet been adequately researched. In a 2006 report, Plastic Debris in the World's Oceans, Greenpeace stated that at least 267 different species are known to have suffered from entanglement and ingestion of plastic debris. The National Oceanographic and Atmospheric Administration said that plastic debris kills an estimated 100,000 marine mammals annually, millions of birds and fishes.

The largest pieces of marine plastic debris, miles long discarded fishing nets and lines mostly, take an obvious toll on animals. These derelicts nets, called ghost nets, snare and drown thousands of larger sea creatures per year, such as seals, sea lions, dolphins, sea turtles, sharks, dugons, crocodiles, seabirds, crabs, and other creatures. Acting as designed, these nets restrict movement causing starvation, laceration,

infection, and, in animals that need to return to the surface to breathe, suffocation. On shores, researchers have also watched in horror as hungry turtles wolf down jellyfish-like plastic bags and seabirds mistake old lighters and toothbrushes for fish, choking when they try to regurgitate the plastic trash for their starving chicks. In the waters, plastic bags specifically, can be mistaken as food and consumed by a wide range of marine species, especially those that consume jellyfish or squid, which look similar when floating in the water column.

Albatross and others birds are choosing plastic pieces because of their similarity to their own food as well. Captain Moore and his Alguita team noticed that albatrosses and tropicbirds are circling above the line of trash. With little else to choose, they were obviously eating plastic. The birds seemed to be picking and choosing "the reds and pinks and browns. Anything that looks like shrimp," Moore says. Earlier in the trip, the Alguita had visited the French Frigate Shoals, off Hawaii, home to endangered monk seals and seabird rookeries. In the birds' gullets researchers found red plastic particles. Greenpeace reported that a staggering 80 percent of seabird populations observed worldwide have ingested plastics. Research into the stomach contents of dead Fulmars from the Netherlands, between 1982 and 2001, found that 96 percent of the birds had plastic fragments in their stomachs with an average of 23 plastic pieces per bird. When plastic ingestion occurs, it blocks the digestive tract, gets lodged in animals windpipes cutting airflow causing suffocation, or fills the stomach, resulting in malnutrition, starvation and potentially death. Indeed, it is found that debris often accumulates in the animals' gut and give a false sense of fullness, causing the animal to stop eating and slowly starve to death. In April 2002 a dead Minke whale washed up on the Normandy coast in France. An investigation found that its stomach contained 800 kg of plasticbags .

In February 2004, a Cuviers Beaked whale (Ziphiuscavirostris) was found washed ashore on the west coast of the Isle of Mull, Scotland. Cuviers beaked whales are rarely seen in coastal waters, as they are predominantly a deep-water species. The Hebridean Whale and Dolphin Trust took various skin and blubber samples and removed the stomach for further study by the Scottish Agricultural College. On initial removal it was found that the entrance to the stomach was completely blocked with a cylinder of tightly packed shredded black plastic bin liner bags and fishing twine. It is believed that this made it difficult for the animal to forage and feed effectively.50 to 80 percent of sea turtles found dead are known to have ingested plastic marine debris.

A. **Food chain :** In a September press conference, Doug Woodring from Project Kaisei, said that assessments of the impact of plastic debris on phytoplankton, zooplankton, and mesopelagic (midwater) fishes are undergoing. The samples collected

from the seawater will be subject to more scientific studies for the toxicity of the plastics and how this is really affecting our food chain (in ways that are only just becoming known… and not good ways). Katsuhiko Saido, Ph.D said, "We found that plastic in the ocean actually decomposes (…) giving rise to yet another source of global contamination that will continue into the future." Furthermore, as Saido added: "We are concerned that plastic pollution is also caused by these invisible materials and that it will harm marine life." While the potential toxicity of these tiny plastic constituents is still understudied for much of marine life, plastics are abundant in many forms. Plastics, including polystyrene, are common in the wads of accumulated, undigested matter that young black-footed albatrosses cough up before they fledge.

Whether plastics present a unanimously accepted and proven toxic challenge to marine life, and subsequently to humans, is one of the biggest challenges facing scientists right now.

IV.14.5.2. Health Effect

The decomposition of polystyrene plastics vests a simple reality where Bisphenol A (BPA) has been shown and proven to interfere with the reproductive systems of animals. PS oligomer and BPA from plastic decomposition are toxic and can be metabolised, while styrene monomer is a suspected carcinogen. Low levels of BPA and PS oligomer have been proven to cause hormone disruption in animals.

More scientific reports are being published on the effects of Bisphenol A on animal and human health, and the news is not good. In 2009, a professional, international medical organisation in the field of endocrinology and metabolism, the Endocrine Society, reported data from new research on animals experimentally treated with BPA. Studies presented at the group's annual meeting show BPA can affect the hearts of women, can permanently damage the DNA of mice, and appear to be entering the human body from a variety of unknown sources. A 2005 study, which analysed BPA serum concentrations, concluded that "exposure to BPA is associated with recurrent miscarriage".

The first major study of health effects on humans associated with bisphenolA exposure was published in September 2008 by Iain Lang and colleagues in the Journal of American Association. The cross-sectional study of almost 1,500 people assessed exposure to bisphenol A by looking at levels of the chemical in urine. The authors found that higher bisphenol A levels were significantly associated with heart diseases, diabetes, and abnormally high levels of certain liver enzymes.

A 2008 scientific review concluded that "prenatal exposure to (…) low doses of BPA alters breast development and increases breast cancer risk". The 2009 scientific review, funded by the ‘Breast Cancer Fund’, has recommended "a federal ban on the

manufacture, distribution and sale of consumer products containing bisphenol A". The 2009 study on urinary concentrations concluded that prenatal BPA exposure might be associated with externalising behaviours in two-year old children, especially among female children.

The 2009 study on Chinese workers in BPA factories found that workers were four times more likely to report erectile dysfunction, reduced sexual desire, and overall dissatisfaction with their sex life than workers in factories that made products ranging from textiles to machinery, in which there was no heightened BPA exposure. They were also more likely to report reduced sexual function within one year of beginning employment at the factory, and the higher the exposure, the more likely they were to have sexual difficulties.

In 2009 review of available studies has concluded, "Prenatal BPA exposure acts to exert persistent effects on body weight and adiposity." Along with that scientific review about environmental chemicals and thyroid function concluded, "Available evidence suggests that governing agencies need to regulate the use of thyroid-disrupting chemicals, particularly as such uses relate exposures of pregnant women, neonates and small children to the agents". The review summarised BPA adverse effects on thyroid hormone action. All sea creatures, from the largest to the microscopic organisms are, at one point or another, swallowing the seawater soup instilled with toxic chemicals from plastic decomposition. Much of ocean's life is in the microscopic size range and zooplankton is the base of the food chain.

IV.14.5.3 Pollution of Different Types

Plastics wastes have resulted in the destruction and decline in quality of the earth's land surfaces in term of use, landscape and ability to support life forms. Mainly, it's because plastics leach hazardous chemicals on land, forms breeding grounds for diseases, and litters available space thereby reducing the productive land areas. The bulk of plastics also end up in the landfills and since they take years to breakdown they heap up causing significant health implications to plants, people, and animals within the surrounding. This indeed leads to Land Pollution.

It also creates air and ground water Pollution when plastics are burned in the open air. It is because of the poisonous chemicals that are released into the atmosphere during combustion. When animals or humans inhale the polluted air it can affect their general well-being and cause respiratory disorders. Whenever plastics are dumped in landfills, the hazardous chemicals present in them seep underground when it rains. The leaching chemicals and toxic elements infiltrate into the aquifers and water table, indirectly affecting groundwater quality. Eventually, it thwarts the efforts of water conservation around the world since it endangers the sustainability of the waters.

In relation to this it also acts as the catalyst of water Pollution Many lakes and oceans have reported alarming cases of plastic debris floating on water surfaces, affecting a great number of aquatic creatures. It leads to dreadful consequences to marine creatures that swallow the toxic chemicals. Besides, the hazardous plastic chemicals contaminate water and reduce its quality. Estimations reveal the existence of billions of tons of plastics in swirling convergences constituting about 40% of the globe's oceanic surfaces. In 2014, UN report estimated the annual impact of plastic pollution on oceans at US$ 13 billion. Other numerous water surfaces across the globe have thousands of tons of floating plastic debris and are experiencing similar economic impacts. A study revealed that 20 rivers (mostly from Asia) carry two-thirds of plastic waste to the ocean; the Ganga's contribution to this is one of the highest.

IV.14.5.4 Beaches, Coasts, Sea Floor, Shorelines

Blatantly visible is the plastic spill washing up on the shores and beaches. Just a walk on any beach, anywhere in the world, and plastic debris are found in one form or another. All over the world the statistics are ever growing, just staggeringly. Last year, an estimated 150,000 tons of marine plastic debris washed up onto the shores of Japan and 300 tons a day on India's shores.The Hawaiian Archipelago, extending from the southernmost island of Hawaii 1,500 miles northwest to Kure Atoll, is among the longest and most remote island chains in the world. The 19 islands of the archipelago, including Midway atolls, receive massive quantities of plastic debris, shot out from the Pacific gyres. Some of the plastic litter is decades old. Some beaches are buried under 5 to 10 feet of plastic trash, while other beaches are riddled with ‘plastic sand,’ millions of grain-like pieces of plastic that are practically impossible to clean up. One of the reasons marine debris accumulates in these islands is the movement of debris within the North Pacific Subtropical Convergence Zone (STCZ), as we have explained supra. It's been reported by Greenpeace that an estimated 70 percent of the mass of fragmented plastic present in the open oceans of the world does sink to the deep-sea bed. A limited body of literature exists, though, concerning these small to microscopic particles (micro debris) mirroring the little research addressed to marine litter on the sea floor.

It also has an effect on Coral Reef since it is an animal even though they may exhibit some of the characteristics of plants and are often mistaken for rocks. In scientific classification, corals fall under the phylum Cnidaria and the class Anthozoa. They are relatives of jellyfish and anemones. (NOAA) Nets and lines become snagged on coral and subsequent wave action causes coral heads to break off at points where the debris was attached. Once freed, debris can again snag on more coral and the whole process is repeated. This cycle continues until the debris is removed or becomes

weighted down with enough broken coral to sink . Eventually, derelict fishing gear may become incorporated into the reef structure. Plastic bags can kill coral by covering and suffocating them, or by blocking sunlight needed by the coral to survive. During 2001, so many plastic bags were regularly seen in the Gulf of Aqaba, off the coast of Jordan, that the Board of Aqaba Special Economic Zone issued a law banning the production, distribution, and trade of plastic bags within the areas under their jurisdiction.

IV.14.5.5 Effect on Economy

Scattered plastics at the beaches or on dumpsites/towers/traffic lights/poles within cities usually portray a very bad picture of the respective regions and depict environmental insensitivity. Winds may also carry the plastics to other areas, increasing plastic littering. As a result, tourism to such areas is affected leading to loss of tourism revenue. Furthermore, millions of money are spent annually to clean regions littered or affected by plastic pollution. Hundreds of endangered marine creatures such as the sea turtles are lost on a yearly basis for having consumed pieces of plastic. Humans are as well extensively affected by the health implications of plastic pollution whereas plants continue to decline due to plastic chemical intoxication.

In a 2007 Fortune Magazine in the article about India, it was written that the costs of river pollution to the economy are enormous. Waterborne diseases are India's leading cause of childhood mortality. Shreekant Gupta, a professor at the Delhi School of Economics who specialises in the environment, estimates that lost productivity from death and disease resulting from river pollution and other environmental damage is equivalent to about 4 percent of gross domestic product.

The bill for cleaning the beaches in Bohuslän, on the west coast of Sweden, in just one year was reportedly at least 10 million SEK or $1,550,200. In Britain, Shetland fishermen reported that 92 per cent of them had recurring problems with debris in nets, with each boat losing between $10,500 and $53,300 per year as a result of marine litter. The cost to the local industry could be as high as $4,300,000. The municipality of Ventanillas in Peru has calculated that it would have to invest around $400,000 a year in order to clean its coastline, while its annual budget for cleaning all public areas is only half that amount. Our Oceans and coastlines are under unprecedented plastics waste attack. It's coming back at us in many ways. It's a dire problem that only received serious scientific and public attention in the early 90's, as we know, but all along the perpetrators have simply and clearly been identified.

IV.14.6 Methods to Combat Plastic Pollution

The easiest and most obvious way to eliminate plastic in the future is to stop buying products featuring any plastic at all - however, 'cold turkey-ing' plastic products is not necessarily convenient or practical and people are still heavily reluctant to the idea. Nevertheless, countries like France and Kenya are phasing out single-use plastics by banning the use of plastic ware, plates, and cups. Infractions with plastic products are being heavily fined and could lead to jail time. Discussions are also being made to ban single-use plastic products across all of Europe as well.

The European Commission is calling to ban all single-use plastics in a bid to rid the ocean of plastics. In a report recently released by the Commision, they claim "The legislation is not just about banning plastic products. It also wants to make plastic producers bear the cost of waste management and cleanup efforts, and it proposes that EU states must collect 90% of single-use plastic bottles by 2025 through new recycling programs. The European Commission estimates that these rules, once fully implemented in 2030, could cost businesses over €3 billion ($3.5 billion) per year. But they could also save consumers about €6.5 billion ($7.6 billion) per year, create 30,000 jobs, and avoid €22 billion ($25.6 billion) in environmental damage and cleanup costs."

Even a Somalian terrorist group is allegedly banning plastic bags - it would appear some parts of the world are attempting to at least partly reduce plastic waste and cleanse the plastic world Earth has become. But it will take much more than eliminating and reducing the use of plastic to rid the world of its plastic woes.There are still 8.3 billion tons of plastic around the world, much of which can be expected to be or has already been disposed of in an overfilled dump or carelessly thrown into the environment. But there is hope for salvation; new technologies are being developed to cleanse the oceans of plastic, and new lifeforms and organisms are being discovered and engineered to decompose the plastic which already exists.

Some innovative methods that are being drawn up by different countries to solve the crisis are- First, in a small town on a tiny island off Panama, residents are taking on the plastic problem themselves by transforming plastic bottles into eco-friendly and stylish buildings. The plastic bottle village is transforming one man's trash into another's condo. The man leading the project, Canadian born RoberBezue, developed the project after becoming fed up with cleaning bottles, sometimes years old, off of the island's beaches. Determined to find a resolution, Bezue developed a way to transform plastic bottles into a building. Construction promptly began, and the small village was aptly dubbed the Plastic Bottle Village. The buildings are remarkably efficient, keeping the house nearly 35 degrees cooler than the surrounding Panamanian Jungle. Moreover, one house can consume and lock away more than 20,000 bottles.

The bottles are stuffed in between wire mesh and act as both insulation and a structural component. The final step involves covering the walls with concrete. Unfortunately, plastic bottles are not the only type of plastic plaguing the world's waterways and beaches - plastic bags. Like bottles, they too are used and thrown out long before the product is no longer usable. And, just like bottles, once in the environment plastic bags also never truly go away - that is, unless they are transformed into fuel.

Secondly, Japanese inventor Akinori Ito, has developed a proclaimed household appliance which converts plastic bags into fuel.Through a realisation, plastic bags are nothing than processed crude oil, Ito wondered what it would take to convert plastic bags into their original form. The process is remarkably efficient - just one kilogram of plastic can produce approximately one litre of oil. The conversion process requires approximately 1 kWh of electricity, which is worth approximately 20 cents (depending on location). In a world with exponentially rising petrol rates, recycling plastic into oil may be a viable and profitable approach to creating an alternative fuel. Although the solution is not without its downfalls - the trade-off is transforming one pollutant into another. However, it can be argued oil will continue to be used for many years to come, and that oil may as well come from a product which would otherwise remain in the environment for many decades yet.

Thirdly, ReDeTec has developed the world's first and the only system which can recycle plastic waste into a new filament, then use it to print entirely new objects. The printer, called the ProtoCycler, can be loaded with a variety of plastics such as empty bottles and rejected 3D-printed models where it grinds down recycled plastic into digestible pieces before melting and extruding out spools of plastic filament to be used on the next project. "ProtoCycler is the only extruder on the market to feature an included grinder. Recycle your 3D printer waste, and make it back into filament."

Fourthly on political level Countries around the world are phasing out the thin plastic bags given out in stores. Bangladesh, Rwanda, China, Taiwan, Macedonia, Gambia, Mali, Morocco, Niger, Tanzania and Sri Lanka and other countries have totally banned them. Many European Union countries impose a fee on plastic bags. And while there is no national ban or fee on bags in the U.S., California, American Samoa and Puerto Rico have banned plastic bags; more than 200 counties and municipalities have also banned bags or imposed fees for using them.

Attorney Jennie Romer founded PlasticBagLaws.org as a resource for cities, states and communities that want to institute plastic bag bans. Romer has found that hybrid bans are the most effective-those that ban thin plastic carryout bags and also impose a charge for paper or any other bags. She explained that with a straight bag ban that only outlaws the carryout plastic bag, consumers often switch to paper bags or thicker plastic bags that qualify as reusable. Even a small bag fee, however, dramatically

changes consumer behaviour and has resulted in an overall drop in bag consumption. For example, in San Jose, the hybrid ban model with a 10-cent charge for paper bags led to an increase in reusable bag use from 4 percent to 62 percent. 500 million straws are used each day in the U.S. Malibu, Miami Beach, San Luis Obispo, Fort Myers and numerous restaurants have stopped giving out straws unless customers specifically request them. As a result of the Strawless in Seattle campaign, Seattle too will ban straws in July, which could reduce straw use by a million a month. Inspired by Seattle, residents of Santa Fe are starting a Strawless Santa Fe campaign. Surfrider's Straws Suck campaign encourages consumers to identify businesses that use straws by taking a photo of the plastic item and posting it to Twitter or Instagram.

British prime minister Theresa May has proposed a ban on all single-use plastic items in the U.K., including straws and cotton swabs, by early 2019. Iceland Foods, a British supermarket chain specialising in frozen foods, has promised to do away with plastic packaging for its own brand by the end of 2023, and instead use recyclable paper or pulp packaging. Ekoplaza, a Dutch supermarket chain, has created the first plastic-free supermarket aisle with 700 items that use no plastic packaging. The products carry the Plastic Free Mark, a new label that enables consumers to more easily choose plastic-free products. The products will be packaged in compostable bio-materials, cardboard, glass and metal.

Fifthly, on an individual and society level ninety percent of the plastic items in our daily lives are used once and then chucked: grocery bags, plastic wrap, disposable cutlery, straws, coffee-cup lids. Not only that each year, close to 20 billion plastic bottles are tossed in the trash. In case of recycle less than 14 percent of plastic packaging is recycled. Confused about what can and can not go in the bin?

For example in India on June 5, 2018 government offices in Kerala made the switch to ink pens and steel cutlery to ensure articles like plastic water bottles, disposable teacups and plastic carry bags are no longer used across the office premises. Mooted by the Suchitwa Mission and HarithaKeralam Mission, the idea envisioned by the concerned authorities was to make government departments set an example for a clean environment. The step can be easily emulated across not just government offices but also corporates and private organisations while paving the way for an environment-friendly work culture. Along with this Sikkim is the second smallest state in the country, and therefore, it had no scope for the creation of multiple landfill sites. In 1998, it became the first Indian state to ban disposable plastic bags, and in 2016, it took a significant step by banning the use of packaged drinking water in government offices and government events and the use of Styrofoam and thermocol disposable plates and cutlery across the entire state. Along with that the brilliant initiative helmed by Kerala's Suchitwa Mission, 28 fishermen from the

Neendakaraharbour have been engaged in not just finding fish but also plastic that either gets stuck in the fishing nets or floats in the sea. In last 10 months since the project was launched, they have managed to recover 25 tonnes of plastic waste.

IV.14.7 What is E-waste?

Electronic waste, or e-waste, is a term for electronic products that have become unwanted, non-working or obsolete, and have essentially reached the end of their useful life. Because technology advances at such a high rate, many electronic devices become "trash" after a few short years of use. In fact, whole categories of old electronic items contribute to e-waste such as VCRs being replaced by DVD players, and DVD players being replaced by blu-ray players. E-waste is created from anything electronic: computers, TVs, monitors, cell phones, PDAs, VCRs, CD players, fax machines, printers, etc.

Obsolete electronic devices are rapidly filling the landfills of the globe. In the US alone, more than 100 million computers are thrown away with less than 20% being recycled properly. Most electronics that are improperly thrown away contain some form of harmful materials such as beryllium, cadmium, mercury and lead. These materials might be trace elements, but when added up in volume, the threat to the environment is significant. Besides adding harmful elements to the environment, improper disposal of e-waste is a recycling opportunity lost. Almost all electronic waste contains some form of recyclable material, including plastic, glass and metals. In India, the lack of an updated inventory of e-waste generated makes it difficult to quantify the e-waste recycled and disposed. According to the Central Pollution Control Board's comprehensive inventory from 2005, India was to generate 0.8 million tonne of e-waste by 2010.However, a few independent studies suggest that the generation of e-waste could be much higher. The Global E-Waste Monitor, 2017 published by the United Nations University estimated that India generates about 2 million metric tonnes of e-waste (2016) annually. Nearly 82 per cent of this is personal devices.

India is ranked 5th in the world among top e-waste producing countries-USA, China, Japan and Germany. "The large increase (in total e-waste generation of the world) was mainly attributed to India," said the report. An ASSOCHAM-KPMG study, Electronic Waste Management in India identified computer equipment account for almost 70 per cent of e-waste, followed by telecommunication equipment-phones (12 per cent), electrical equipment (8 per cent) and medical equipment (7 per cent) with remaining from household e-waste. United Nations predicts that by 2020 e-waste from old computers in South Africa and China will have jumped by 200-400 % and by 500 % in India compared to 2007 levels. It also states that by 2020 e-waste from

discarded cell phones will be increased to 7 times than 2007 in China and 18 times in India. This report also mentions that in the United States more than 150 million mobiles and pagers were sold in 2008, up from 90 million five years before, and globally more than 1 billion mobile phones were sold in 2007, up from 896 million in 2006. The UN report estimates that countries like Senegal and Uganda can expect e-waste flows from personal computers alone to increase 4 to 8-fold by 2020.

The Electrical and electronic equipments contain several hazardous materials which are injurious to human health and the environment if not managed to recycle properly. Most of the electronic parts contain toxic chemicals. When dead computers are placed in landfills, burned, or improperly recycled, toxic chemicals presented in the electronic parts are released into the air, water and soil. The most dangerous chemical in technologic devices is lead which is used in soldering of circuit boards. It causes problems to the human body, nervous system, kidneys, liver and child development. It can cause retardation and high blood pressure. The harmful materials such as lead, cadmium, chromium, brominated flame retardants or polychlorinated biphenyls (PCBs), from inhalation of toxic fumes, as well as from accumulation of chemicals in soil, water and food. In addition to its hazardous components, being processed, e-waste can give rise to a number of toxic by-products likely to affect human health. Furthermore, recycling activities such as dismantling of electrical equipment may potentially bear an increased risk of injury.

Children are especially vulnerable to the health risks that may result from e-waste exposure and, therefore, need more specific protection. As they are still growing, children's intake of air, water and food in proportion to their weight is significantly increased compared to adults, - and with that, the risk of hazardous chemical absorption. Furthermore, their bodies' functional systems such as the central nervous, immune, reproductive and digestive system are still developing and exposure to toxic substances, by hampering further development, may cause irreversible damage. Many children are exposed to e-waste-derived chemicals in their daily life due to unsafe recycling activities that are often conducted at their home- either by family members or by the children themselves. Furthermore, children may be exposed through dump sites located close to their homes, schools and play areas. During the last few years, various international calls for action have highlighted the need of strategic interventions in the field of e-waste. These include the Libreville Declaration emanating from the first Inter-Ministerial Conference on Health and Environment in Africa 2008, the Busan Pledge for Action on Children's Environmental Health of 2009 and the Strategic Approach to Integrated Chemical Management's expanded Global Plan of Action issued at the International Conference on Chemical Management ICCM3 in 2012. Currently, there are a number of international initiatives that are addressing global e-

waste management and trade concerns, as well as issues with environmental pollution due to e-waste.

Together with its collaborating partners, WHO is working at identifying the main sources and potential health risks of e-waste exposures and defining successful interventions. Initial support is being provided by the United States Environmental Protection Agency (US EPA), the United States' National Institute of Environmental Health Sciences (NIEHS) and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. WHO has recently launched the E-Waste and Child Health Initiative aiming at protecting children and their families from detrimental health consequences due to e-waste. Science Daily brings our attention to a new study published in Environmental Research Letters that took air samples from Taizhou of Zhejiang province in China -- one of the largest dismantling areas in the country that uses 60,000 people to dismantle over two million tons of e-waste annually and explored how the chemicals found in that air affects human lungs.

The researchers found that e-waste pollution in the air, that workers in these e-waste dumps breath in constantly, cause inflammation and stress that lead to heart disease, DNA damage and possibly even cancer.After exposing the cultured lung cells to the organic-soluble and water-soluble constituents of the samples, the researchers tested for the level of Interleukin-8, a key mediator of inflammatory response, and Reactive Oxygen Species (ROS), chemically reactive molecules that can cause extensive damage in excess.The samples were also tested for the expression of the p53 gene -- a tumour suppressor gene that produces a protein to help counteract cell damage. If there is evidence of this gene being expressed it can be seen as a marker that cell damage is taking place.The results showed that the samples of pollutants caused significant increases in both IL-8 and ROS levels — indicators of an inflammatory response and oxidative stress respectively. Significant increases were also observed in the levels of the p53 protein with the risk of organic-soluble pollutants being much higher than water-soluble pollutants. Other pollutions are

a) **The impact of E-waste on Air :**

Burning e-waste can be used as a disposal method but can also be a way to get to valuable metals such as copper. The problem with this method is that burning can also release pollutants into the air. For instance–when computer monitors and other electronics are burned, they create cancer-producing dioxins that are then released into the air.

b) **The impact of E-waste on water :**

Remember those contaminants we mentioned before? Some of those are heavy metals - Lead, barium, mercury and also lithium (found in mobile phone and computer

batteries). When these heavy metals are improperly handled or disposed of via landfill, they can leak into the soil and eventually the groundwater. Picture the groundwater as the first domino waiting to fall. The heavy metals then make their way from the groundwater into streams then ponds, lakes, and rivers. These heavy metals make the water tables toxic and unusable for the communities, animals, and plants that rely on them.

c) **The impact of E-waste on soil :**

Though soil is the pathway on which heavy metals find water, it does not go unaffected by these harmful contaminants. E-waste has a very negative impact on the Soil-Crop-Food Pathway. The Soil-Crop-Food Pathway is exactly as it sounds - crops grow in the soil and food comes from the crops. When the soil is contaminated by heavy metals via e-waste the crops, and the food they provide, are also contaminated. This causes many of the illnesses mentioned above and restricts viable farmland for clean food production.

IV.14.8 Methods to Combat E-Waste.

Some naturally occurring substances are harmless in nature but their use in the manufacture of electronic equipment often results in compounds which are hazardous, for example chromium becomes chromium VI. According to current trend e-waste travel large distances to developing countries, where rudimentary techniques or the backyard methods are implied to extract precious metals or recycle parts for further use. But this disposal is hazardous to health of the poorly protected workers and communities in the vicinity. E waste amounts to 40 million tons per annum, which is enough to fill a line of dump trucks stretching half way around the globe.

This whole process cannot be placed down certain headings. A more specific and detail analysis is undertaken below

a. **Legislative Process :** In Europe, legislation has been drafted to deal with the problem, including the Waste from Electrical and Electronic Equipment (WEEE) Directive and the Basel Convention. In the United States, initiatives have mostly come from the private sector, such as eBay's Rethink project.

Extended producer responsibility requires companies that make products to be responsible for the management and disposal of them at the end of their lives. The idea is to turn waste materials into a resource for producing new products. The New York State Electronic Equipment Recycling and Reuse Act requires manufacturers to provide consumers with free and convenient e-waste recycling. Hong Kong, a prime dumping ground for U.S. e-waste and a huge producer of e-waste itself, deals with 77,000 tons of e-waste yearly (80 percent of which is sent to Africa and Southeast

Asia for recycling). It has just instituted a producer responsibility system that will require suppliers and sellers of electronic products to pay for the free removal, collection, handling and proper disposal of items. China's largest internet company, Baidu, and the United Nations Development Programme developed a smartphone app called Baidu Recycle. Chinese users can indicate the item they want to recycle, enter its size, the date it's to be picked up along with their name and address, then submit a photo of it. Within 24 hours, an accredited recycler comes to pick it up. In two months, 11,000 devices were recycled.

Nicholas Themelis, professor emeritus of earth and environmental engineering and director of the Earth Engineering Center at Columbia University, said that the best and only economical large-scale recycling being done in North America today uses a copper smelter in Canada. He explained that when e-waste is fed into the copper smelter, precious metals like silver, gold, platinum, palladium, selenium, and others dissolve in molten copper, which acts like a solvent at high temperatures. The impure copper (because it comprises other metals) that results is then sent to a refinery where pure copper is separated out and the other valuable metals can be collected. This integrated smelting process combined with refining, though it recovers only metals that dissolve in copper, is a relatively inexpensive method of reclaiming e-waste metals. The smelter, in Rouyn-Noranda, Quebec, receives about 50,000 tons of e-waste each year. "The model of Noranda with a small [e-waste] collection company in the U.S. and a larger one in Canada and a big smelter, could be done in other countries," said Themelis. "It could be done in China which already has copper smelters, as well as in America.".

In India On 1 October 2016, the newly launched E-waste (Management) Rules 2016 replaced the existing E-waste (Management and Handling) Rules, 2011. The concept of Extended Producer Responsibility (EPR) mandated producers of electrical and electronic equipment to register and specified targets to collect back e-waste generated and to ensure that it is channelised to authorised recyclers. In March 2018, the E-waste (Management) Amended Rules reduced the target to 10 per cent for 2016-17 (as against 20 per cent), 20 per cent for 2017-18 (remains same). This target progressively goes up to 70 per cent in the seventh year.

The penalty and punishment for non-compliance were the same as sections 15, 16 of the Environment (Protection) Act, 1986. The sections specify an imprisonment term that may extend to five years or a fine which may extend to Rs 1 lakh would be the penalty for non-compliance. EPR authorisation has been provided to 726 producers by the Central Pollution Control Board (CPCB) as on 12 October 2018. The authorisation, which is valid for a period of five years from the date of issue, specifies the collection targets for the specified time (five years).

a) **Awarness :** The companies and enterprises to realise their obligation towards e-waste disposal. This can be done through proactive employee engagement activities. Sustainability teams, CSR (Community Service Responsibility) teams and HR teams should work in tandem to promote such activities and incentivise employees.

The common thread here is awareness. Companies and individuals should take it upon themselves to educate people about the hazards of e-waste and illegal recycling. Even enterprises that are not themselves categorised as bulk consumers should contribute towards activities that deliver awareness to the major e-waste contributors. A concerted effort is needed to convert e-trash to cash. While profit can of course be a great motivator, the problem of e-waste can only be fully tackled when all parties come together with a common vision of helping the environment. The e-waste problem is real, but it is not irreversible. What the planet needs is a future where recyclers buy back electronics, manufacturers use second-generation materials and consumers get rid of e-waste responsibly. Planet Green is part of the solution by remanufacturing ink cartridges. These remanufactured ink cartridges are just as good as their original-brand counterparts–the average ink cartridge can be re-manufactured up to four times. This keeps tons of plastic, metals and toxic chemicals out of landfills.

IV.14.8.1 Leadership for E-Cycling

i. Apple :

- Creating compact, efficient products that require less material to produce
- They use arsenic-free glass and recyclable high-grade aluminum
- All e-waste is processed in the region it was collected (nothing is shipped overseas for recycling or disposal)
- Recycling programs have been instituted in cities and on college campuses in 95 percent of the countries where Apple products are sold. This alone has diverted more than 130.2 million pounds of equipment from landfills since 1994
- Apple operates a number of free Takeback and recycling programs

ii. Best Buy :

- Collects and recycles products in store at all 1100+ locations no matter where the item was purchased
- Non-Best Buy branded TVs (less than 32-inches) and monitors are accepted for a $10 fee that is offset by a $10 Best Buy gift card
- Best Buy offers a TV haul-away service when a new product is delivered

– They offer a Tech Trade-In program that compensates consumers with gift cards for valuable products

In early 2011, Best Buy stores nationwide collected nearly 400 pounds of recyclable electronics every minute.

iii. Dell (Dell Reconnect) :

– Dell Reconnect has formed a partnership with Goodwill Industries International that lets consumers drop off used computers for free recycling

– Since 2004, Reconnect has diverted more than 96 million pounds of electronic waste from landfills while creating roughly 250 "green jobs"

– Some donations are resold

– Devices needing repair are either refurbished or broken down into parts to be recycled by Dell partners

– Dell Reconnect does more than recycle. Reconnect supports Goodwill's job training programs, employment placement services, and various community-based programs for people who have disabilities, lack education or job experience, or face other challenges to finding employment

iv. HP :

– HP has been recycling computer electronics since 1987

– They currently operate recycling services in 56 countries and territories worldwide

– They launched a U.S. buyback program in 2009

– In 2009 they recycled more than 200 million pounds of hardware globally

v. LG :

– LG allows consumers to drop off unwanted electronics at any Waste Management designated E-Cycling Center

– LG has recycled more than 7 million pounds since 2009

vi. Nintendo of America:

– Because Nintendo gaming systems and games retain their value past their lifecycle, Nintendo of America offers a variety of customer support options to maximise their continued use

– They offer a free Takeback program that provides recycling of their hardware, software, accessories, and rechargeable batteries

vii. Panasonic, Sharp and Toshiba : (Electronic Manufacturers Recycling Management Company, LLC or MRM):

- As of 2008 these three leading electronics brands were the first to create a Product Stewardship Organisation to manage collection and recycling programs in the United States
- The goal of the MRM is the creation of a national recycling infrastructure that provides convenient recycling opportunities to consumers for used electronic products
- The MRM provides compliance services to manufacturers in states with recycling requirements
- The MRM operates a nationwide collection and recycling service for brands produced by Panasonic, Sharp, Toshiba, Mitsubishi and Vizio
- MRM has established 840 collection sites across the U.S. and has recycled more than 78 million pounds of electronics since October of 2007

viii. Samsung (Samsung Recycling Direct) :

- Samsung Recycling Direct provides drop-off locations in all 50 states
- Samsung Recycling Direct was founded on the principles of the protection of people, the environment and developing countries through responsible management of materials
- Samsung holds its recyclers accountable for environmentally responsible recycling in the way of no landfill, incineration, or export of hazardous electronic waste to developing countries

ix. Sony :

- Sony's Takeback recycling program was the first to pair a major electronics manufacturer with a national waste management company
- Sony has established a goal of collecting a pound of electronics for every pound it produces since 2007
- As of 2014, Sony has collected and recycled more than 43 million pounds of electronics.

The recent scenario of E Waste Management in India- Laws to manage E-waste have been in place in India since 2011, mandating that only authorised dismantlers and recyclers collect e waste. E-waste (Management) Rules, 2016 was enacted on October 1, 2017. Over 21 products (Schedule-I) were included under the purview of the rule.The rule also extended its purview to components or consumables or parts or spares of Electrical and Electronic Equipment (EEE), along with their products. The rule has strengthened the Extended Producer Responsibility (EPR), which is the global best practice to ensure the take-back of the end-of-life products.

A new arrangement called Producer Responsibility Organisation (PRO) has been introduced to strengthen EPR further. The producers have to meet targets, which should be 20 per cent of the waste generated by their sales. This will increase by 10 per cent annually for the next five years. The law also says that the responsibility of producers is not confined to waste collection, but also to ensure that the waste reaches the authorised recycler/dismantler. E-waste is growing at a compound annual growth rate (CAGR) of about 30 per cent in the country. ASSOCHAM, one of the apex trade associations of India, estimated that e-waste generation was 1.8 MT per annum in 2016 and would reach 5.2 MT per annum by 2020. The Ministry of Electronics and Information Technology (MeitY) has initiated an e-waste awareness programme under Digital India, along with industry associations from 2015, to create awareness among the public about the hazards of e-waste recycling by the unorganised sector, and to educate them about alternate methods of disposing their e-waste.

The programme stresses the need for adopting environment friendly e-waste recycling practices. The programme has adopted the best practices for e-waste recycling available globally, so that this sector could generate jobs as well as viable business prospects for locals. The programme also stresses the need for adopting environmentally friendly e-waste recycling practices. The general public is also encouraged to participate in 'Swachh Digital Bharat', by giving their e-waste to authorised recyclers only.It has adopted the best practices for e-waste recycling available globally, so that this sector could generate jobs as well as viable business prospects for locals. In the initial phase of the programme, a city each in the 10 identified states (namely Madhya Pradesh, Uttar Pradesh, Jharkhand, Orissa, Goa, Bihar, Pondicherry, West Bengal, Assam and Manipur) are being covered. The stakeholders involved are schools, colleges, Residents' Welfare Associations (RWAs), bulk consumers, regulatory bodies, and the media.

So far, a total of 1,23,087 participants from schools, colleges, RWAs, manufacturers, refurbishers, informal operators to 2273 government officials have participated in various cities. A dedicated website (www.greene.gov.in), Twitter handle and Facebook page have been created in order to spread awareness through social media. Besides, 'E-Waste Mass Awareness Campaign through Cinema' has also been initiated for awareness amongst the youth. An audience of nearly 7.6 crores has been covered in around 815 theatres. The second phase has been initiated, with 20 more states, including Andhra Pradesh, Andaman and Nicobar Islands, Chhattisgarh, Daman and Diu, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Lakshadweep, Maharashtra, Meghalaya, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura and Uttarakhand.

The MeitY has developed affordable technologies to recycle valuable materials and plastics in an environmentally sound manner, including two exclusive PCB recycling

technologies, viz 1000 kg/ day capacity (~35 MT e-waste) and 100kg/batch (~3.5MT e-waste) processes, with acceptable environmental norms.The 1000kg PCB/day continuous process plant would be suitable for creating an eco-park in the country, whereas, the 100kg PCB/batch process plant would be suitable for the informal sector. This could be done by upgrading and transforming the present state of affairs of informal sectors. E-waste also contains plastic, up to nearly 25% of its weight. Novel recovery and conversion of e-waste plastics to value-added products have also been successfully developed. The developed process is capable of converting a majority (76%) of the waste plastics into suitable materials, which could be used for virgin plastic products. The technology has already been transferred for commercialisation. The 1000kg PCB/day continuous process plant would be suitable for creating an eco-park in the country, whereas, the 100kg PCB/batch process plant would be suitable for the informal sector. This could be done by upgrading and transforming the present state of affairs of informal sectors to semi-formal units, with acceptable environmentally robust operations. This transformation would definitely attract more informal units to upgrade their operations for healthy, hygienic, legally acceptable livelihoods. The regulator would also then be empowered to implement the rule more stringently and close down the remaining illegal informal operations. This revolution in the country would be able to concentrate feedstock at some designated places, presently scattered across various informal sectors, which are actually demotivating the state-of-the-art recycling industry to set up their units in the country.

Union Minister for Environment, Forest and Climate Change, Dr. Harsh Vardhan has said that the Government has amended the E-waste (Management) Rules in a move to facilitate and effectively implement the environmentally sound management of e-waste in India. Dr. Vardhan highlighted that the amendment in rules has been done with the objective of channelising the E-waste generated in the country towards authorised dismantlers and recyclers in order to formalise the e-waste recycling sector. He pointed out that the collection targets under the provision of Extended Producer Responsibility (EPR) in the Rules have been revised and targets have been introduced for new producers who have started their sales operations recently.

IV.14.9 Conclusion

The condition of Pollution has risen to such a level on the Global scale, that the concluding statement of every discussion on the subject ends with a notion of caution, precaution and steps that are necessitated from our end to reduce the scale of the Pollution. In the above discussion Plastic and E waste were stated as the source of the Pollution. Along with that the methods to combat such pollution was also discussed forth. But what is necessary is to have strong legal framework, acting as a monitor

both on the corporate and individual self to counter such source of Pollution. We have to be a part of the solution to the Pollution, rather than acting as a catalyst of the Pollution. The survival of Mother Earth is append to our Survival.

IV.14.10 Model Questions.

A. Answer in brief (5 Marks) :

i. What are the different types of Plastic?

ii. What are the reason for the rsisng E waste?

B. Answer in detail (10 Marks) :

iii. Discuss the effects of Plastic pollution with suitable data and examples.

iv. Do you think that technological advancement acts as a catalyst in increasing Pollution level in the Environment.

v. Write a case study on the E Waste management.

vi. Discuss the aspect of PhotodegenerationvsBiodegeneration.

IV.14.11 Suggested Readings

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V : MEDICAL WASTE, POLLUTION AND HEALTH RISK

Structure

V.14.0 Objectives
V.14.1 Introduction
V.14.2 Explanation of Medical Waste
V.14.3 Types and Sources of Medical Waste
V.14.4 Effects of Medical Waste
V.14.5 Medical Waste Management
V.14.6 Conclusion
V.14.7 Model Questions
V.14.8 Suggested Readings

V.14.0 Objectives

- To have an understanding of what is meant by Medical Waste
- A detail analysis of the categorisation of Medical Waste
- A wider understanding of the effects of Medical Waste
- Different ways of managing Medical Waste–from treatment to chemical and biological methods

V.14.1 Introduction

The United States Code defines medical waste as "Isolation wastes; infectious agents; human blood and blood products; pathological wastes; sharps; body parts; contaminated bedding; surgical waste and potentially contaminated laboratory wastes; dialysis wastes; and such additional medical items as the Administrator shall prescribe by regulation." The below study is a detailed analysis of the nature, source and categorisation of Medical Waste. Along with that, the study also emphasises how Medical Waste acts as a catalyst for creating Pollution. The study ends with a frame of understanding the way of managing the medical waste in order to stop the contamination of the environment.

V.14.2 Explanation of Medical Waste

Medical waste is defined as: potentially infectious waste materials generated at health care facilities, such as hospitals, clinics, physician's offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories.

The Medical Waste tracking Act of 1988 defines medical waste as "any solid waste that is generated in the diagnosis, treatment, or immunisation of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals."

It is also defined as Biomedical Waste which means any kind of waste containing infectious (or potentially infectious) materials. It may also include waste associated with the generation of biomedical waste that visually appears to be of medical or laboratory origin (e.g., packaging, unused bandages, infusion kits, etc.), as well as research laboratory waste containing biomolecules or organisms that are mainly restricted from environmental release. As detailed below, discarded sharps are considered biomedical waste whether they are contaminated or not, due to the possibility of being contaminated with blood and their propensity to cause injury when not properly contained and disposed of. Biomedical waste is a type of biowaste which may be solid or liquid. The examples of infectious waste include discarded blood, sharps, unwanted microbiological cultures and stocks, identifiable body parts (including those as a result of amputation), other human or animal tissue, used bandages and dressings, discarded gloves, other medical supplies that may have been in contact with blood and body fluids, and laboratory waste that exhibits the characteristics described above. Waste sharps include potentially contaminated used (and unused discarded) needles, scalpels, lancets and other devices capable of penetrating skin. It is generated from biological and medical sources and activities, such as the diagnosis, prevention or treatment of diseases. Common generators (or producers) of biomedical waste include hospitals, health clinics, nursing homes, emergency medical services, medical research laboratories, offices of physicians, dentists, and veterinarians, home health care, and morgues or funeral homes. In healthcare facilities (i.e., hospitals, clinics, doctor's offices, veterinary hospitals and clinical laboratories), waste with these characteristics may alternatively be called medical or clinical waste.

Biomedical waste is distinct from normal trash or general waste, and differs from other types of hazardous waste, such as chemical, radioactive, universal or industrial waste. Medical facilities generate waste of hazardous chemicals and radioactive materials. While such wastes are normally not infectious, they require proper disposal. Some wastes are considered multihazardous, such as tissue samples preserved in formalin.

V.14.3 Types and Sources of Medical Waste

Individual states define regulated medical waste (RMW). The Department of Transportation (DOT), Environmental Protection Agency (EPA), United States Postal Service (USPS), and Occupational Safety and Health Administration (OSHA) all have their definitions of regulated medical waste management based on the specific agency's jurisdiction. For example, the EPA in transport, is concerned about the treatment and disposal of such waste, and individual states can cover all the above regarding their own state.

While the term "medical waste" refers to any waste resulting from medical diagnosis, treatment, or research, very little of that waste is regulated. OSHA and other regulatory agencies use the term "regulated medical waste" to describe medical waste that "contains enough blood or other potentially infectious materials (OPIM) to potentially spread bloodborne pathogens." OPIM is defined as certain body fluids, other than blood, that could contain enough of a bloodborne pathogen to cause infection if transmitted through non-intact skin, mucous membranes, or punctures. These body fluids (OPIM) include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluids that are visibly contaminated with blood, all body fluids in situations where it is difficult or impossible to differentiate between body fluids, and any unfixed human tissue or organ from a human.

There are seven types of regulated medical waste are most commonly subjected to state regulation.

a) **Contaminated sharps waste:** Items that can induce subdermal inoculation of infectious agents or that can easily penetrate the skin, puncture waste bags and cardboard boxes, sharps that have been used or are intended to be used in human or animal patient care or in medical, research, or industrial laboratories, including hypodermic needles, syringes, Pasteur pipettes, capillary tubes, broken glass from the laboratory including slides and slide covers, razor blades, and scalpel blades.Sharps require special handling and packaging but there is a confusion as to on whether needleless injection devices, heel lancers and retractable or needles destruction technologies are considered as sharps as well.

b) **Pathological and anatomical waste:** All human anatomical wastes and all wastes that are human tissues, organs, or body parts removed by trauma, during surgery, autopsy, studies, or any other hospital procedure, which is intended for disposal. It is important to understand the distinction between anatomical and pathological waste. While both are wastes derived from the human body, pathological wastes are unique in that these are typically samples of tissues that are examined in

a laboratory setting to understand the nature of the disease or affliction from which a patient suffers. For the most part, pathological waste refers to very small tissue sections and body material derived from biopsies or surgical procedures that are then examined in the lab. Anatomical wastes are typically distinguished as recognisable human organs, tissue and body parts, and may require special treatment under some state regulations; though some states do not consider hair, teeth and nails to be pathological/anatomical waste.

c) **Microbiological waste :** It includes discarded cultures, culture dishes and devices used to transfer, inoculate and mix cultures, stocks, specimens, live and attenuated vaccines and associated items if they are likely to contain organisms likely to be pathogenic to healthy humans. Discarded etiologic agents and wastes from the production of biological and antibiotics are likely to have been contaminated by organisms which are pathogenic to healthy humans. Waste that originates from clinical or research laboratory procedures involving communicable infectious agents.

Microbiological waste that is also considered a 'sharp', should be managed first and foremost as a 'sharp'. Recent federal regulations require healthcare facility laboratories to maintain the capability of destroying discarded cultures and stocks on-site if these laboratories isolate from a clinical specimen any micro-organism or toxin identified as a 'select agent' from a clinical specimen.

d) **Blood, blood products, and OPIM:** Bulk waste like human blood, human blood components or products derived from blood including serum, plasma and other blood components, or bulk human body fluids as defined by OSHA to include the following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visually contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids. This category includes sample of these fluids taken in hematology labs, as well as drainage from surgery, and urine or faeces when visibly contaminated by blood.

e) **Contaminated items:** Items that would release blood or OPIM in a liquid or semi-liquid state if compressed (e.g., blood-soaked gauze) and items that are caked with dried blood or OPIM and can release these materials during handling (e.g., blood-soaked gauze that has dried and the blood could flake off and bloody gloves or other items that have not absorbed the blood) are also regulated.

f) **Isolation waste:** Isolation wastes are wastes from patients infected with highly communicable diseases such as Ebola, Marburg, and other diseases. According to the CDC, they include biological waste and discarded materials contaminated with blood, excretion, exudates, or secretion from humans or animals who are isolated to protect

others from highly communicable diseases. Unless patients are infected with one of these highly communicable diseases, their wastes are managed as other regulated medical waste. For example, if a patient is isolated then all contact precautions are practised according to CDC Isolation Precautions. However, the wastes are managed like any other medical waste.

g) **Animal waste:** Body parts, carcasses, and bedding of animals infected with zoonotic diseases, or exposed to pathogens during research must be handled and disposed of as infectious waste. Most states require that sharps used in veterinary care be managed as sharps waste. Non-infectious animal carcasses or large body parts should be properly managed as per state regulations as well.

Apart from the above mentioned types of Medical Waste, the Radioactive Medical Waste is another type of Hazardous Medical Waste. The Radioactive Waste is waste that contains radioactive material. In a medical setting, this includes radioactive therapies for tests such as thallium stress tests, and other nuclear medicine therapies to treat certain cancers. Nuclear medicine uses radiation to provide diagnostic information about the functioning of a person's specific organs, or to treat them. radioactive waste is waste that contains radioactive material. In a medical setting, this includes radioactive therapies for tests such as thallium stress tests, and other nuclear medicine therapies to treat certain cancers.

h) **The Sources of Medical Waste:** The Medical Wastes are generated from certain sources. These sources include:

- Hospitals
- Emergency care facilities
- Outpatient facilities, dialysis centres, prisons, transfusion centres, blood banks
- Laboratories
- Mortuaries, death care facilities
- Veterinarians
- Nursing homes
- Doctor and dentist offices
- Chiropractors
- Ambulance companies
- Needle exchanges
- Tattoo parlours
- Ear piercing businesses

In case of dentists' clinics the old style dental fillings were a mercury amalgam (alloy of mercury and other materials). While mercury is rarely employed in today's fillings, dentists' offices still deal with mercury waste when old fillings or teeth are removed. Regulatory agencies keep an eye on dentist's offices as generators of hazardous waste containing mercury and lead. They also produce waste cotton and plastic which may be contaminated with body fluids as well as sharps common in other medical facilities such as scalpels, lancets, needles, and syringes. Funeral homes and mortuaries also product sharps waste.Home healthcare providers are in a special situation. When the patient and/or family produce medical waste at home with no nurses or assistants involved, the waste is under no special regulation. It can be disposed of as regular household waste as far as the law is concerned. When a home healthcare provider is employed, it must employ waste management practices similar to those used in doctors' offices.

Waste from different facilities may be subject to different rules. In the state of Texas, for instance, businesses that generate less than 50 pounds per month of medical waste are classified as small quantity generators (SQG) while those that generate over 50 pounds per month are large quantity generators.

V.14.4 Effects of Medical Waste

The World Health Organization (WHO) defines medical waste as "Waste generated by health care activities including a broad range of materials, from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials." Medical waste disposal is an issue of considerable scale. As the world's top medical waste producing nation, the United States alone creates over 3.5 million tones of medical waste per year with an average disposal cost of $790 per tones . Medical waste production in the developing world is rising quickly due to improved access to medical services, which allow ever greater number of people to receive modern medical care. The trend away from multi-use medical devices towards safer, single use medical devices is further adding to the production of medical waste in developing nations. These combined trends are causing a rapid increase in the amount of medical waste that requires safe disposal in developing nations . In the developed world, a rapidly aging population is the major driver of increasing medical system usage, and this rising medical system usage is producing a corresponding increase in medical waste production. It is estimated by the World Health Organisation (WHO) that 20 percent of these medical wastes can be classified as hazardous materials that may be infectious, toxic, or radioactive. However, there is no globally agreed upon definition of medical waste, which poses a challenge from

a comparative standpoint, as changing definitions make a meaningful comparison between countries, or even between regions within countries, quite difficult.

Of all the health care waste (HCW) there is essentially two types: Regulated medical waste (RMW) and unregulated medical waste (UMW). Approximately 75% to 90% of HCW is UMW (unregulated) or known as healthcare general waste (HCGW). This waste is similar to typical household waste consisting of papers and plastics that have not been in contact with patients and is categorised as non-infectious. This type of waste is simply disposed in accordance with municipal regulations. Approximately only 10% to 25% of HCW is infectious/regulated medical waste (RMW).

Naturally this RMW has to be handled with special care as we'll describe below because it could pose a threat to the health of others, either by contaminating the environment or through direct contact with an individual. Easier way to differentiate the two types is to ask yourself, "Could this waste kill someone or make them sick?" If yes, then this waste is regulated and must be handled with special care.

Eight Categories of Medical Waste:

It's important to know what kind of medical waste your facility produces then you can determine the proper disposal. The WHO classified the medical waste into eight (8) categories of medical waste :

1. **Infectious waste:** Waste that may transmit infection from virus, bacteria, parasites to human, i.e. lab cultures, tissues, swabs, equipment and excreta
2. **Sharps:** Sharp waste, such as needle, scalpels, knives, blades, etc.
3. **Pathological:** Human tissue or fluids i.e. body parts, blood, other body fluids
4. **Radioactive:** Unused liquid in radiotherapy or lab research, contaminated glassware, etc.
5. **Chemical:** Expired lab reagents, film developer, disinfectant
6. **Pharmaceuticals:** Expired and contaminated medicines
7. **Pressurized containers:** Gas cylinders and gas cartridges
8. **General waste (UMW):** No risk to human health because no blood or any related body fluid is involved, i.e.: office paper, wrapper, kitchen waste, general sweeping, etc.

Improper segregation of biomedical waste and different medical waste streams from the point of origin can trigger a domino-like effect on the environment that incurs dangers to people, animals, or soil and water sources. Improper segregation and disposal of biomedical waste has the potential to contaminate ground water sources, which in turn may infect humans and animals alike. From a hospital's waste and storage receptacles to landfills, biomedical waste needs to be properly contained to

keep it away from birds, rodents, and stray animals (as well as humans). This enhances packaging and labelling of contaminants and helps prevent the spread of illness through human and animal populations–by air, land, or water.

If not properly contained, segregated, and incinerated through on-site or off-site incineration, environmental hazards associated with improper healthcare waste management can contaminate the air we breathe with dangerous airborne particles. Radioactive particles produced by diagnostic technologies have the potential to reach a landfill or other areas of the environment, especially air. Air pollutants disseminated over huge areas of inhabited land have the potential to trigger a number of illnesses. Needle-stick injury and sharps injury incidents increase risk to health of employees on a daily basis. Risk of contamination by HIV, hepatitis B and C pathogens are of primary concern to healthcare workers inside healthcare facilities. Costs of treatment for the over 300,000 needle-stick injury incidents every year add thousands of dollars to a healthcare facility's budget.

The treatment of health care wastes with chemical disinfectants can result in the release of chemical substances into the environment and those substances need to be handled, stored and disposed in an environmentally sound manner.Incineration of wasts has been widely practised, but inadequate incineration or the incineration of unsuitable materials results in the release of pollutants into the air and the generation of ash residue. Incinerated materials containing or treated with chlorine can generate dioxins and furans, which are human carcinogens and have been associated with a range of adverse health effects. Incineration of heavy metals or materials with high metal content (in particular lead, mercury and cadmium) can lead to the spread of toxic metals in the environment."Incineration results in the release of extremely harmful pollutants such as dioxins. If we make a decision today to release dioxins into the environment, they will stay there not only during our lifetime, but also the lifetime of our children and their children, and their children's children," warned environmental scientist Dr Jorge Emmanuel during his presentation at a forum on the environmental and health impacts of incineration. Dr Emmanuel explained that dioxins are a group of chemically related compounds that are persistent organic pollutants (POPs). These pollutants accumulate in the environment and in the food chain, mainly in the fatty tissue of animals. Highly toxic dioxins can cause reproductive and developmental problems, damage the immune system and interfere with hormones, he said. "The effects of dioxins include cancer, birth defects, alterations in the reproductive system, impacts in child development, suppression of the immune system, female reproductive effects, reduced fertility and lower sperm count in males, to name a few," Dr Emmanuel said.

Only modern incinerators operating at 850-1100 °C and fitted with special gas-

cleaning equipment are able to comply with the international emission standards for dioxins and furans. Alternatives to incineration such as autoclaving, microwaving, steam treatment integrated with internal mixing, which minimise the formation and release of chemicals or hazardous emissions should be given consideration in settings where there are sufficient resources to operate and maintain such systems and dispose of the treated waste.

Health care waste also includes the waste originating from "minor" or "scattered" sources--such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.). Infectious waste is material suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. This category includes waste contaminated with blood or other body fluids, cultures and stocks of infectious agents from laboratory work, waste from infected patients in isolation wards; dressings, bandages and other material contaminated with blood or other body fluids which is infectious because it contains bacteria, viruses, parasites or fungi. Sharps are the hypodermic, intravenous or other needles; auto-disposable syringes; syringes with attached needles; infusion sets; scalpels; pipettes; knives; blades; broken glass. Pathological waste contains human tissues, organs or fluids; body parts; unused blood products. Chemical Waste contains chemical substances (e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; waste with high content of heavy metals, e.g. batteries; broken thermometers and blood pressure gauges). Pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals; cytotoxic waste containing substances with genotoxic properties waste containing cytostatic drugs (often used in cancer therapy) genotoxic chemicals. Radioactive waste containing radioactive substances (e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources. Generation of waste depends on numerous factors such as type of healthcare facility, specialisation, proportion of reusable items employed in hospital, and proportion of patients treated on a day-care basis. Hospitals and clinics are the only one source of infectious waste generation which are heterogeneous mixtures composed of general refuse, laboratory and pharmaceutical chemicals and their containers, and pathological wastes. As a result, some infectious wastes do not separate from general waste and may pose a threat to the environment. Management of healthcare waste is very important for keeping living environment healthy. It has been reported that in UK in period of the to 2004, 2140 people got occupational exposures to blood borne viruses. It has been found that 21% of the injuries occurred during the disposal process. As per study in Mexico city, out of 69 interviewed waste handlers 34%

reported 22 needle stick injuries between them during the first 12 months and 96% had seen needles and syringes in waste. In Pakistan, on an average scavenger boys who were going through medical wastes, for collection and resale, experienced three to five needle-stick injuries a day . Dozen of children in Sadri City, largest suburb of Baghdad, have been admitted to hospitals with symptoms of infectious diseases due to contact with waste. Low income households are more likely to live close to waste sites resulting in more direct contact with health care waste. In India more than 30% of the injections administered each year were carried out using re-used or inadequately sterilised medical equipment and that nationally, 10% of health care facilities sold used syringes to waste pickers. Research suggests that population living within 3 km of old incinerators saw an increase of 3.5% in the risk of contracting cancer. Traditionally, hospital wastes have been disposed of along with the municipal wastes in landfills. However, since the late 1980s, the spreading trend of immunodeficiency virus (HIV), hepatitis B virus (HBV) and other agents associated with blood bone diseases has raised public awareness and concerns about the disposition of medical wastes. As a result, medical waste is required to be treated in a special way and not to be mixed with municipal waste. Proper medical waste management requires special treatment of medical waste such as incineration or hazardous waste landfill facilities.

V.14.5 Medical Waste Management

The medical waste management system is done in accordance with some definite steps. These steps define the procedure of waste management.

1. Waste collection
2. Segregation
3. Storage
4. Treatment
5. Disposal

1. **Waste Collection:** The biomedical waste has to be collected in containers that are resilient and strong from breakage during the handling process. The sharps, used needles, syringes, or other contaminated tools cannot be placed in common waste disposal or recycle bin because the entire waste will become infectious by doing so. The segregation also needs to be performed between the liquid and solid biomedical waste products. Categorising the medical waste with correct segregation to isolate and manage each waste in the proper way. For this purpose, the segregations come in coloured waste containers, label coding and plastic bags. The collection of biomedical waste involves use of different types of containers from various sources of biomedical

wastes like Operation Theatre, laboratory, wards, kitchen, corridor etc.The containers/ bins should be placed in such a way that 100% collection is achieved. Sharps must always be kept in puncture-proof containers to avoid injuries and infection to the workers handling them.

2. **Segregation:** Segregation refers to the basic separation of different categories of waste generated at source.It is the most crucial step in biomedical waste management. An effective segregation alone can ensure effective biomedical waste management. Segregation reduces the amount of waste, needs special handling and treatment.

It prevents the mixing of medical waste like sharps with the general municipal waste.Along with that it prevents, illegal reuse of certain components of medical waste like used syringes, needles and other plastics and provides an opportunity for recycling certain components of medical waste like plastics after proper and thorough disinfection. The recycled plastic material can be used for non-food grade applications. It reduces the cost of treatment and disposal (80 per cent of a hospital's waste is general waste, which does not require special treatment, provided it is not contaminated with other infectious waste). The bins and bags should carry the biohazard symbol indicating the nature of waste to the patients and public. As per the Schedule III (Rule 6) of Biomedical Waste (Management and Handling) Rules, 1998 which specifies the Label for Biomedical Waste Containers / Bags as: Cytotoxic and Biohazard.

Segregation should always take place at the source, that is at the ward bedside, Operation Theatre, Medical Analysis Laboratory, or any other room or ward in the hospital where the waste is generated. It should be simple to implement for the medical and ancillary staff and applied uniformly throughout the country and should guarantee the absence of infectious wast in the domestic waste flow. It needs to be regularly monitored to ensure that the procedures are followed properly.

3. **Storage:** There are specific requirements for storage facilities, such as a secure area that is inaccessible to the general public, as well as separated from areas for food consumption. The storage facilities also have to be accompanied with refrigerator or freezer unit that can be used medical waste if necessary. Some facilities even provides special vehicles and protective devices to dispose, handle or transport the biomedical waste products. Remember to observe and keep maintaining the protective devices periodically so it won't be a source of transmitting the infections. The duration of storage should not exceed 8-10 hrs in big hospitals (more than 250 bedded) and 24 hrs in nursing homes.Each container may be clearly labelled to show the ward or room where it is kept. The reason for this labelling is that it may be necessary to trace the waste back to its source.Besides this, storage area should be marked with a caution sign.

4. **Treatment:** The treatment process will use several medical waste equipments that ranged from handling, carts, shredding, conveying, size reducing, compactors, to sterilisation or recycling. To differentiate which biomedical waste can be performed on-site and off-site is important. Because in majority of the cases, the biomedical waste is a mixture and can be very difficult to manage it properly or even to segregate it, which is why an accurate simplified management of medical waste in segregating it according to the regulations will reduce the erroneous element. The on-site treatment usually requires expensive equipment. Not all facilities have this due to major infrastructure expenditure, but it is generally cost-effective for very large hospitals and laboratories. Thus most medical waste producers choose off-site treatment known as regulated medical waste disposal companies because these companies have either the proper medical waste equipment or have been state certified operating permits.

The treatment methods that can be applied forth are:-

a) **Incineration:** This is the controlled burning of the medical waste in a dedicated incinerator. Among industry professionals, these units are often referred to as hospital/medical/infectious waste incinerators. It is an old technology and was widely used in the past for all sorts of waste. In fact before 1997, over 90% of all infectious medical waste was disposed of by incineration. Individual buildings had their own waste incinerators in many cases. Incinerators got a bad reputation because of the air pollution they created and because the bottom ash, or clinker, was hard to keep under control. Members of the public unfortunately still have negative associations with incinerators. Today's incineration units are typically much cleaner. Incineration requires no pretreatment because most medical waste can be incinerated and the waste does not always require sorting or separation prior to treatment. Incineration has the benefit of reducing the volume of the waste by 80 percent or more, sterilising the waste, and reducing the need for pre-processing the waste before treatment. The resulting incinerated waste can be disposed of in traditional methods, such as landfilling. The downside of incineration is potential pollution from emissions generated during incineration. Another concern of incinerator is the ash. As incinerators are designed or retrofitted with pollution prevention equipment, more of the potentially toxic chemicals that previously ended up in emissions now remain in the ash. The ash is hazardous waste and is generally disposed of in landfills after it is stabilised.

b) **Autoclaving:** Autoclaving is a thermal process at low temperatures where waste is subjected to pressurised saturated steam for a sufficient length of time to be disinfected (60 minutes at 121°C and 1 bar). Where prions (which cause Creutz feldt Jakob's disease) are present, a cycle of 60 minutes at 134°C is

recommended, since they are exceptionally resistant. 1918 Efficiency tests (biological or thermal) must in any case be carried out regularly. Autoclaving is environmentally safe but in most cases it requires electricity, which is why in some regions it is not always suitable for treating wastes. Small autoclaves are frequently used for sterilising medical equipment, but the models used for treating healthcare wastes can involve relatively complex and expensive plants (with internal mixing,shredding and drying systems) requiring meticulous design, proper sorting and a high level of operating support and maintenance. Furthermore, the effluents must be disposed of carefully and properly monitored. And lastly, large autoclaves may require a boiler that generates several types of emissions, which have to be monitored. Once wastes have been processed in an autoclave, they are no longer infectious materials, so they can be landfilled with municipal refuse. Autoclaving is often used for pre-treating highly infectious waste before it is transported outside the hospital.

c) **Microwaving :** Another way to render hazardous healthcare waste non-hazardous is to microwave it with high-powered equipment. As with autoclaving, this method opens up the waste to normal landfill disposal or incineration afterward.

d) **Chemical :** Some kinds of chemical waste may be neutralised by applying reactive chemicals that render it inert. This type of treatment is suitable mainly for treating liquid infectious wastes such as blood, urine, faeces or hospital sewage. Typically, a 1% bleach (sodium hypochlorite) solution or a diluted active chlorine solution (0.5%) is used. In the case of liquids with high protein content, such as blood, a non-diluted solution of bleach is required as well as a contact time of more than 12 hours. Pay caution that when bleach is mixed with urine, toxic gases are formed (combination of chlorine and ammonia). Furthermore, liquid waste that has been disinfected with chlorine must not be discharged into a septic tank. The other disinfectants used are as follows: lime, ozone, ammonium salts and peracetic acid. Formaldehyde, glutaraldehyde and ethylene oxide must no longer be used because of their toxicity (carcinogenic or sensitising properties). All strong disinfectants irritate the skin, eyes and respiratory system. They must be handled with caution–in particular, personal protective equipment must be used–and they must be stored correctly. Solid medical waste can be chemically disinfected, but they must first be shredded. This practice poses a number of safety problems, and the wastes are only disinfected on the surface. Thermal disinfection must be preferred over chemical disinfection for reasons of effectiveness and for ecological reasons.

e) **Biological:** This experimental method of treating biomedical waste uses enzymes to neutralise hazardous, infectious organisms. It's still under development and rarely used in practice.

f) **Encapsulation :** It (or solidification) consists of a small number of hazardous items or materials in a mass of inert material. The purpose of the treatment is to prevent humans and the environment from any risk of contact. Encapsulation involves filling containers with waste, adding an immobilising material, and sealing the containers. The process uses either cubic boxes made of high-density polyethylene or metallic drums, which are three-quarters filled with sharps, chemical or pharmaceutical residues, or incinerator ash. The containers or boxes are then filled up with a medium such as plastic foam, bituminous sand, lime, cement mortar, or clay. Once the medium has dried, the containers are sealed and disposed of in a sanitary landfill or waste burial pit. The following proportions are recommended, for example: 65% pharmaceutical waste, 15% lime, 15% cement, 5% water. The main advantage of the process is that it is very effective in reducing the risk of scavengers gaining access to the hazardous waste. Encapsulation of sharps is generally not considered to be a long-term solution. Encapsulation of sharps or unwanted vaccines could, however, be envisaged in temporary settings, such as camps or vaccination campaigns.

5. **Disposal:** The Common Biomedical wastes treatment facility, cast the responsibilities on municipal bodies to collect biomedical wastes/treated biomedical wastes and also provide sites for setting up of incinerator.One of India's major achievements has been to change the attitudes of the operators of health care facilities to incorporate good management and to purchase on-site waste management services from the private sector.Several medical facilities can use this Common Biomedical Waste Treatment Facility.

In the US, for solid waste, once medical waste producers have adhered to regulations for collecting, storing, transporting, and treating their waste, they may then use their municipal landfill and sanitary sewer system as their final disposal method. local municipal landfill is commonly used as the final place of your treated decontaminated biomedical waste.

For fluids such as blood, suctioned fluids, excretions and secretions, almost every state and local government has its own regulations and guidelines to provide the best way to dispose it.

For example, the approach to handling medical waste in the U.S. has evolved markedly since the 1980’s. In that decade, a series of incidents of healthcare waste

washing up on East Coast beaches gained widespread media attention. The events caused calls for increased regulation, which came in the form of 1988's Federal Medical Waste Tracking Act. The Act imposed strict rules on the transportation of waste from hospitals and other facilities. When it expired in 1991, the states largely took on the regulatory burden, basing their individual programmes on lessons learned from the Act. New solutions in the medical waste industry continue to offer advancements in security, convenience, cost savings, and speed of service. But only a few waste disposal firms accept waste-transfer by mail.

V.14.6 Conclusion

The faltering history of Medical science–from the first known dentistry dated 7000 BC in Baluchistan where Neolithic dentists used flint-tipped drills and bowstrings to the present age wireless brain sensors and robotic surgery–medical science has defined the prognosis of human life. The signification of Good and Evil is actually relative to one another. In a same fashion Medical Science has brought forth a baggage of its own demerits along with its progress. The aspect of Medical Waste is a by-product of the activities of Medical Science which needs to be dealt in a more progressive fashion to impede the spread of diseases. The above discussion takes us into a much needed detailed analysis of Medical Waste along with its effect on the environment we live in. It has also cited out how the whole gamut of Medical Waste acts as a catalyst to the Pollution around us–much more in a hazardous fashion. If we, along with different institutions, are responsible enough in treating ourselves with the advancement of Medical Science, then we also have to shoulder the responsibility of treating the medical waste in appropriate fashion to live a healthy life that Medical Science aims at.

V.14.7 Model Questions.

A. Answer in brief (5 marks):

i. What do you understand by Encapsulation?

ii. Why segregation is necessary in case of Medical Waste?

B. Answer in detail (10 marks):

i. What are the various types of Medical Wastes that are generated?

ii. What are the treatment methods that can be used to reduce the effects of Medical Waste?

iii. What do you understand by the idea of Medical Waste?

iv. What is Autoclaving?

V.14.8 Suggested Readings

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