UNIT 1 ENVIRONMENT AND GLOBAL ISSUES

Contents

Learning Objectives

At the end of this unit, you will be able to:

- understand the global environmental issues like ecological sustainability, global warming and biodiversity;
- understand the degradation of water and land resources and pollution due to anthropogenic activities;
- understand the global picture of environmental discourse; and.
- understand the ecology of global consumer culture.

1.1 INTRODUCTION

The term environment refers to the sum total of physical, biological and cultural elements which are interlinked individually as well as collectively in myriad ways and which surrounds man at a given point in space and time. Physical elements (space, landforms, water bodies, climate, soils, rocks and minerals) determine the variable character of the human habitat, its opportunities as well as limitations. Biological elements (plants, animals, micro-organisms and man) constitute the biosphere. Cultural elements (economic, social and political) are essentially human made features, which go into the making of cultural milieu. All these elements are so intimately related with each other that changes in one affect the others. This unit is going to discuss various global environmental issues in the backdrop of the environmental problems occurring in the world today.

1.2 GLOBAL ENVIRONMENTAL ISSUES

As early as 1896, the Swedish scientist Svante Arrhenius had predicted that human activities would interfere with the way the sun interacts with the earth, resulting in global warming and climate change. His prediction has come true and climate change is now disrupting global environmental stability. The last few decades have seen many treaties, conventions, and protocols for the cause of global environmental protection. Some of the major environmental issues in global context are sustainability of world's ecology; ozone layer depletion and global warming and loss of biodiversity.

1.2.1 Ecological Sustainability

"Sustainability," says Michael Crow, president of Arizona State University, "is at the intersection of environmental, economic, and societal stewardship." Sustainability focuses on balancing these three areas. Ecological sustainability is defined as a capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term. Ecologically sustainable development is the environmental component of sustainable development. Also important is the principle of intergenerational equity, namely that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations

Ecological sustainability, in simple terms means that whatsoever activity taking place on planet earth, has to continue forever. This can be achieved only if the activity does not 'use up' or worse still destroy any of the resources or the life forms which exist as a result of it and also does not ultimately destroy the very basis of such activity.

1.2.2 Global Warming

Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. Over the last 100 years, it was found out that the earth is getting warmer and warmer, unlike previous 8000 years when temperatures have been relatively constant. The present temperature is 0.3 - 0.6 ^{o}C warmer than it was 100 years ago. This is caused primarily by increases in "greenhouse" gases (GHG) such as Carbon Dioxide (CO_2). Before the Industrial Revolution, human activities released very few gases into the atmosphere and all climate changes happened naturally. After the Industrial Revolution, through fossil fuel combustion, changing agricultural practices and deforestation, the natural composition of gases in the atmosphere is started getting affected and climate and environment began to alter significantly.

Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases. Carbon dioxide, one of the most prevalent greenhouse gases in the atmosphere, has two major anthropogenic (human-caused) sources: the combustion of fossil fuels (oil, natural gas and coal), wood and wood products and changes in land

use. Net releases of carbon dioxide from these two sources are believed to be contributing to the rapid rise in atmospheric concentrations since Industrial Revolution. Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic wastes in municipal solid waste landfills, and the raising of livestock. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels. Very powerful greenhouse gases that are not naturally occurring include Chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), which are generated in a variety of industrial processes.

India's Greenhouse Gas Emissions

India has experienced a dramatic growth in fossil fuel CO_2 emissions, and the data compiled by various agencies shows an increase of nearly 5.9 % since 1950. At present India is rated as the 6th largest contributor of CO_2 emissions behind China, the 2nd largest contributor. However, our per capita CO_2 of 0.93 tons per annum is well below the world average of 3.87 tons per annum. Fossil fuel emissions in India continue to result largely from coal burning. India is highly vulnerable to climate change as its economy is heavily reliant on climate sensitive sectors like agriculture and forestry. The vast low-lying and densely populated coastline is susceptible to rise in sea level. The energy sector is the largest contributor of carbon dioxide emissions in India. The national inventory of greenhouse gases indicates that 55% of the total national emissions come from energy sector. These include emissions from road transport, burning of traditional bio-mass fuels, coal mining, and fugitive emissions from oil and natural gas. Agriculture sector constitutes the next major contributor, accounting for nearly 34%. The emissions under this sector include those from enteric fermentation in domestic animals, manure management, rice cultivation, and burning of agriculture residues. Emissions from Industrial sector mainly came from cement production.

The United Nations Framework Convention on Climate Change (UNFCCC)

In June 1992, the "United Nations Framework Convention on Climate Change" (UNFCCC) was signed in Rio de Janeiro by over 150 nations. The convention's overall objective is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The deciding body of the climate convention is the Conference of Parties (COP). At the COP meetings, obligations made by the parties are examined and the objectives and implementation of the climate convention are further defined and developed.

1.3 DEGRADATION OF WATER AND LAND RESOURCES

The world's land and water resources provide goods such as food crops, fish, livestock and timber and non-timber products. They also provide ecological services such as purification of air and water, maintenance of biological diversity, and decomposition and recycling of nutrients (WRI, 2000). Despite the importance of these resources, land and water ecosystems are being degraded at an alarming rate. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is under increasing demand for human activities. The world has an estimated 1.34 billion cubic kilometers of water, but 96.5 percent of it is

salty. Nearly 70% of that fresh water is frozen in the icecaps of Antarctica and Greenland. Most of the remainder is present as soil moisture or lies in deep underground aquifers as groundwater not accessible to human use. Less than 1% of the world's fresh water or 0.007% of all water on earth is accessible for direct human use. This is the water found in lakes, rivers, reservoirs and those underground sources that are shallow enough to be tapped at an affordable cost. Only this minuscule amount is regularly renewed by rain and snowfall, and is therefore available on a sustainable basis. The amount of available freshwater supply in some regions is decreasing because of (i) climate change, which has caused receding glaciers, reduced stream and river flow, and shrinking lakes; (ii) contamination of water by human and industrial wastes; and (iii) overuse of non-renewable groundwater aquifers. Many aquifers have been over-pumped and are not recharging quickly. According to one saying it is said that where water ends there life ends. In this context, the term 'Peak Water' has been put forward as a concept to help understand growing constraints on the availability, quality, and use of freshwater resources.

There is concern that the state of peak water is being approached in many areas around the world. Some areas are suffering from peak renewable water, where entire renewable flows are being consumed for human use, peak non-renewable water, where groundwater aquifers are being over pumped (or contaminated) faster than nature recharges them and peak ecological water, where ecological and environmental constraints are overwhelming the economic benefits provided by water use. If present trends continue, 1.8 billion people will be living with absolute water scarcity by 2025, and two thirds of the world population could be subject to water stress. Ultimately, peak water is not about running out of fresh water, but about reaching physical, economic, and environmental limits on meeting human demands for water and the subsequent decline of water availability and use.

Soil and land degradation can be identified and described in terms of physical, chemical and biological changes from some ideal state brought about by natural or man-made influences. Key processes for land and water degradation includes erosion and sedimentation, nutrient depletion, water pollution, de-vegetation and irregular stream flow. The foothills of the Himalayas, sloping areas in southern China and South-east Asia, the East African Highlands, sub-humid Central American hillsides and semi-arid Andean valleys are some of the degradation hotspots (Scherr and Yadav, 1996). In vast areas, all topsoil has been washed away. In others, the productive potential of the lands has been degraded significantly.

Land Degradation has been taking place extensively for as long as agriculture has been practiced (Ponting, 1991). Yet it is hard to quantify it because of the slow and very heterogeneous nature of the process. Major trends related to land degradation and agricultural productivity globally include: Loss of water for agriculture and reallocation to cities and industries; reduction in land quality in many different ways, leading to reduced food supplies, lower agricultural incomes, increased costs to farmers and consumers, and a deterioration of water catchment functions; reduction in water quality due to pollution, water-borne diseases and disease vectors; loss of farmland through conversion to non-agricultural purposes. The major long term impacts of land degradation are deforestation, desertification and loss of biodiversity.

While the aggregate picture of land and water degradation is quite worrying, there are also many bright spots. The term 'bright spot' is used to describe a community (village, district or catchment) that has succeeded in stopping or reversing degradation while improving livelihoods. Examples from upper watersheds include conservation farming in the Philippines (Nilo, 2001) and Thailand, hillside conservation investment in East Africa (Rwanda, Kenya and Burundi), projects in Morocco, West Cameroon, and Fouta Djalon in Guinea. There is widespread adoption of specific technologies that have contributed to bright spot development, including conservation tillage (Mexico, Central America, Brazil, Argentina, Chile, Uruguay and Paraguay), perennial crops use (in the mountains of Himachal Pradesh, India, and on hillsides of southern Mexico and Central America), multi-storey gardens (in densely populated areas with volcanic soils in Indonesia and southern China), and perennial plantations in areas of low population density with fragile soils (Malaysia, India, southern Thailand and the Philippines) (Scherr and Yadav, 1996).

1.3.1 Loss and Conservation of Biodiversity

Biodiversity refers to the variety of life on earth, and its biological diversity. The number of species of plants, animals, micro organisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all a part of a biologically diverse earth. Biodiversity actually boosts ecosystem productivity where each species, no matter how small, all have an important role to play and that it is in this combination that enables the ecosystem to possess the ability to prevent and recover from a variety of disasters. It is now believed that human activity is changing biodiversity and causing massive extinctions. Both plant and animal species have been disappearing at 50 to 100 times the natural rate, due to such factors as the large-scale clearing and burning of forests, over-harvesting of plants and animals, indiscriminate use of pesticides, draining and filling of wetlands, destructive fishing practices, air pollution and the conversion of wild lands to agricultural and urban uses. Recent studies suggest that this high rate of extinction will accelerate even faster, taking an increasing number of living plants and animals away from us forever. This species loss and ecosystem disruption is causing a complex range of circumstances with consequences to human health. In addition, the loss of biodiversity obstructs the discovery of new medicines to treat various diseases. The United Nations Convention on Biological Diversity (UNCBD), which was adopted at UNCED in 1992 and has since been ratified by more than 175 countries, establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.

Conservation has been defined as "maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties". Conservationists believe that conservation can be achieved in a number of ways, but in particular, by following practices of sustainable use and by creating protected areas. Sustainable use has been defined as "the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations".

Conservation of biodiversity includes formulation of National Park and Wild life Sanctuaries which is an area of ecological, faunal, floral, geo-morphological, or zoological importance; development of Conservation Reserve and Community Reserve for protecting landscapes, seascapes, flora and fauna and their habitat and also for protecting traditional or cultural conservation values and practices, where the community or an individual has volunteered to conserve wildlife and its habitat; development of Tiger Reserve in order to protect this fast diminishing species. Apart from this World heritage sites are areas of universal natural and cultural value, declared under an international Convention for the Protection of the World Cultural and Natural Heritage. Important bird areas are identified to give special attention to areas that are significant for bird conservation. Wetlands of significant biodiversity value can be declared Ramsar sites. These sites are declared under an inter-governmental treaty on wetlands called the Ramsar Convention which was signed by countries at Ramsar, in Iran, in 1971. Nineteen wetlands have been declared Ramsar sites in India, covering an area of almost 648,507 hectares. Medicinal plant conservation areas (MPCAs) program is a national effort initiated in 1993 by the Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore. Under this program, MPCAs are identified with the main objective of conserving medicinal plants in their natural habitat and preserving their gene pool.

Indigenous and local communities play a significant role in conserving very substantial areas of high biodiversity and cultural value. In addition to officially-designated protected areas, there are many thousand Community Conserved Areas (CCAs) across the world, including sacred forests, wetlands, and landscapes, village lakes, catchment forests, river and coastal stretches and marine areas. These are natural and/ or modified ecosystems of significant value in terms of their biodiversity, cultural significance and ecological services. They are voluntarily conserved by indigenous and local communities, through customary laws or other effective means, and are not usually included in official protected area statistics. Globally, 4 to 8 million square km (the larger estimate is an area bigger than Australia) are owned or administered by communities. In 18 developing countries with the largest forest cover, over 22% of forests are owned or preserved for communities. In some of these countries (for example Mexico and Papua New Guinea) the community forests cover 80% of the total. In fact, some studies show that levels of protection are actually higher under community or indigenous management than under government alone.

1.3.2 Intensive Farming

Intensive farming or intensive agriculture is an agricultural production system characterized by the high inputs of capital, labor, or heavy usage of technologies such as pesticides and chemical fertilizers relative to land area. It is associated with the increasing use of agricultural mechanization, which has enabled a substantial increase in production, yet has also dramatically increased environmental pollution by increasing erosion and poisoning water with agricultural chemicals. This is in contrast to many sorts of sustainable agriculture such as organic farming or extensive agriculture, which involve higher inputs of labor, and energy relative to the area of land farmed, but focus on maintaining the long-term ecological health of the farmland, also the product which is being produced is generally produced with fewer synthetic chemicals.

The use of intensive farming techniques is creating not only localized ecological disasters but in many places having impacts across way sections of the countryside. Intensive farming designs limit the range of habitats; inputs to the system particularly those used for soil fertility and pest control determine the impact on species within the habitats. Intensive farming substitutes rather than enhances the natural biological production processes. Autumn and winter-sown cereals decrease the availability of food for wild birds at the start of the crucial breeding season and thus limiting the range of wild birds, hares and other small mammals. The large farm size further limits the size of animal populations because field boundaries are smaller, fewer and farther apart. Habitats within boundaries, especially hedgerows, are important to many wild flowers, insects, birds and mammals. Weed control is more efficient further limiting the range of species of plants and animals. Continuous cropping of autumn and winter-sown cereals promotes erosion because the soil is exposed during the wetter part of the year. Plants that are chemically fertilized may look lush, but lush growth produces watery tissues, which become more susceptible to disease; and the nutritive quality, suffer.

Agricultural production has witnessed dramatic rise in the last 3 decades or so in the countries world over. In India, Green Revolution brought about technological breakthrough, which led to the use of short duration high yielding varieties helping intensive use of land in a year, increasing area brought under irrigation and prolific use of chemicals such as fertilizers and pesticides. India, being vastly agriculture oriented, historically has had policies in various phases for the development of agriculture with the expectation that development of agriculture would lead to overall development of the nation and help eradication of poverty. It has been of late recognized that the increasing efforts to raise agricultural growth has cost us dearly in the form of land and water degradation. Large scale ecological losses were reported in crop land, grass land and forest land, such as soil erosion, soil alkalinity and salinity, micronutrient deficiency, water logging and fast depletion and contamination of ground water. These factors limit future gains from the land and water resources. Irrigation is considered as the principle means of water loss from the natural system and it leads to arid condition downstream and ground water depletion. Apart from on site costs reflected in the loss of productivity of soil, the offsite costs due to agriculture is reported to be quite significant. The offsite costs are caused by soil sediments transported in the surface water from eroded agricultural land. These include river and dam siltation, damage to roadways and sewers, siltation of harbors and channels, loss of reservoir storage, disruption of stream ecology and damage to public health. Intensive farming practices, particularly with wheat and rice in India, have virtually mined nutrients from the soil. Due to heavy use of fertilizers, excess nitrates have leached into groundwater and contamination of groundwater with nitrates has increased dramatically. According to the National Remote Sensing Agency and Forest Survey of India, 60% of the total area under cultivation is substantially degraded. Most of this damage is in the form of loss of topsoil.

1.3.3 Anthropogenic Landscapes

Anthropogenic landscapes are areas of Earth's terrestrial surface where direct human alteration of ecological patterns and processes is significant, ongoing, and directed toward servicing the needs of human populations for food, shelter and other resources and services including recreation and aesthetic needs. Nearly

all humans live in anthropogenic landscapes, especially in urban, suburban and densely populated rural village landscapes. Anthropogenic landscape transformation (land-use change) is one of the primary drivers of global changes in climate, biodiversity and biogeochemistry. Ecological processes in anthropogenic landscapes differ profoundly from those of pristine and indirectly impacted ecosystems. These processes include species introduction and domestication, population management and harvest, the tillage transport and cover of soils by impervious structures, fossil fuel combustion, irrigation and the fertilization of ecosystems with nitrogen, phosphorus and other limiting nutrients. Anthropogenic landscapes are highly fragmented fine-scale mosaics of managed and unmanaged landscape features with clearly defined boundaries such as buildings, roads, yards and agricultural plots. To measure and mediate long-term ecological changes in a Anthropogenic landscapes, land transformation and management must be measured at the fine spatial scales at which this generally occurs.

1.3.4 Dams Construction

Dams can be used to supply drinking water, generate hydroelectric power, increasing the water supply for irrigation, provides recreational opportunities and to improve certain aspects of the environment. However, adverse environmental and sociological impacts have also been identified during and after many reservoir constructions. Whether reservoir projects are ultimately beneficial or detrimental—to both the environment and surrounding human populations— have been debated since the 1960s and probably long before that. The damming of a river creates a reservoir upstream from the dam. The reservoir waters spill out into the surrounding environments, flooding the natural habitats that existed before the dam's construction. To date, over 400,000 km^2 of the earth have been flooded due to damming. The construction of large dams completely change the relationship of water and land, destroying the existing ecosystem balance which, in many cases, has taken thousands of years to create. Currently there are around 40,000 large dams which obstruct the world's rivers, completely changing their circulation systems. Throughout the past few years, the negative impacts of dams have become so well known that most countries have stopped building them altogether and are now forced to invest their money into fixing the problems created by existing dams.

One of the first problems with dams is the erosion of land. Dams hold back the sediment load normally found in a river flow, depriving the downstream of this. In order to make up for the sediments, the downstream water erodes its channels and banks. This lowering of the riverbed threatens vegetation and river wildlife. A major example of soil erosion problem is the Aswan Dam built on the river Nile in Egypt. Dams and the creation of reservoirs also require relocation of potentially large human populations if they are constructed close to residential areas. The record for the largest population relocation belongs to the Three Gorges dam built in China. Its reservoir submerged a large area of land, forcing over a million people to relocate. "Dam related relocation affects society in three ways: an economic disaster, human trauma, and social catastrophe", states Dr. Michael Cernea of the World Bank and Dr. Thayer Scudder, a professor at the California Institute of Technology. As fish and marine animals are an important source of food supply, more attention is being paid to the harmful effects of dams on many fish and marine mammal populations. The vast majority of large dams do not

include proper bypass systems for these animals, interfering with their lifecycles and sometimes even forcing species to extinction. Dam reservoirs in tropical areas, due to their slow-movement, are literally breeding grounds for mosquitoes, snails, and flies, the vectors that carry malaria, schistosomiasis, and river blindness. NASA geophysicist Dr. Benjamin Fong Chao found evidence that large dams cause changes to the earth's rotation, because of the shift of water weight from oceans to reservoirs. Because of the number of dams which have been built, the Earth's daily rotation has apparently sped up by eight-millionths of a second since the 1950s. Chao said it is the first time human activity has been shown to have a measurable effect on the Earth's motion.

1.3.5 Pollution

Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. The major forms of pollution are air, water, noise, light, radioactive, thermal and solid waste pollutions. World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these deaths attributable to indoor air pollution. Worldwide more deaths per year are linked to air pollution than to automobile accidents. Direct causes of air pollution related deaths include aggravated asthma, bronchitis, emphysema, lung and heart diseases, and respiratory allergies. Cities around the world with high exposure to air pollutants has the possibility of children living within them to develop asthma, pneumonia and other lower respiratory infections as well as a low initial birth rate. Estimates suggest that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases. With over 70 percent of the planet covered by oceans, people have long acted as if these very bodies of water could serve as a limitless dumping ground for wastes. Raw sewage, garbage, and oil spills have begun to overwhelm the diluting capabilities of the oceans, and most coastal waters are now polluted. Beaches around the world are closed regularly, often because of high amounts of bacteria from sewage disposal, and marine wildlife is beginning to suffer. Perhaps the biggest reason for developing a worldwide effort to monitor and restrict global pollution is the fact that most forms of pollution do not respect national boundaries. At the time of UNEP's creation in 1972, only 11 countries had environmental agencies. Ten years later that number had grown to 106, of which 70 were in developing countries. It has become increasingly clear that the sources and causes of pollution are far more diffused, complex and interrelated; and the effect of pollution more wide spread, cumulative and chronic- than hitherto believed. Pollution problems that were once local are now regional or even global in scale.

1.4 DISCOURSE ON SCIENCE AND GLOBAL ENVIRONMENT

Environmental discourse has given us the awareness of the global, all encompassing nature of some of the processes of environmental change. The "climate catastrophes", the diminishing ozone layer or the reduced forest cover

of the earth's surface are seen as problems facing "mankind" thus strongly invoking the idea that, when it comes to the ecological crisis, "we are all in a same boat".

The concept of globalization has two connotations. It primarily refers to political-economic changes and is employed to give a label to the increasing power international financial networks and the growing interdependency in the political-economic sphere. The second meaning of the concept of globalization is that not only suggest do the interdependencies occur on a larger scale than before, it also suggests that the world has become smaller. This is the idea of a "shrinking" of the globe both in a physical and a cultural sense. It refers to the diminishing importance of distance, the "annihilation of space by time", and the proliferation of Western life styles that came with it. It is the cultural icons and narratives of Coca Cola, Disney and McDonalds that represent the most prominent forces of this new globalized cultural discourse. The term Mcdonaldization, however formed by George Ritzer states the process by which the principles of the fast food restaurant are coming to dominate more and more sectors of American society as well as the rest of the world. The emphasis on a growing interdependency and the strong forces of a cultural colonization (also known as "coca-colonization") suggest that we are becoming aware that, when it comes to globalization, we are in the same boat too.

In the present era of science and technology, many of the scientific activities (industrialization, mining, modern agriculture technology, intensive farming etc), through over exploitation of natural resources are creating a wide variety of environmental problems and concerns at global level. But at the same time through advance scientific researches and developments we, the humans are able to assess the environmental impacts of these activities on our own self as well as on the other living beings of the planet earth.

There are many numbers of scientific studies conducted which demonstrates the environmental discourse on global level. To start with in 'green discourse' one of the early markers of the impact of development products on nature was Rachel Carson's Silent Spring (1962) in which she warned us of the unintended impacts of the over use of pesticides. Next is the Barry Commoner's The Closing Circle (1971) which argued that technology could not solve ecological problems. In 1972 Barbara Ward and Rene Dubos wrote 'Only One Earth: The Care and Maintenance of Small Planet' which explored the anthropogenic impacts on global environment and nature. It served the background material for the Stockholm Conference on Human Environment. In 1982, Erik Eckholm came out with 'Down to Earth' a review of the global efforts taken to protect the world's environment. Scientists have had a key role in defining what counts as an environmental problem. Yet it was not as if science just functioned to put issues on the agenda. Science was important as provider of the particular discourse that facilitated global consensus. Science is here seen as a practice that allows producing universally valid truth, thus opening the possibility to negotiate agreements on the remedial strategies required. Yet since science is explicitly silent on cultural matters, it cannot make differences between what some authors have called "survival emissions" and "luxury emissions". In other cases the very methods with which data were generated implied a cultural bias.

The emphasis on the global dimension of the ecological crisis stems from the early 1970s. This was the era of "saving the planet" and brought about the globalization of the terms of environmental discourse, at least in the circles of policy makers. Starting with the Stockholm Conference on Human Environment in 1972, the environmental discourse attracts the attention throughout the world but got a global face and importance after twenty years with the Earth Summit of 1992 held at Rio. Thereafter, both the developing and developed countries have framed and signed many number of environmental conventions, treaties and protocols for the conservation and protection of our mother nature from the harmful anthropogenic activities causing environmental pollution and degradation of global scale. Another way of sensitizing the issues of environmental discourse and making it global is the role visual and print media is playing in highlighting it. The heads of various States have also joined hands together to initiate the environmental crisis which has now taken a global face.

Emergence of green politics in 1970s which is a political ideology that aims for the creation of an ecologically sustainable society rooted in environmentalism, social liberalism, and grass root democracy and light outs campaign are some of the major positive consequences of globalization of environmental discourse. 90,000 migratory birds die every year from colliding with skyscrapers in New York alone. The Light Outs Campaign, started in Chicago encourages tall building to dim their lights during peak migratory seasons every fall. While it seems like the light on sky scrapers might ward off birds, it actually attracts them. The Empire State Building, the Chrysler building and the Rock feller Centre (among other New York skyscrapers) will all be dimming their lights this fall. The campaign will not only save birds; it will save energy as well. If a 2.5 million square foot building shut off all of its light after midnight this fall, it would conserve, 750,000 kilo watts and save $120,000.

1.5 THE ECOLOGY OF GLOBAL CONSUMER CULTURE

Our consumption of goods obviously is a function of our culture. Only by producing and selling things and services does capitalism in its present form work, and the more that is produced and the more that is purchased the more we have progress and prosperity. The single most important measure of economic growth is, after all, the gross national product (GNP), the sum total of goods and services produced by a given society in a given year. It is a measure of the success of a consumer society, obviously, to consume. However, the production, processing, and consumption, of commodities requires the extraction and use of natural resources (wood, ore, fossil fuels, and water); it requires the creation of factories and factory complexes whose operation creates toxic byproducts, while the use of commodities themselves (e.g. automobiles) creates pollutants and waste. Yet of the three factors environmentalists often point to as responsible for environmental pollution — population, technology, and consumption — consumption seems to get the least attention. One reason, no doubt, is that it may be the most difficult to change; our consumption patterns are so much a part of our lives that to change them would require a massive cultural overhaul, not to mention severe economic dislocation. A drop in demand for products, as economists note, brings on economic recession or even depression, along with massive unemployment.

Is the whole world drinking Coke? Is it a new freedom or a new form of tyranny? Is the world becoming one big McDonalds, dominated by global brands, multinationals, and Hollywood media? Or is there a resurgence of nationalism and fundamentalism that is creating new kinds of local cultures founded in existing traditions? And is consumerism going to eventually destroy the planet's ecology? 'Five days work and two days spend' is something called as hyper consumerism prevalent in America. The world is in the grip of unprecedented social and cultural changes, as world trade in consumer goods begins a new phase of expansion. Global communications media and cheap air travel have reduced the costs of cross-cultural connections of all kinds, boosting television, tourism and emigration to new levels. At the same time, following the collapse of the Eastern Bloc, capitalism has become more pervasive, less nationally-limited and more powerful all over the world. Global financial integration proceeds at a furious pace, while commodity flow increase and countries become increasingly dependent on each other for food and basic commodities.

Something important is happening, and we are only beginning to understand what the effects will be on our lives and on the knots of shared identity and practice that anthropologists have always called "cultures." One important dimension of this global change is the dramatic increase in the consumption of goods manufactured, designed and/or marketed by firms based in Europe, North America and Japan. The dramatic global increase in the consumption of "northern" goods has been perceived, in many places, as the greatest threat to the continued existence of local traditions, local cultures and local economic autonomy. As per an estimate Indians are fifth in purchasing power or consumption of goods. Pollution is also related to increased consumption. That is, the consumption itself, plus the production and waste of products used in consumption. Automobiles are a clear example. Other examples include industrial waste (especially when just dumped into the rivers and oceans), waste from the tourist industry (including cruise liners, air travel, etc.), waste from industrial agriculture, consumer waste such as household waste, excessive product packaging, our "throw-away" culture, and so on.

While pollution is increasing in poorer countries as well, it is not solely due to rising populations, because, as the U.N. points out, and as mentioned earlier, 86% of the world's resources are consumed by the world's wealthiest 20%. Hence, even if pollution is occurring in poor countries, a large portion of it is to meet this consumer demand. In its September 2008 issue, the journal *Energy Policy* found that around 1/3rd of Chinese carbon dioxide emissions were due to the production of exports and that it is mostly the developed world consuming these. Another trend is to also export waste to other regions of the world. As one example, hazardous electronic waste, such as old computers, old computer monitors, etc primarily from wealthier nations, are also being exported to places like China, India and Pakistan, where they are processed in operations that are extremely harmful to human health and the environment. However, minimal or non-existent environmental and working standards and regulations, old technologies for recycling and processing, etc. is putting a lot of people and surrounding environment at risk due to the sheer amount of waste to be processed.

Junk-food chains, including KFC and Pizza Hut, are under attack from major environmental groups in the United States and other developed countries because of their environmental impact. Intensive breeding of livestock and poultry for

such restaurants leads to deforestation, land degradation, and contamination of water sources and other natural resources. For every pound of red meat, poultry, eggs, and milk produced, farm fields lose about five pounds of irreplaceable top soil. The water necessary for meat breeding comes to about 190 gallons per animal per day, or ten times what a normal Indian family is supposed to use in one day, if it gets water at all. Overall, animal farms use nearly 40 percent of the world's total grain production. In the United States, nearly 70 percent of grain production is fed to livestock. Thus the growing consumer culture at global level is disturbing the ecological homeostatic mechanism of our planet which if not stopped will create havoc to it.

1.6 SUMMARY

The term environment refers to the sum total of physical, biological and cultural elements which are interlinked individually as well as collectively in myriad ways and which surrounds man at a given point in space and time. As early as 1896, the Swedish scientist Svante Arrhenius had predicted that human activities would interfere with the way the sun interacts with the earth, resulting in global warming and climate change.

Ecological sustainability is defined as a capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term. Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures.

Number of global environmental issues threatening our mother nature and are also the topic of hot debate is ecological sustainability; global warming; degradation of Water and Land Resources; loss and conservation of biodiversity; intensive farming; Anthropogenic Landscapes; dams construction; and pollution. Science is also playing an important role in the Globalization of Environmental Discourse. While due to fast growing population a new consumer culture is emerging globally and affecting the ecology of our environment.

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Sample Questions

1) Define global warming and its ecological impacts.
2) What are the main causes of water and land degradation?
3) What do you mean by 'peak water' condition?
4) What are the ways and means of conservation of bio diversity?
5) Discuss the role of global consumer culture on the ecology of earth.

Elements of Geography:

Includes: Atmosphere, Hydrosphere, Lithosphere and Biosphere

Atmosphere:

Total 5 layers:

Troposphere

- The troposphere is the atmospheric **layer closest to the planet** and contains the largest percentage (around 80%) of the mass of the total atmosphere.
- Temperature and water vapor content in the troposphere **decrease rapidly with altitude.**
- The troposphere contains **99 % of the water vapor** in the atmosphere.
- **All weather phenomena** occur within the troposphere, although turbulence may extend into the lower portion of the stratosphere.
- Troposphere means "**region of mixing**" and is so named because of vigorous convective air currents within the layer.
- The upper boundary of the layer, known as the **tropopause**, ranges in height from **8 km near the poles up to 16 km above the equator.** Its height also varies with the seasons; highest in the summer and lowest in the winter.

Stratosphere

- The stratosphere is the second major strata of air in the atmosphere.
- It extends above the tropopause to an altitude of about (50 km) above the planet's surface.
- The air temperature in the stratosphere remains relatively constant up to an altitude of (25 km).
- Then it increases gradually to up to the stratopause.
- **Ozone** plays the major role in regulating the **thermal regime of the stratosphere**, as water vapor content within the layer is very low.
    - **Temperature increases with ozone concentration**.
    - The ozone layer is centered at an altitude between (15-30 km).
    - Approximately **90 % of the ozone in the atmosphere resides in the stratosphere**.
    - Ozone concentration in this region is about 10 parts per million by volume (ppmv) as compared to approximately 0.04 ppmv in the troposphere.
    - **Ozone absorbs the bulk of solar ultraviolet radiation** in wavelength. These **wavelengths are harmful** to life because they can be absorbed by the nucleic acid in cells.

Mesosphere

- The mesosphere a layer extending from approximately **(50 to 85 km)** above the surface, is characterized by **decreasing temperatures.**
- The **coldest temperatures** in Earth's atmosphere occur at the **top of this layer**, the mesopause, especially in the summer near the pole.
- The stratosphere and mesosphere together are sometimes referred to as the **middle atmosphere.**

Thermosphere

- The thermosphere is located above the mesosphere.
- The temperature in the thermosphere **generally increases with altitude** reaching 600 to 3000 F (600-2000 K) depending on solar activity.
- This increase in temperature is due to the absorption of intense solar radiation by the limited amount of remaining molecular oxygen.
- At this extreme altitude gas molecules are widely separated.
- Above (100 km) from Earth's surface the chemical composition of air becomes strongly dependent on altitude and the atmosphere becomes enriched with lighter gases (atomic oxygen, helium and hydrogen).

Exosphere

- The exosphere is the most distant atmospheric region from Earth's surface.
- In the exosphere, an upward travelling molecule can escape to space (if it is moving fast enough) or be pulled back to Earth by gravity (if it isn't) with little probability of colliding with another molecule.
- The altitude of its lower boundary, known as the **thermopause or exobase,** ranges from about (250-500 km) depending on solar activity.
- The exosphere is **a transitional zone** between Earth's atmosphere and interplanetary space.

Hydrosphere:

(1) Surface water: includes any freshwater that's sent into wetlands, stream systems, and lakes. Includes two ecosystems: (i) lentic and (ii) lotic

- **Lentic**: Pools, ponds ecosystems, and lakes are examples of still or slow-moving water, and it is home to both floating and rooted plants, algae, and animals. Lentic ecosystems comprise all standing water environments, such as lakes and ponds. These

ecosystems are home to algae, rooted and floating-leaved plants, and crustaceans such as crabs and shrimp. Here you'll find frogs and salamanders, as well as reptiles like alligators and water snakes

- **Lotic**: rapidly moving water, for example, rivers and streams. They are home to a broad range of insects, including beetles, mayflies, and stoneflies. River dolphins, beavers, otters, eels, minnows, and trout are among the creatures that call it home

(2) Groundwater: On the other hand, groundwater exists in subterranean aquifers that are situated underground. Most groundwater is obtained from snowmelt and rainfall that gets into the bedrock via the surrounding soil. Karst Topography is the formation of landforms due to solution and deposition on any limestone or dolomitic region by the action of groundwater.

Lithosphere:

Divided into three parts: Crust, mantle and core

Crust:

- It is the **outermost solid part of the earth**, normally about **8-40 kms thick.**
- Nearly **1% of the earth's volume** and **5% of earth's mass** are made of the crust.
- The thickness of the crust under the oceanic and continental areas are different. **Oceanic crust is thinner** (about 5kms) as compared to the **continental crust** (about 30kms).
- **Major constituent elements** of crust are Silica (Si) and Aluminium (Al) and thus, it is often termed as **SIAL**(Sometimes SIAL is used to refer Lithosphere, which is the region comprising the crust and uppermost solid mantle, also)

Mantle:

- The portion of the interior beyond the crust is called as the mantle.
- The discontinuity between the **crust and mantle** is called as the **Mohorovich Discontinuity or Moho discontinuity.**
- The mantle is about 2900kms in thickness.
- **Nearly 84% of the earth's volume** and 67% of the earth's mass is occupied by the mantle.

- The major constituent elements of the mantle are Silicon and Magnesium and hence it is also termed as **SIMA**.
- The uppermost solid part of the mantle and the entire crust constitute the **Lithosphere**.

Core:

-
  - It is the innermost layer surrounding the earth's centre.
  - The **core is separated from the mantle by Guttenberg's Discontinuity**.
  - It is composed mainly of iron (Fe) and nickel (Ni) and hence it is also called as **NIFE**.
  - The core constitutes nearly 15% of earth's volume and 32.5% of earth's mass.
  - The Core consists of two sub-layers: the inner core and the outer core.
  - The inner core is in solid state and the outer core is in the liquid state (or semi-liquid).
  - **Barysphere** is sometimes used to refer the core of the earth or sometimes the whole interior.

Biosphere:

It includes the interaction of physical environment with biotic and abiotic components in a specific geographical area. Comprises:

(i) Forest Ecosystem and (ii) Aquatic ecosystem

(I) Forest Ecosystem: 5 Types Of Forests

1. Tropical Evergreen Forests

- Found in **warm and humid areas** with an annual precipitation of over 250 cm and mean annual temperature above 22°C.
- **Trees:** In these forests, trees reach great heights up to 60 m or above.
- There is no definite time for trees to shed their leaves, flowering and fruition; **these forests appear green all the year round.**
- Species found in these forests include Rosewood, Mahogany, Aini, Ebony, etc.

- The more common trees that are found here are the jackfruit, betel nut palm, jamun, mango, and hollock.
- **Climatic Conditions:** Usually have a prolonged hot and dry season and a cold winter.
    - **Areas in India: Western Ghats, Andaman and Nicobar Islands** and **north-eastern region.**

2. Tropical Deciduous Forests (Monsoon Forests)

- **Region:** These forests are found in the **north-eastern states** along the **foothills of Himalayas, eastern slopes of the Western Ghats** and **Odisha.**
- **Rainfall:** Found in the regions which record **rainfall between 100-200 cm.**
- **Trees:** Tall trees with broad, branched trunks.
- Some of the taller trees shed their leaves in the dry season, gets new leaves in spring season.
- **Teak, sal, shisham, hurra, mahua, amla, semul, kusum, and sandalwood** etc. are the main species of these forests.

3. Thorn Forests

- **Rainfall:** The forests occur in the areas that receive **annual rainfall less than 50cm.**
- **Regions:** This type is found in areas with black soil: North, West, Central, and South India.
- Includes semi-arid areas of south west Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh and Uttar Pradesh.
- **Trees:** The trees do not grow beyond 10 metres and consist of a variety of grasses and shrubs. Spurge, caper, and cactus are typically found in this region.
- The plants remain leafless for most part of the year also known as Xerophytes.
- Babul, Acacia, Kokko, Khair, Khajuri, Ber, Neem, Khejri, Palas, etc.are common species of the forests.

4. Montane/ Coniferous Forests

- **Region:**

- at a height of 1800–4000 metres, receiving a **minimum rainfall of 200 cm.**
- In the South, it is found in parts of the **Nilgiri Hills, the higher reaches of Kerala.**
  - **Climatic Conditions:** Found in the region where **average rainfall is 100-200 cm** and temperature varies between 15°C to 22°C.
  - **Region:** Found in **north-western Himalayas** (except Ladakh and Kashmir), Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh, J&K, Chamba, Lahaul & Kinnaur districts (Himachal Pradesh) and Sikkim, Found in Jammu & Kashmir, Himachal Pradesh, Uttarakhand and northern hilly parts of Bengal.
- **Trees:** Mainly coniferous; deodar, oak, chilgoza, maple, olive, mulberry and willow.

5. Littoral/Swamp Forests

- **Region:** Found along the Andaman and Nicobar Islands and the delta area of the Ganga and the Brahmaputra.
  - Other areas of significance are the Mahanadi, the Godavari and the Krishna deltas.
- **Trees:** Some of these forests are dense and impenetrable. Only a limited number of plants are found in these evergreen forests.
  - They have roots that consist of soft tissue so that the plant can breathe in the water.
  - It consists mainly of whistling pines, mangrove dates, palms, and bulletwood.
- **Mangroves in India:** In India, the mangrove forests spread over 6,740 sq. km which is 7% of the world's mangrove forests.
  - The forests stabilise the shoreline and protect the coastal areas from erosion.
  - **Sunderbans along the Ganges delta is the largest tidal forest in the world.**

UNIT 4 SOLAR GREENHOUSES

Structure

4.1 INTRODUCTION

Solar greenhouses are the enclosures where crops, vegetables, flowers and plants can be grown under unfriendly climatic conditions. You know that the plant growth gets affected by availability of light, moisture, ambient temperature and carbon dioxide. It is possible to design enclosures which admits sunlight when it is desired and at the same time controls inside temperature within acceptable range. Usually, solar greenhouse find application in cold areas where vegetation is damaged due to extreme low temperatures. You will be happy to see that the greenhouse effect is a natural process.

You have already studied the solar radiation and its characteristics in OEY-002, Block 1, Unit 1. The amount of solar radiation incident on the earth's surface is almost constant and has the value of 1347 W/m^2 and is called the solar constant. A faction of the solar radiation is reflected back to the atmosphere by the clouds and the earth's surface. The radiation reflected by the clouds is called the albedo and has the value of about 30%. A fraction of the radiation is absorbed by the earth's surface until it emits the same amount of radiation. The radiation emitted by the earth's surface at room temperature is in infrared range.

After studying this unit, you will be able to :

- understand greenhouse effect,
- different types of greenhouses,
- design principles of greenhouses, and
- different uses of greenhouses.

4.2 GREENHOUSE EFFECT

It is only because of greenhouse effect that our life on Earth is possible to a great extent. Imagine for a moment that natural greenhouse in not there. What will be its effect? Without natural greenhouse the Earth's surface temperature would be 33°C cooler – a chilly – 18°C rather than the tolerable 15°C. The natural greenhouse is due to naturally occurring greenhouse gases such as water vapour, carbon dioxide, methane and nitrous oxide. If this is so then you may be wondering why we are so afraid with greenhouse effect. The reason of our worry is that due to rapid industrialization and extensive use of fossil fuels, the concentrations of greenhouse gases are increasing at an alarming rate.

The greenhouse effect is referred to the rise in temperature due to absorption of infrared radiation. You may better understand the greenhouse effect by seeing the Figure 4.1. You can see that earth absorbs the solar radiation. The earth emits long wavelength infrared radiations. These radiations are absorbed by the greenhouse gases and hence can't escape. The net effect is the result of increase of mean annual temperature.

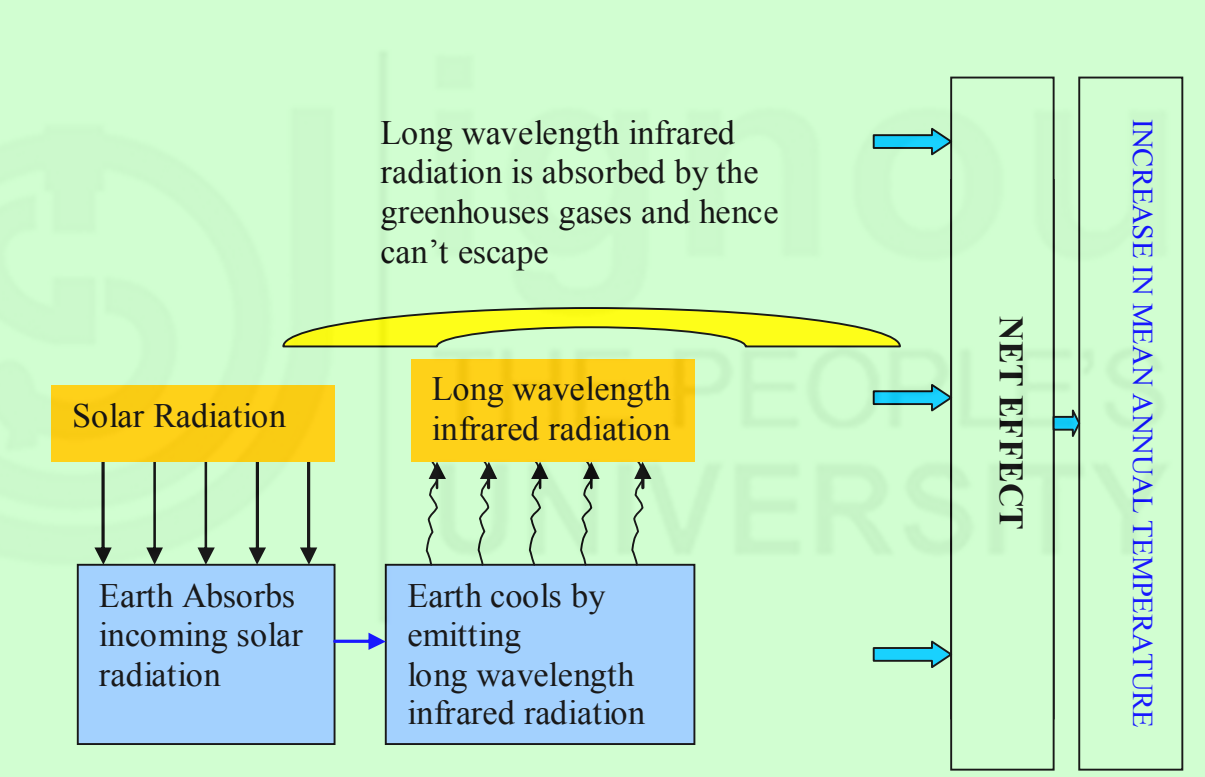

Figure 4.1 : Greenhouse Effect

Let us further understand this by examining the greenhouse effect as depicted in Figure 4.2. The following things are happening :

(1) The solar radiation is incident on the upper atmosphere.

(2) A fraction of it is absorbed by the earth.

(3) A fraction of the radiation absorbed by the earth is radiated towards the atmosphere.

(4) A faction of the radiation absorbed by the atmosphere is reflected back to outer space.

(5) The atmosphere emits radiation towards upper atmosphere and towards earth.

If the atmosphere absorbed all the infrared radiation emitted by the earth and continue to transmit all the incident radiation, the atmosphere will get heat up. The atmosphere radiates into outer space and towards the earth's surface in equal amounts. The earth's surface receives more radiation and gets heat up. This is greenhouse effect.

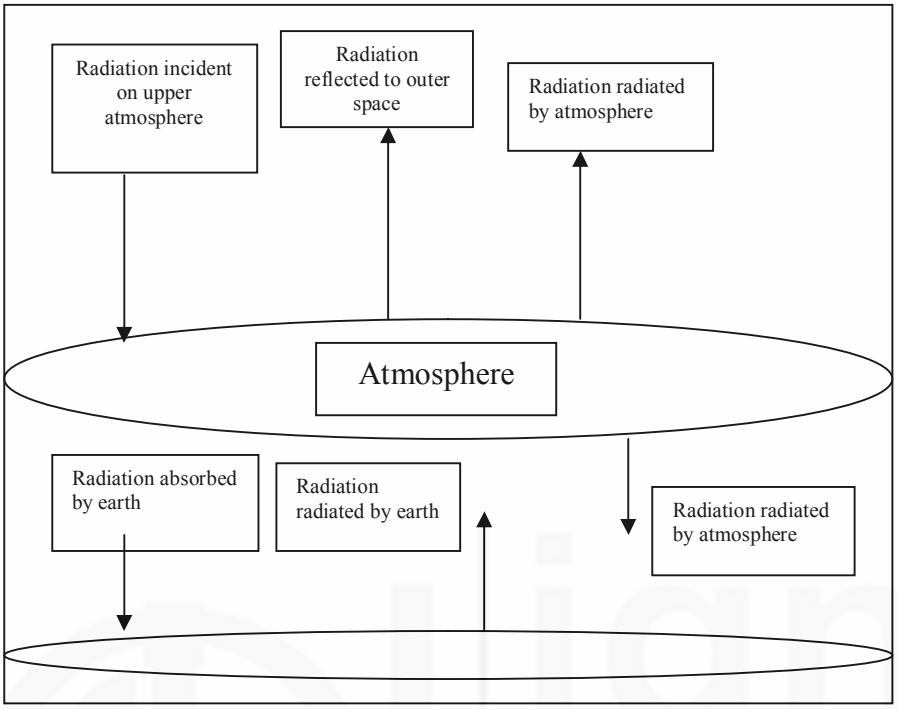

Figure 4.2 : Overview of Greenhouse Effect

4.3 IMPACT OF GREEHOUSE EFFECT IN NATURE

Before discussing details of solar greenhouses, it would be interesting for you to learn how the greenhouse effect in nature is affecting us, and how we can contribute in decelerating its growth.

The impact of greenhouse effect is the Global warming which is turn is affecting entire ecosystem and health of the people. The significant temperature rise is going to have drastic social, economic and ecological implications. The global warming is affecting the human society in many ways like causing the storms, hurricanes, floods and droughts, glaciers and polar ice is melting, sea levels is rising, forest fires cases are increasing and tropical diseases are increasing.

4.3.1 Greenhouse Gases

The naturally occurring greenhouse gases are water vapour, carbon dioxide, methane and nitrous oxide. The man made greenhouse gases are also the same. What actions generate these greenhouse gases is given in Table 4.1.

Table 4.1 : Greenhouse Gases and their Source

Sl. No.	Greenhouse Gas	Action Responsible for Generation of Greenhouse Gas
1	Carbon dioxide, CO_2	Burning of fossil fuels
2	Methane, CH_4	Anaerobic bacteria in rice fields, sewage
3	Nitrous Oxide, N_2O	Fossil fuels and fertiliser
4	Chlorofluorocarbon, CFCs	Refrigeration

We are approximately depositing 2 billion extra tonnes of carbon as shown in Figure 4.3.

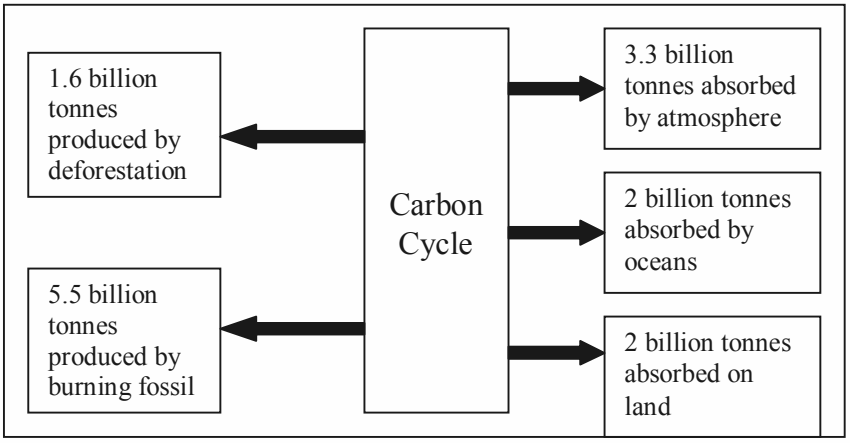

Figure 4.2 : Carbon Cycle

4.3.2 Climate Change

You will be surprised to know that various climatic models developed to predict the atmospheric temperature indicate that the atmospheric temperature is going to increase by between 1.5 and 4.5°C by the year 2100 if significant efforts are not made to control the emissions of greenhouse gases. An increase of about 5°C in the global temperature since the last ice age (10,000 years ago) has already happened. It is estimated that the Earth's average temperature has risen by 0.5 to 0.6°C since 1880 because of emissions of greenhouse gases from burning of fossil fuels and other human activities.

You can see the effect of rising temperature by observing the Figure 4.2. You can see that rising temperature leads to multiple effects like changes in regional wind systems, global rainfall, coral bleaching, destruction of coral reefs, growth in insect populations, negative effect on agriculture and human health, etc.

At this point, you may be in a position to differentiate between the greenhouse effect, global warming and climate change. All these three terms are interlinked. You may understand these terms in better ways by considering a problem and then its consequence or cause and its effect as shown in Figure 4.3. You can see that the greenhouse effect is the cause and global warming and climate change are the consequences. The increase in the temperature of the Earth's lower atmosphere is the global warming. The alterations such as rainfall patterns, evaporation and cloud formation result in climate changes.

4.3.3 Steps for Reducing Greenhouse Effect in Nature

Now you may be thinking what an individual can do about greenhouse effect. Each one of us can help to reduce the impact of greenhouse. Some of the simple steps are listed below :

A : Greenhouse Education

- You should make serious efforts to know all about the greenhouse effect, global warming and climate change.
- You must understand that consumption of the fossil fuels in making our energy requirements produces greenhouse gases which are responsible for greenhouse effect.
- Consuming more energy therefore leads to more greenhouse effect.
- You should make serious efforts to know about alternate energy sources.

B : Energy Conservation

- Energy conservation is in your hands. You should always remember that energy saved is more than the energy produced.
- The main greenhouse gas, CO_2, comes from the burning of fossil fuels. You can help in reducing the emissions of CO_2 by reducing consumption of electricity and energy in transportation.
- A car produces CO_2 roughly 2 tonnes per year.

You will learn more about energy conservation in OEY-003. We will give some tips which you can follow immediately for saving electricity.

C : Save Electricity

- Switch off the lights and any other electrical appliances (like ACs, TVs, radio) when not in use.
- Start making use of energy efficient lamps.
- Always use energy efficient appliances. They may cost more initially but will be more advantageous in long run.

D : Save Petroleum Fuels

- Easiest and more effective way is to reduce private transport. You may adopt a car pool to go to work or elsewhere.
- Make sure that your own vehicle is fuel efficient.

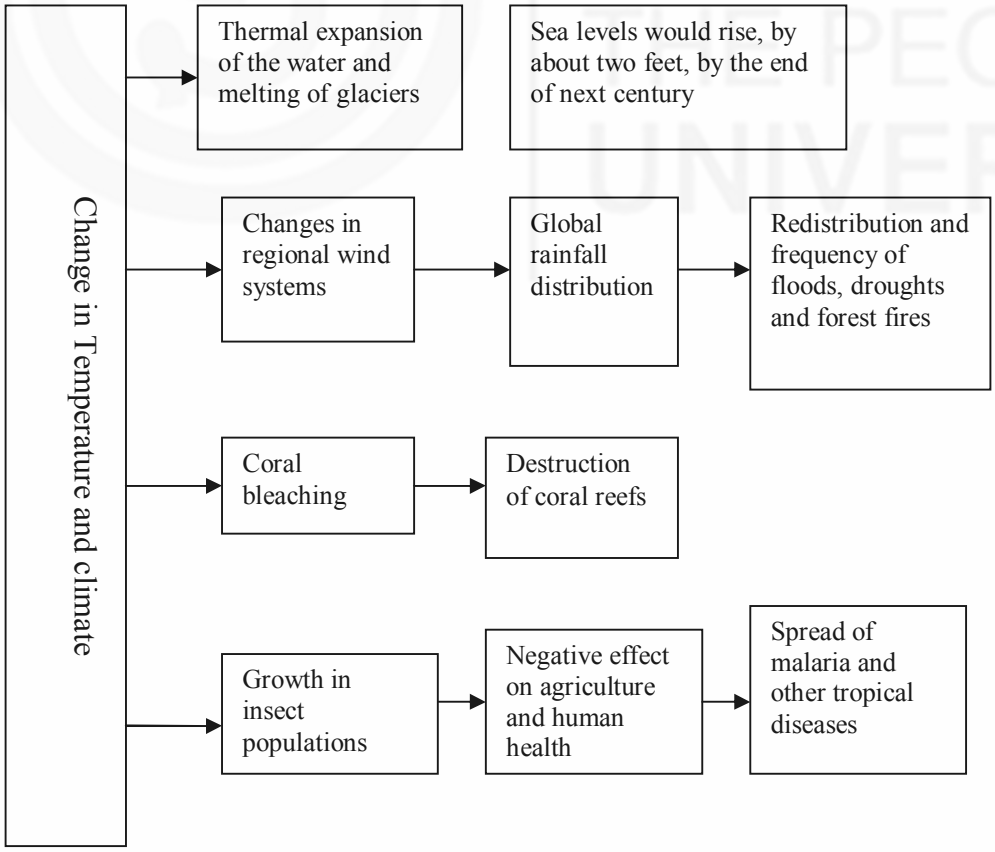

Figure 4.3 : Effect of Change of Temperature and Climate

SAQ 1

Give five steps which you can follow in order to reduce the effect of greenhouse.

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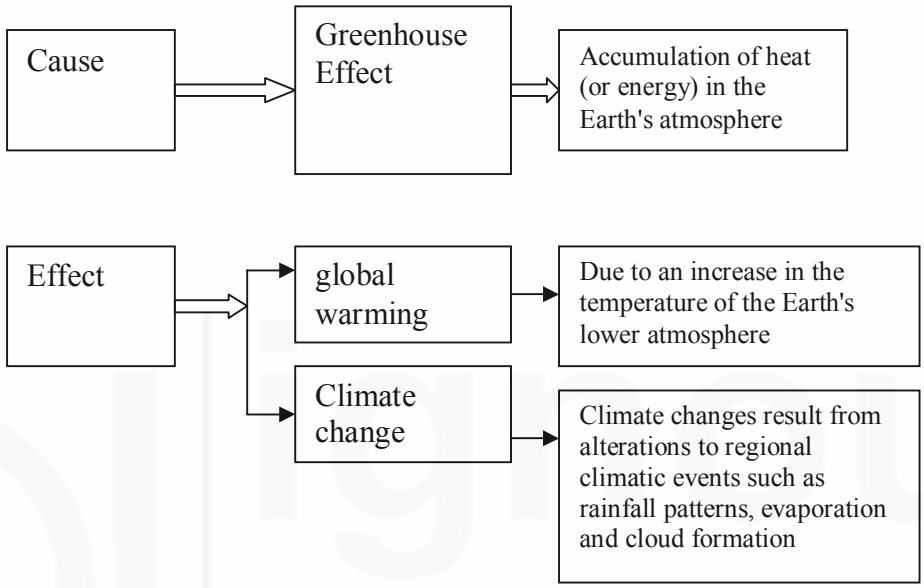

Figure 4.3 : Difference between Greenhouse Effect, Global Warming and Climate Change

SAQ 2

What are the effects of global warming?

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4.4 SOLAR GREENHOUSE

The most important purpose of a greenhouse is to collect solar energy to raise the indoor temperature and also store heat for use during night. Solar greenhouses are climate controlled.

The crops may be grown in solar greenhouses under favorable controlled environment, viz. temperature, humidity, light intensity, ventilation, soil media, disease control, irrigation and other agronomical practices throughout the season irrespective of the natural conditions outside.

The greenhouse technology available today is suitable for :

- Production of vegetable crops.
- Production of off-season flowers, vegetables.
- Production of roses, carnation, cut-flowers, etc.
- Plant propagation, raising of seedlings.
- Primary and secondary hardening nursery of Tissue cultured plant.

The basic principle of solar greenhouses is that the solar radiation coming from sun passes through the glass cover, but the radiation emitted by the heated surfaces present inside the enclosure cannot escape as the glass is opaque for longer wavelength radiation.

SAQ 3

Explain the difference between greenhouse effect, climate change and global warming.

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An interesting thing about solar greenhouses is that there are choices to choose from and to suit the needs for various applications. Solar greenhouses could be of stand alone structure type to cater to larger capacity requirements. Solar greenhouses are also constructed to meet limited domestic requirements of growing vegetables as an attachment to the existing building. Depending upon the use of auxiliary energy source, the solar greenhouses are broadly classified as passive and active greenhouse. These two makes use of different resources, but still serve a same purpose.

4.4.1 Passive Solar Greenhouse

The passive solar greenhouse does not make use of mechanical devices like motors, fans, etc. for transferring the solar heated air from the storage area to the other parts of the greenhouse.

4.4.2 Active Solar Greenhouse

The active solar greenhouse makes use of mechanical devices like motors, fans etc for transferring the solar heated air from the storage area to the other parts of the greenhouse.

4.4.3 Solar Heat Storage

The main feature in designing a solar greenhouse is that there must be sufficient amount of solar heat stored for use when sun is not shining. The solar energy can be stored by making use of rocks or concrete, etc. in the floor and the walls of the greenhouse.

4.5 DESIGNING OF SOLAR GREENHOUSE

Solar greenhouses have the following features :

- Solar greenhouse should be elongated along east-west axis to have longer south side to allow receipt of maximum solar radiation.
- North wall could be made opaque, especially in regions where sub-zero ambient temperatures are experienced.
- To prevent one sided growth of the plants, ceiling and upper part of the north wall should be made white painted to reflect sunlight onto the plants.
- Double glass cover can also be used in regions with severe winters for constructing solar greenhouse.
- Provision of openings to be provided to evacuate extra heat through ventilation during periods of temperatures higher than acceptable.
- Solar greenhouse makes use of heat storing materials to retain solar heat. Pebbles can be provided in the floor with top surface painted in dark colour to capture maximum solar heat. This heat can be blown in during night to keep inside warm.
- Plastic sheets can also be used in place of glass for constructing solar greenhouse, however, these needs to be UV_stabilized to have their longer life.

4.6 LET US SUM UP

While discussing about solar greenhouses, in this unit you have learned all about greenhouse effect, global warming and climate change. You have also learned how to reduce their impact.

The greenhouse effect is referred to the rise in temperature due to absorption of infrared radiation. The Earth absorbs the incoming solar radiation. The earth emits long wavelength infrared radiations. These radiations are absorbed by the greenhouse gases and hence can't escape. The net effect is the result of increase of mean annual temperature.

The impact of greenhouse effect is the Global warming which is turn is affecting entire ecosystem and health of the people. The global warming is affecting the human society in many ways like causing the storms, hurricanes, floods and droughts, glaciers and polar ice is melting, sea levels is rising, forest fires cases are increasing and tropical diseases are increasing.

The naturally occurring greenhouse gases are such as water vapour, carbon dioxide, methane and nitrous oxide. The man made greenhouse gases are more or less similar. The main source of the greenhouse gases is the burning of fossil fuels for various applications. It is estimated that we are adding about 2 billion tons of carbon in the overall carbon cycle.

The rising temperature leads to multiple effects like changes in regional wind systems, global rainfall, coral bleaching, destruction of coral reefs, growth in insect populations, negative effect on agriculture and human health, etc.

The greenhouse effect, global warming and climate change are interlinked. The greenhouse effect is the cause and global warming and climate change are the consequences. The increase in the temperature of the Earth's lower atmosphere is the global warming. The alterations such as rainfall patterns, evaporation and cloud formation result in climate changes.

The solar greenhouse technology available today is suitable for production of vegetable crops; production of off-season flowers, vegetables; production of Roses, Carnation, cut-flowers, etc. plant propagation, raising of seedlings; primary and secondary hardening nursery of tissue cultured plant. This technology has high potential in areas with severe winter conditions.

4.7 KEY WORDS

Carbon Dioxide (CO_2)

A product of combustion.

Carbon Monoxide (CO)

A colorless, odorless, highly poisonous gas made up of carbon and oxygen molecules formed by the incomplete combustion of carbon.

Chlorofluorocarbons (CFSs)

A family of artificially produced chemicals; used as refrigerants, solvents and in the production of foam material; composed primarily of carbon, hydrogen, chlorine, and fluorine.

Greenhouse Gases

The greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and water vapor (H_2O). They allow visible light and ultraviolet light (short-wave radiation) to pass through the atmosphere and heat the earth's surface. This heat is re-radiated from the earth in form of infrared energy (long-wave radiation). The greenhouse gases absorb part of that energy before it escapes into space.

Greenhouse Effect

A warming of the Earth and its atmosphere caused by greenhouse gases and water vapor trapping heat from the sun.

4.8 ANSWERS TO SAQS

SAQ 1

The five steps for reducing the impact of greenhouse effect are :

(1) Greenhouse Education : Know all about the greenhouse effect, global warming and climate change and make others also to know about them.

(2) Know About Alternate Energy Sources : You should make efforts to know renewable energy sources and how to use them.

(3) Adopt Energy Conservation : It is in your hands. Always remember that energy saved is energy produced.

(4) Save Electricity : Switch off some thing some where which is not in use, starting using energy efficient appliances.

(5) Save Petroleum Fuels : Make sure that your own vehicle is fuel efficient.

SAQ 2

Global warming is the consequence of the greenhouse effect and is causing harm to the environment and health of the people. The significance effects of global warming are (1) harm to the entire ecosystems, (2) the storms, hurricanes, floods and droughts are increasing, (3) glaciers and polar ice is melting, (4) sea levels is rising, (5) forest fires cases are increasing and (6) tropical diseases are increasing.

SAQ 3

The greenhouse effect, global warming and climate change are interlinked. The greenhouse effect is the cause and global warming and climate change are its consequences. The increase in the temperature of the Earth's lower atmosphere is the global warming. The alterations such as rainfall patterns, evaporation and cloud formation result in climate changes.

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