UNIT 37 ECOLOGY AND THE FUTURE OF SOCIETY

Structure

37.0 OBJECTIVES

After going through this unit you should be able to

- define ecology and state the interconnection between human beings and their environment
- list some of the approaches in ecology

- state the basic needs of human society and describe the nature—human beings nexus in the context of Indian society
- describe the health hazards that follow from pollution of water, atmosphere and soil
- examine the situation regarding forest exploitation
- describe the social movement which has emerged to check forest exploitation
- list the measures taken to preserve forests for the present and for the future.

37.1 INTRODUCTION

This unit describes certain aspects of the interaction between human beings and their environment in the context of Indian society. We have begun this unit by stating what is ecology and gone on to describe the interconnection between human beings and their environment. We have outlined some of the basic ecological approaches, which explain this interrelationship between society and environment. Then we have focused on ecology in the context of Indian society. We have listed the basic needs of human beings and described the situation regarding human dependency on nature in India and the condition of India's environment. We have focused our attention on sources of water and atmospheric **pollution**. We have then listed the health hazards that follow from food **contamination**, toxins, chemical **effluents** and pesticides. While examining the situation regarding human exploitation of forests we have described **deforestation**, timber business and the growing social movement in Uttaranchal (*Chipko* movement) to check indiscriminate felling of trees. While describing the efforts taken to preserve forests and the steps towards future use of forests we have focused on measures relating to conservation and **afforestation**.

37.2 WHAT IS ECOLOGY?

Ecology is the study of the interrelationship between organisms and their environment. It is viewed as an interdisciplinary or multi disciplinary field of science which systematically draws knowledge from many disciplines like genetics, anthropology, sociology etc. As sociologists we are interested in the interrelationship between human beings and their environment. By environment, here, we mean the natural environment, including forests, rivers, lakes, seas, mountains, plans, etc.

Human beings have always had a dynamic interaction with the environment. The interaction has been reciprocal i.e., two-way relationship. Four factors in the environment have been crucial in this interaction. The factors are climate, land and soil configuration, specific location i.e., in a desert, wooded or water logged area, and natural resources including forests, mining deposits and so on. These four factors have had a deep effect on human societies. The culture of a society, to a great extent, reflects the profound impact of environment on human thought and behaviour. Occupation, food, clothing, shelter, religion,

arts, morals, ideas and so many other cultural creations of human beings are influenced by the kind of environment they live in.

At the same time, human beings have also made a deep impact on their natural environment. The culture of a society, especially the quantity and a quality of technology has affected many elements in the environment. For instance, the invention of saw or axe or electronically operated cutting machines has helped in a quick and efficient way of felling trees. Timber is needed by human beings for a variety of purposes. Excessive felling of trees produce a strain on the environment that a new approach and technology is required to combat the ill-effects created on the environment as well as the human society due to a quick and drastic reduction of forest cover. The way in which human societies deal with the environment determines their future.

As industrialisation specially technology has advanced in a society, the interaction between human beings and their environment in that society has taken an alarming turn. Air, water, atmosphere, forests, rivers, plants and many elements of nature have been affected by the kind and quantity of technology used. Nature affected by technology, in turn, has created problems for man especially in terms of health. Pollutants, for instance, from factories, is so much changing the environment that the entire culture, a product of the environment must adjust to the situation of its own making.

There are many facets to the interaction between human beings and their environment. This interaction varies not only between cultures but also within a society. It is not uncommon to find that within a nation or a country there are groups of people who differ from one another in many aspects of living. Sometimes, a government, keeping in view national development, may introduce or impose technology on a group of people depending on nature for their living. Such a group of people, who have been depending on and interacting with nature with simple technology, may find the new technology absolutely disrupting. The equilibrium that they had created with nature may be destroyed by the new governmental plans and schemes. Such a group of people may feel totally uprooted and alienated when their source of economic, social, moral, physical and mental well being is altered by the introduction of new technology.

What we are trying to emphasise here is that the interconnection between human beings and their environment is a complex one. It has varied through time, place and people. Where there is a balanced, reciprocal relationship between a human society and their environment, there is little to worry about. But what seems to be a growing threat to the quality of human life and the very survival of man, is the problems created by the exploitation of nature by human beings. The problems of “taking too much from the environment and restoring too little” have to be solved. In this unit we are going to focus only on certain aspects of the interrelationship between human beings and their environment. We will focus our attention especially on the problems created by indiscriminate use of nature by human beings in the Indian context. But before that let us describe some of the approaches to the study of the interrelation between human beings and their environment. The ecological approaches gives us an idea as to what factor and how much each factor contributes to the interaction between human beings and their environment.

37.3 APPROACHES IN ECOLOGY

Approaches to the study of the interrelationship between organisms and their environment are varied. Here we will describe four approaches. They are 1) **Determinism** and Possibilism, 2) Cultural Ecology, 3) Ecosystem Model and 4) System model.

37.3.1 Determinism and Possibilism

The first approach in the study of ecology that we introduce is called determinism. The determinist argument revolves basically around the question of which factor influences the other more—human beings or their environment. In this theory the environment is given primacy in terms of influence. In doing so, however, it is understood that human beings are not entirely passive. That is to point out that humans are not completely at the mercy of their environments. However, it should be noted here that in modern civilisation nature does not determine human behaviour so much. In fact, in many areas human beings are taking a heavy toll of nature. This toll has been in terms of cutting down forests indiscriminately.

In possibilism approach, primacy is given once again to environment. The basic idea of this theory is that environment is the key factor in civilisational developmental possibilities. That is to say if the natural environment provides mineral and forest, good climate, proper topography and so on, it leads to a strong powerful nation. If resources like timber, oil, precious metals coal, etc., do not exist in sufficient quantities then a nation becomes weak, inefficient, and dependent on other nation-states. Let us take an example. Often developing nations have to export timber and other raw materials. When timber resources fall below a certain danger mark, say ten per cent forest area, then the donor country suffers. The people and communities have to bear with the consequences.

37.3.2 Cultural Ecology

We now consider the theory of cultural ecologists. These ecologists feel that the state of environment is directly related to the state of technology prevalent in any society. Cultural ecologists feel that technology, economics and population form the basic influences on societal processes. The relationships between technology and natural environment are significant. Thus, if we have electronic sawing machines, huge trucks to load it away, and a great need for timber for houses, furniture, shipbuilding and so on, forest cover (for example) will reduce greatly. So cultural ecology deals with the impact of culture on nature. There are occasions when this impact is beneficial, at others it is not so. Today, there is an imbalance against forests in India and the World.

37.3.3 Ecosystem Model

This model points out that human beings play powerful role in maintaining the balance between organisms and their environment. Human beings can preserve or destroy nature. The main advantage of this ecological model is that it is dynamic. Here the human being is considered to be one part of the overall ecosystem. The model points out that nature cannot now destroy entire towns and cities in a regular way. It may be possible in a calamity like a major earthquake. But this is a factor not to be easily ignored. It has been seen that

deserts infiltrate into villages, and floods inundate many fertile fields with silt. Thus, the ecosystem model indicates that there will be a severe backlash from natural disasters if human beings do not mend their irresponsible attitude. This includes all environment including forests, urban dwellings, transport system and even developmental paradigms or models.

37.3.4 Systems Model

Let us now examine the Systems Model. The advantage of this model is that it puts human beings at the centre of the scheme of ecological issues. Nevertheless it retains its interactive view. This is a great advantage since it posits mutuality between human beings and nature. This implies that ecological devastation can be halted only by a new creative and regenerative attitude. Thus the environment itself cannot be held responsible. So, human beings cannot expect the forest to regenerate itself! Human society must take the initiative to reverse the damage in all ecological areas of which acute deforestation is a real problem. Consider the diagram (figure 37.1) given below:

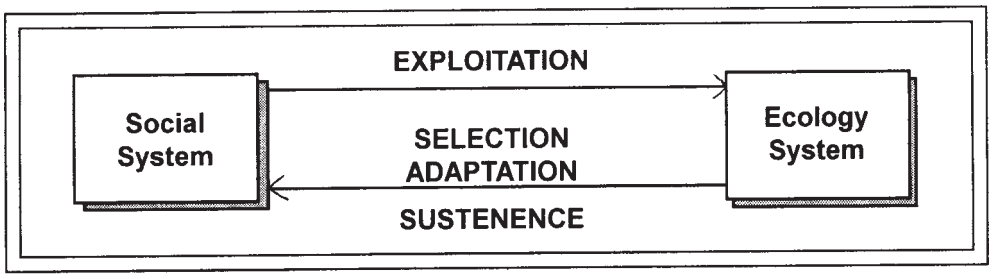

Fig. 37.1: The systems model of ecology

As we can see here the social system or society as a whole selectively exploits the ecological system. Simultaneously, the ecological system adapts to society and sustains it and its technological needs. Thus we find that the social system takes inputs from the ecological system including fuel, petroleum, food, wood, and so on. On the other hand, human beings very often do not pay back to nature for what they have taken. In other words, this "ecological borrowing" is on a vast and usually non-returnable basis.

We have seen in this section on ecological approaches that the interconnection between human beings and nature is reciprocal process. All these models indicate to us without any exception the guilt of humans in destruction of forests, minerals, and other natural wealth. It is human beings who pollute the river and seas with chemical effluents and technological wastes. It is amply clear that the flora and fauna are simply not considered when the forests are attacked and destroyed for commercial profits. This scenario can be changed only when all of us, no matter in what part of the country or world, decide to save our natural, forest and other wealth from permanent destruction. If the warnings that are given against this mass destruction are not heeded then mankind, as a whole will be in grave danger. The consequences may be totally unpredictable and uncontrollable. The people should be made aware of the advantages of the forests (Mclntosh, 1985). A Certificate Programme in Participatory Forest Management was started in 1999 by Indira Gandhi National Open University (IGNOU) with the general objective of developing an approach to the integration of forest depended communities into forest management.

In our next section we will look at ecology in the context of Indian society.

Check Your Progress 1

Use the space given below for your answers.

i) What is ecology? Use two lines for your answer.

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ii) What is the Cultural Ecology Approach? Use three lines for your answer.

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iii) Briefly explain the basic advantage of the systems model. Use four lines for your answer.

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37.4 ECOLOGY IN THE CONTEXT OF INDIAN SOCIETY

In this section we will list the basic needs of human society before we look into the situation regarding the interaction between human beings and their environment in the context of Indian Society.

37.4.1 Basic Needs of Human Society

All living systems at all biological levels remain interacting with the environment, which makes a complex network of ecosystem. Ecosystem is defined as the interaction of all living beings within themselves as well as with the environment, living in a single location (Malik and Bhattacharya 1986: 3). Human beings interact with one another as well as the environment. The environment including rivers, lakes, sea, atmosphere, forests, plants, deserts, hills, plains etc. helps in satisfying some of the basic needs of human society. Water and air, for instance, are essential for human survival. Water is needed for a variety of human purposes. Apart from human beings, plants, trees, animals, soil also need water for their sustenance and growth. Human beings also need plants, trees, soil and animals for their survival. Hence, there is a complex system of interdependency between living organisms and their environment. Similarly, the atmosphere (including air) is a basic and crucial component in the life of all living organisms including human beings. Air is needed for breathing. Without air no human life is possible.

Hence, it is very important that the water, the human beings use and the air they breathe are free from contamination. It is also essential that every human society has enough stock of healthy water and atmospheric resources, in order to build up a healthy future for its oncoming generations. Preservation of natural resources, and prevention of indiscriminate use of nature by human beings are essential steps for ensuring a long and better quality of life for all living organisms.

37.4.2 Situation in the Indian Context

That nature has been so much a part of Indian social life. Its significance has been very much evident in both the oral and written traditions of Indian literature. Trees, plants, streams, rivers, lakes, seas, sky, waterfalls, hills, mountains, snow, rain etc. have been intertwined with every kind of human experience. But, like in many other countries of the world, the interaction between human beings and their environment is taking an alarming turn in India too. Overemphasis on industrialisation, eagerness to catch up with the technological advancements of the developed world, pressures created by a rapidly increasing population are some of the factors which are threatening the human environment equilibrium in Indian society.

As it stands today, technology has not advanced so much that Indians are less dependent on nature and more dependent on technology. The average Indian citizen is still very much dependent on natural environment for the satisfaction of his/her basic needs. Agriculture is the main occupation in India. And this occupation is so much intertwined with nature. Water, soil, atmosphere greatly shape the kind and extent of agricultural activities in India. If monsoons fail a chain of serious and alarming consequences follow. Every aspect of human activity is affected by lack of or insufficient supply of water. To a sizeable extent, the problems posed by environment factors are created by the way human beings have used nature. Contamination of water sources, indiscriminate felling of trees, atmospheric pollution created by smoke and fumes, extensive use of pesticides for plants and crops are some of the problematic areas in Indian society. Indian society cannot afford to misuse nature upon which is dependent both the quantity and quality of life.

Let us now briefly describe the way in which water, atmosphere (including air) plants, crops and soil are contaminated by technology and human misuse in India.

37.4.3 Water Pollution

India is a nation, which is the abode of many rivers such as the Ganga, Jamuna, Krishna, Indus, Brahmaputra, Godavari. The longest river in the world, the Brahmaputra also runs through India. These rivers are not only a source of life but also religiously significant to the people of India. Apart from this many beautiful lakes such as those of Udaipur, Nainital, Bhimtal, Ootacumund and so on also exist. However, water is still a very scarce and valued resource. Of all available water seventy per cent has become polluted over the years. This is a very large percentage of water to be polluted. This includes the waters of the Dal Lake of Srinagar down to the Chaliyar and Periyar rivers in the South. Again we find that the waters in the Hooghly and the Damodar in the East and the Thane in the West have water pollution levels that are very high.

Ganga, a symbol of purity has had chemical effluents continuously dumped into it from the factories.

Water pollution is also evident from our bad drainage system. The disease arising from dirty water drains, and from the waste matter from human settlements are major pollutants. Pollution from them accounts for four times as much as does industrial effluents. Most of these pollutants are disposed of untreated into the water-ways. In 1981 out of India's 3119 cities and towns only 217 had some sewage treatment facilities. Take example of Delhi which had a population of 3 million in 1960 and by 2003 the population is about 14 million. The available water resources cannot support the increase and water treatment capacity of waterwork is simply too low in comparison. In Delhi, urban genocide is a real prospect (Soni 2003). Such a high percentage of pollution is a cause of grave concern. It has been discovered that two thirds of water based diseases like typhoid, cholera and jaundice cause very severe health problems. As quoted in Gadgil (1998), as per an estimate of World Health Organisation more than five million people die every year because of unsafe drinking water

Activity 1

Observe the functioning of the drainage system in your area and answer the questions.

i) Is it functioning properly?

ii) If not, then how is it affecting your life and the life of the people living in your area?

iii) Are people in your area aware of the effect of bad drainage on their health or not?

iv) Do you think the functioning of the drainage system is related to your social life? If so, give two examples.

Write a note of about two pages and compare your answer, if possible with the notes of other students at your Study Centre.

When water sources get polluted we find that all life forms are affected for the worse. Industrial effluents and pollutants very often kill fish forms, and plants. This leads to lowering of our food quantum and breaks down the livelihood of many Indians.

Similarly, all over India the pollution of river and lake water due to direct drainage of sewage into it, the unloading of industrial effluents, and the unabated washing of clothes with detergents has led us to badly polluted water sources. It is really necessary to find out what can be done about these problems. They must be resolved. This is because pure drinking and potable water is a must for forging ahead towards health and greater prosperity.

Today steps are being taken to contain water pollution. Government as well as voluntary agencies are using the television, radio, press, and other educational sources to warn people of the dangers of living with water contamination. However, the 1987 water policy of the Government of India was not able to change the way water resources were managed in India. Unless,

an operational agenda is adopted, even the 2002 water Policy is likely to result in non-implementation (Shah and others 2004).

37.4.4 Atmospheric Pollution

Let us now turn to the issue of atmospheric pollution and the problems that have arisen due to this. In its pristine (pure) state atmosphere provides man and animal a clear source of oxygen for breathing. If it is not pure due to exhaust fumes from industries and motor cars then we find that it can lead to many diseases including tuberculosis, asthma and even cancer. The Motor Vehicles Act, 1989 has a major objective to check this pollution emitted from motor vehicles. The atmosphere is not unlimited and we find that industrial production, commercial and private use of vehicles leads to a blackening of the atmosphere. In fact, inhaling of the polluted atmosphere in a big city equals the nicotine smoke of several cigarettes. One of the most dangerous forms of pollution is cigarette smoke. Not only does it cause ill health for the smoker but also the non-smokers in the vicinity also. The government banned this in public places, buildings and institutions. The increasing amounts of carbon dioxide in the atmosphere have led to the "greenhouse" effect whereby the earth's temperature becomes much higher than it should be for efficient environmental functioning. The immediate effects of air pollution are diminished visibility, health hazards, and diseases of crops and vegetation. In fact, the marble of the Taj Mahal itself is getting dangerously eroded due to the polluted air that is poured out from industrial chimneys.

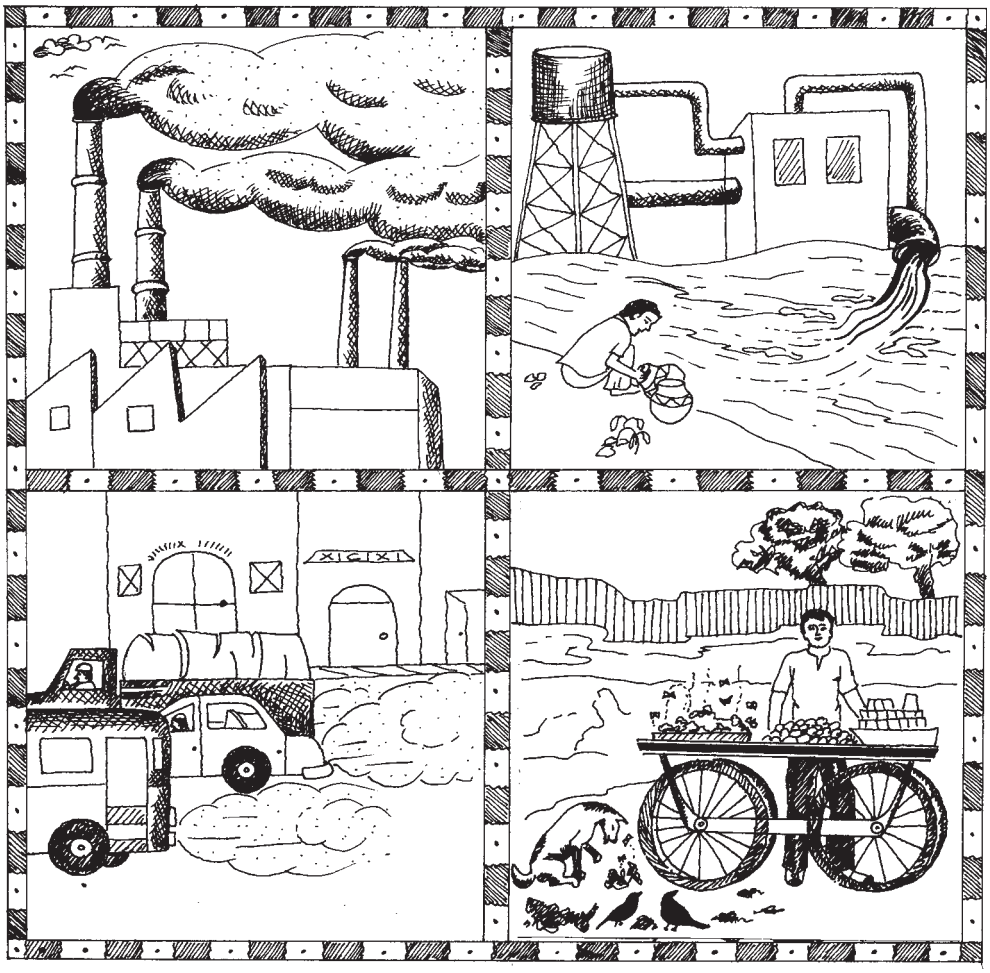

Fig. 37.2: Environmental Pollution

Our knowledge of the long-term ill effects of atmospheric pollution is not very much, but we do know the matter is serious. An increase of 1-2°C in world temperature would completely upset the efforts of Indian agriculturists. There would be more heat in the summer and more rains in the monsoon. Thus atmosphere is an important fact for all human activity. Endeavours should be made to make the air pure. Air pollution levels are being steadily controlled in many major cities of the west. However, in India these levels are alarmingly increasing. A large percentage of metropolitan dwellers in India suffer from respiratory diseases. Figure 37.2 shows various sources of environmental pollution in our society. Those living in large cities and their congested conditions are well aware of the various types of pollutants that plague the atmosphere. Compulsory use of compressed liquid gas for running public transport in Delhi had been known to reduce the pollution level in Delhi's air. Yes, this does not seen to be adequate measure to contain the extreme air pollution of the city. We need more efforts in several directions.

37.4.5 Land Degradation

On the fertility of agricultural land depends our capacity to feed the population of India. Increased foodgrains production is feasible only by intensive farming and multicropping. Water resources are relatively unharnessed and efforts can be made to harness a larger percentage of these.

India's total area comes to about 328 million hectares. Of this the cultivated land is about 43.6 per cent, and permanent pastureland is about 14.6 per cent. Potentially arable land is about 14.6 per cent. Forested area makes up about 10.7 per cent. Barren and uncultivable lands are 6.4 per cent. Urban land is about 5.5 per cent. Under the above distribution of lands, according to forecasts, India should reach a target of 300 million tonnes in foodgrains. This estimate is based on an average of four tonnes per hectare, from lands that are irrigated. On a similar projection for 2000 A.D., the production was upto 426 million tonnes. However, such estimates are based often on very many factors remaining constant. For example, they would need good regular monsoons. This is not a realistic assumption, more so, with atmospheric pollution disturbing geographic air movements.

The Indo-Gangetic Plain a major agricultural belt is very much subject to top-soil **erosion**. Hence, unless top-soil is kept fertile we find that it will become much less productive. Crop leftovers and organic manure needs to be further used to maintain fertility. The reason they are not used is the ready and cheap availability of relatively crude/inferior chemical fertilisers. However, with organic manures greater productivity is possible. They also regenerate the soil and make it more fertile. This knowledge needs to be disseminated to all Indian farmers. It is also important that the land be made nitrogen rich for higher productivity. Thus, the land's fertility needs to be protected and it should be seen that we keep manuring and fertilising it. This would help restore and maintain an ecological balance, with land fertility. Such soil erosion leads to severe economic stress on human societies. The yield is lowered if the soil erodes and therefore this must be protected (Chopra 1982).

Check Your Progress 2

i) Write a note on Water Pollution. Use three lines for your answer.

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ii) Write a note on atmospheric pollution. Use about five lines for your answer.

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37.5 HEALTH AND ENVIRONMENT

While describing the situation regarding water and air contamination we referred to the health hazards that contamination gives rise to. The nature and extent of use of environment by human society is closely related to health systems. Let us look at the health aspect more closely. For example, the water we drink, the food we eat is closely related to our physical well being. If drinking water is contaminated disease inevitably follows. Thus, the drinking water should be clean and free of diseases. Of all diseases that take a significant toll of human lives only small pox has been fully eliminated. Due to the unfortunate and widespread use of pesticide sprays in India where wheat, lentils and rice are usually taken as meals the toxic pesticide residues of DDT (Dichloro Diphenyl Trichloroethane) and BHC (Benzene Hexachloride) are also inadvertently consumed. Although, the amount taken involuntarily ingested is miniscule it is more than the danger level defined by WHO (World Health Organisation) Surveys which have shown that toxic pesticides like DDT and BHC enter into the food chain and poison the diet of Indians. Deplorably, it has also been found that miniscule quantities of DDT are deposited in the breast milk of mothers. Baby foods available in the markets are also not free from such contamination. Toxicologists believe that not only present generations of babies but future generations too will suffer because of this. Social systems and institutions, such as hospitals and allied medical services are all pressed into service severely because of this 'slow' food poisoning. Measures to remedy this must be taken post haste. All acts concerning prevention of food adulteration must be strictly enforced via inspections and other measures. Let us now examine the impact of food contamination, toxins, chemical effluents and pesticides on health.

37.5.1 Food Contamination

We cannot say with great certainty what food contaminations will ultimately result in, yet some concrete indicators do exit. In the Chikmangalur and Shimoga districts of Karnataka about 300 people suffer from arthritis, since 1975. Many people have suffered from terrible personal tragedies because of food contamination.

Another similar tragedy took place in 1975. Farmers in Lakhimpur Kheri in Uttar Pradesh had been using BHC for foodgrain preservation. The people who used such foodgrains suffered from severe convulsions.

The danger of pesticides to human health is that they usually get into the human system and accumulate there. When pesticides like BHC and DDT are swallowed they go into the small intestine. There they hook into fatty tissues of the body forming about ten per cent of total body weight. These pesticides often attach themselves to the vital human organs such as kidney, liver, heart and thyroid.

37.5.2 Effects of Toxins

Toxins create health and mental problems like anxiety, sleeplessness, depression and so on. Headache, memory loss, body tremor, blurred vision, even nervous breakdown are reported. However, these symptoms occur due to prolonged exposure and intake of malathion and other pesticide drugs.

The problem is that since pesticide intake via food may take many years to take its poisonous effect the link between the diseases and pesticide, intake is not easy to prove. However, the question now being debated is whether pesticide intake through foodstuffs is carcinogenic or not. Researchers investigating the Bhopal gas tragedy reveal that we are only able to detect and see very limited aspects of chemical damage caused to human health in the long run.

So far as vegetables are concerned we find that pesticide sprays on vegetables, create high levels of toxicity. This happens in the case of cauliflowers to make them appear white. Ladyfingers are dipped in copper sulphate to make them look alluringly green. Further, the rule that no spraying should be done at least a week before the harvest is generally flouted.

It has been suggested as a preventive health maintenance measure that washing with water and dousing into vinegar can help remove the toxins to a large extent.

Further, it has been researched that dangerous illegal dyes are being used in chilli powder and turmeric to heighten their colour tone. Mustard oil is being adulterated with linseed oil and the toxic argemone oil. The latter causes limb swelling, heart attack and blindness. There is thus no knowing to what extent these environmental hazards contribute to physical diseases.

37.5.3 Effects of Chemical Effluents

Another major source of health problems and hazards is the chemical effluents, which are let out without any thought into rivers and into fields. This is a major source of health hazard. As mentioned earlier in urban centres, the fumes of exhausts of motor vehicles poison the atmosphere. Such fumes contain large quantums of manganese and lead. These settle on water and food sources themselves.

If absorbed by human beings, beyond the danger level they can cause nerve damage and death, more so among children. The social system is thus in a malfunction. Human life is being endangered. The other related problem is whether industrial packing of tin, plastic, paper etc. is sufficiently safe.

In agriculture, which is now deeply committed to using many pesticides the problem is acute. Thus, the use of pesticide sprays has now become ten times more in the last 30 years. They have become an absolutely necessary part of the whole agricultural scene. The pesticides that are in the use do not become harmless or inoperative easily and can have damaging effects even upto twenty years after ingestion. The soil soaks up these pesticides allowing crops and groundwater to absorb them. Trees and wildlife also suffer the onslaught. Thus, it is not only human beings that suffer degradation but animals, plants, and soil as well. The entire efficiency of the social system is thus at stake.

It is not only vegetarian food that is contaminated but non-vegetarian food also. The animals swallow grasses and fodders which have been sprayed with pesticides. As such they themselves imbibe high amounts of DDT which lodge in their flesh milk and eggs.

37.5.4 The Pesticide Threat

In the 1980s the pesticide threat was considered to be acute. The Food and Agriculture Organisation (FAO) analysed 1,500 samples of food. Almost all of them were contaminated by DDT and BHC. In over 25 per cent of samples the pesticides had crossed the safety limit to quite an extent. The findings were alarming. Milk from 50 lactating mothers in India had four times as high DDT and BHC residues than in other countries examined. Thus, this contamination chain can be illustrated (figure 37.2) as follows:

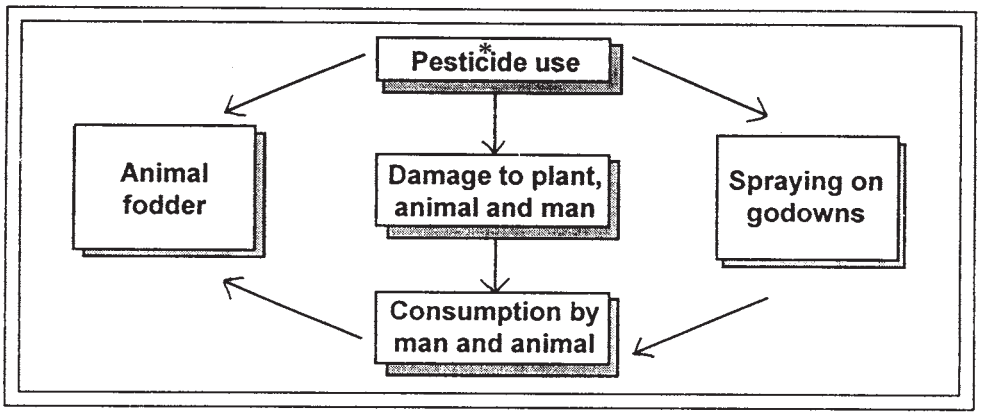

Fig. 37.3: Contamination Chain

As things stand today babies are consuming through food and milk three times as much as the safe digestion limits of pesticides. However, according to some researchers pesticide levels according to them are still relatively safe. No large-scale studies have been done on this subject in India as yet. The advanced countries of the west had a similar laxity of approach until the publication of the book, *Silent Spring.* This was written by a genetic biologist Rachael Carson (1962). It indicated that vast environmental and health problems were being caused due to pesticides.

If fact, almost daily we are finding in newspapers reports by various agencies about poisonous elements in water, milk, fruits, vegetables, eggs, meat, wheatflour, bottled water and soft drinks. Reports have come out against pesticides that have damaged brains of infants in Rajasthan, led to cancer cases in Kerala.

A seven-year study conduced across twelve states by the Indian Council of Medical Research (ICMR) found dangerous levels of residues of pesticides (DHCH and DDT) in milk products. Delivering the sixth JRD Tata Memorial Lecture in 2003, Dr. Swaminathan called for a National Pesticides Policy.

What then can be done to make pesticides and their chemicals less hazardous to human health? i) Pesticides should not be misused, and ii) no spraying should be done a week before harvest. Thus there should be pest management programmes for judicious use of pesticides. iii) War on pests using their natural enemies like bigger insects should be waged. iv) Industries should be asked to stop dumping untreated chemical wastes into the rivers by statute. v) Dangerous pesticides like DDT and BHC should be replaced by less dangerous ones. Finally, market surveys to warn of toxicity levels in various food items should be initiated. Thus an overall policy needs to be enunciated if the war on pests is to be of great use to human beings and not adversely affect our health. This is of course, easier said than done. Even the rich countries have had trouble developing new less deadly pesticides. However, the future of society is deeply dependent on eliminating these dangerous chemicals. They should soon be replaced by less dangerous ones.

37.6 EXPLOITATION OF FORESTS

We will now turn our attention to another aspect of interaction between human society and environment. We will describe the way human beings have been increasingly destroying the forest cover in India.

Today the situation of forests in India is alarming. Barely 10 per cent forest cover exists. The minimum ‘safe’ forest cover is about 30 per cent. Safe forest cover means that monsoons and all agricultural activities related to the same will be benefited and go on normally. The forests too will regenerate themselves. The ministry concerned should attempt to ensure that forest cover does not go below 10 per cent and is raised gradually to the maximum extent possible. Forests and flood control are closely interlinked. Forests play a most important role in controlling floods by:

i) regulating water run offs from the forests

ii) allowing water to go into the soil

iii) preventing landslides and topsoil erosion.

One of the most important features that a good forest provides is a brake against flash floods. These are prevented by a strong forest cover of 30-40 per cent. Such floods are often associated with major landslides. These were true of the Teesta (1968), Alakhananda (1970) and Bhagirathi floods (1978). In each case, floods led to landslides, which blocked the river. These in turn led to damming of rivers and even more violent floods. In October 1968 the human effect of such floods was seen. Landslides blocked the Teesta and when it broke loose some 33,000 people died in three days in Sikkim and West Bengal. Thus, such imbalances can take a heavy toll on society and its day to day working.

The degraded land in India is about 178 m hectares and total arable land is under moderate to serve degradation process (Prakash and others 2003).

In the following subsections we will focus our attention on the increasing exploitation of forests via deforestation and timber business. We shall also point out how in the State of U.P. attempt has been made to check this exploitation.

37.6.1 Deforestation

Let us consider now whether deforestation or reduction of forest cover reduces rainfall. Studies have indicated that annual rainfall is closely connected with forest cover. The higher the forest cover the greater is the rainfall. Thus droughts, which cause immense social problems, are the result of over-cutting of trees. Droughts create conditions for further droughts, as cattle are replaced by goats, which graze fodder grasses. The problem is that forests have been mercilessly and thoughtlessly denuded during the last hundred years in India. Between 1951 and 1972, 3.4 million hectares of forested area was cut for use in industry, dams, roads, and so on. The present rate of deforestation in India is still an incredible one million hectares every year. These statistics do not include the areas near dams and industries whose tree cover has been completely destroyed. They also do not account for illegal felling and 'contract' felling by the forest department. On the one hand, tree felling creates disturbances in the climatological cycle. On the other it makes room for tree use in houses, furniture etc. However, the negative factors far outweigh the positive factors of the situation as has been indicated.

Forest department statistics say that 23 per cent of India's is forest land. But this is not forested area. It simply means area that is under the control of the forest departments. For example, the State of Forest Report of the Forest Survey of India shows that Delhi's green cover of 8,800 hectares in 1999 increased to another 2,310 hectares in 2001. But the final report of the Supreme Count Appointed Environment Protection and Control Authority (CEPCA) noted that most of the city is devoid of forest cover because the forest cover is concentrated in New Delhi and South Delhi.

The National Forest Policy of 1952 wanted to bring 33 per cent land under forest cover. Again progress during 1951-80 was meagre. Of the 3.18 million hectares that were "greened", only 0.6 million hectares (19 per cent) were for trees. The National forest Polity of 1988 was a kind of breakthrough that aimed to involve local communities in protection and management of degraded forests and to share benefits derived from such activities. Consequently. The Joint Forest Management Programme gave impetus to formation of village forest protection committees. Reviews of the practice of JFM show that we need to take lessons from grassroots experiences of JFM and evolve new strategies to save and augment India's forest wealth.

What is very problematic is that large portions of the population are deprived of firewood for their hearth. Most parts of India are facing this problem, from North to South. The problem of facing firewood shortage for the hearth is sociological one. However, its origins are in the ecological sphere. When ecology degrades beyond a point, tree cover is decimated. Human beings in the Developing World will find it difficult to even have firewood to cook their food with.

Activity 2

Deforestation is a serious environmental hazard in India today. Try to ascertain through the voluntary agencies what percentage tree cover is there in your village/town/city. Also find out if there are voluntary agencies working on afforestation or restoration in your locality. Give your suggestions and observations for the regreening of your area in one page.

37.6.2 The Timber Business

Timber selling has become a large-scale business. Thus, for example, the Himachal Pradesh government earns about 75 per cent of its revenue from the regular commercial felling of 2,00,000 trees. This amounted to Rs. 600/- per tree in 1982. The commercial value to the feller was about Rs. 2000 to Rs. 2500, which makes it very lucrative for him. Another problem threatening forest and endangering social life is indiscriminate resin extraction from pine trees. While half inch cuts are allowed the contractors make four inch cuts literally bleeding the tree dry. Against a maximum of three cuts, the resin takers make upto ten such cuts. This reduces the life span of the trees to half their hundred years, which is tragic.

The government is however making some efforts to ban commercial felling of trees. Some State governments however want the Central government to make up for the revenue they lose. Police check posts have also been put to detect and intercept timber smugglers. If we take the case of Uttar Pradesh we find that the forests of the foothills were cut down to contain malaria. Crop lands have come up since then and have yielded very good results. However, the fact remains that corruption is given a renewed lease in timber smuggling activities. Something should be done to stop this from occurring. Let us now study the situation of forest restoration movement to conserve the forest cover.

37.6.3 Tree Density in U.P.

Before separation of Uttaranchal from the total recorded area of forests in U.P. was 5.17 million-hectare or about 17.5 percent of the land area. Over 67 percent of the forestland occur in the hills with about 15 and 19 percent, respectively in each of the Tarai and the Vindhyan regions while the Gangetic Plains have less than 5 percent forest cover. Of the 17.5 percent of the forest area only 11.5 percent is under the tree cover of which only 8 percent are dense forests which is far less than the required 33 percent of the geographical area (Joshi 2002). The best tree density for soil and water conservation exists only in the remote regions. About 8 per cent of the area is facing severe soil erosion and needs something to be done about it immediately. Chandi Prasad Bhatt, the founder of the Chipko Movement (which aims at preventing indiscriminate felling of trees) feels that this decimation has been very bad ecologically speaking. Thus, the tree felling has led to much social disturbance in the forest area of Gavahat. Women have to walk many miles for firewood and fodder. Hills have been degraded of their top soil. This area is landslide prone and soil erosion is heavy problem. In 1970 the Alakhananda which is a tributary of the Ganga had an immense flood. The whole of village Belakuch was flooded and swept away along with several busloads of tourists. This flood affected a 400 kilometre stretch, killing people, cattle, destroying bridges, timber

and fuel. The silt of the flood water literally blocked the Upper Ganga Canal which starts from Haridwar about 350 km from the beginnings of the Alakhananda. This destruction of habitation, human life and animal life could have been prevented had the thick foliage of the trees has been maintained. It is the trees which prevent flooding by storing water in their roots. Fuel scarcity has also become another problem. As mentioned earlier women have to walk between 1-15 km to collect their fuel wood. Forests of oak and rhododendron (shrubs bearing flowers in clusters) are very difficult to find. Even the afforestation programmes have replaced oak with chir. In 1962-63 the hillsides were blasted to open up communication and road networks. In Chamoli district itself 1100 km of motorable roads came up. As a consequence timber felling become both necessary and very profitable. The issue is the same everywhere picture of exploitation of forests and of ruining the ecological balances. This in its turn implies that individuals are trespassing the concerned laws. It also indicates that there are ruthless groups and lobbies operating in and through these forested areas (Desmond 1985).

37.6.4 Hug-the-Tree Movement (*Chipko Andolan*)

Has there been some counteraction to indiscriminate tree felling? Yes, the people themselves have come forward and taken action through the Chipko Andolan or 'hug-the-trees' movement. This movement has become known worldwide for its policies of:

i) hugging the trees earmarked for felling. One's life is risked for that of the tree in defiance of the feller(s);

ii) having spread countrywide, even into the Southern state of Karnataka as Appiko, where afforestation is relatively more important;

iii) prevention of depletion of forest cover;

iv) afforestation programmes.

Such programmes it will be require concentrated mobilisation of social networks, social resources, and organisational skills. They need to do these activities on a long-term basis without expecting immediate results. Society as a whole has to be galvanised into action for ecological restoration of human nature balance.

The *Chipko Andolan* began in Gopeswar of Chamoli in March 1973. Ten ash trees were to be cut down for commercial use by a sports firm. Where no other argument bore fruit the villagers hugged the trees. A year later in 1974 in Reni (65 km from Joshimath), the women rallied behind Gaura Devi (50) and blocked the path leading into the forest.

The movement is an ecological forest-conservation movement. Its founder Chandi Prasad Bhatt believes in organising people for forest preservation. Sunder Lal Bahuguna on the other hand campaigns and publicises against deforestation. He is for regreening of the forests. He believes that saving the forest is a first step towards saving the people themselve (for more information on Chipko movement see Jain 1984, Weber 1987). In the next section we will state some of the problems facing the preservation of the forest cover as well as the steps taken to preserve forests in India.

Check Your Progress 3

i) What are the effects of pesticides on health? Use about five lines for your answer.

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ii) Write a note on the Hug-the-Trees Movement (Chipko Andolan). Use about five lines for your answer.

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37.7 PRESERVATION OF FORESTS: STEPS TOWARDS FUTURE

What is the future regarding Indian forests? What are the major problem areas regarding conservation of forest reserves? Let us look at the problem as it exists in certain states like Meghalaya, M.P., Bihar, Gujarat and Orissa.

37.7.1 Forest Use in States of India

a) **Meghalaya**

Here the traditions are oral and as such we cannot find out how much is clan land or community land. There is a simple plywood factory in Meghalaya near the Assam border. However, there is a proliferation of saw mills there. Sawed wood has become a source of much income. The laws are quite unclear. It is this sort of situation, which is giving rise to problems, viz. they provide employment to people in saw mills and transport, carpentering etc. These problems are pitted against those of alarmingly depleting forest reserves. Should society look into its short term interests viz. chopping trees for marginal employment or halt this plunder for larger gains e.g., regular monsoons, topsoil protection, protection of flora and fauna and so on?

There is another problem—that of the shifting cultivation (*jhum* cycle). Fields are left fallow after cultivation for a few years. This is too small a period for any forest to grow. They need 20-30 years. The short jhumming cycle does not allow the forest to grow. Rather it destroys it. These slash and burn tactics are running forest and vegetation cover. What is worse is that the steepness of slopes leads to much soil erosion in the monsoons.

b) **M.P., Bihar, Gujarat and Orissa**

The problem in Madhya Pradesh, Bihar, Gujarat and Orissa is the same. Apart from Himalayan forests those of Madhya Pradesh, Bihar and Orissa are decidous and some of them are evergreen. These forests are the home of very many tribals (44 million *adivasis*). These tribals depend on these forests for sustenance. Madhya Pradesh earns 12.5 per cent of its revenue annually from its forests. Certain wood pulp projects accepted by the government go against the interests of the *adivasis*. Again this dealt with monoculture growth of pine trees. This project was finally abandoned but felling of trees goes on unabated. From 1958 to 1975 trees worth Rs. 35 crores were felled in this state. Such wanton commercial plunder of trees is now recognized as criminal. Trees take a long time to grow and mature. To hack them for commercial revenues is, gross misdemeanour stemming from corruption and ignorance. It must be stopped forthwith by law. Alternative building materials for houses like cement, plastic and so on must be encouraged. Some of these are now replacing traditional structures in the hills of U.P. and Uttaranchal.

In Bihar the *adivasis* have now taken up the issue of tree protection in a big way. A large number of tribals have been arrested and about 25 killed in the 'tree war'. The issue on hand is to replace sal by teak. The latter is pure commercial timber of no use at all to the tribals. In 1978 when negotiations failed Singhbhum tribals attached tree nurseries and destroyed saplings and forest buildings. Again during 1978 foresters inspecting a teak nursery were trapped and locked in it for 22 hours. They were rescued by the police. Since mid 1980 the Jungle Kato Movement began cutting down hundreds of trees. In Gua in Singhbhum many tribals were shot at and killed while doing this. This is criminal reprisal against tribals who are raising up for a just cause. They have every right for self-determination concerning their age-old association with the environment. Such police action was unwarranted. The tribals who had maintained the equilibrium of nature were subject to brutal assaults.

37.7.2 Conservation and Afforestation

In Gujarat the smokeless *Chullha* was provided at a nominal cost to save on fuelwood. Popular participation became necessary in the afforestation programme. The Gujarat Government has asked villagers to plant fruit, fodder and fuel trees in the forests nearby. School children have also been involved in afforestation programmes. Saplings were given to them and they were asked to care for them. The Madhya Pradhesh Lok Vaniki Act, 2001 applies to private and revenue areas which the *Bhuswami*, the Gram Panchayat or Gram *Sabha* intends to manage as tree clad area. It can go to a long way to support private sector participation raising of forests on large degraded lands under agricultural tenures in Rajasthan desert areas and uneconomic holdings in rainfed areas.

In Tamil Nadu a project was undertaken to give 500 saplings of fuel, fodder and fruit trees. Cash incentives were given based on the surviving saplings and plants. The Tamil Nadu Government trained a cadre of people to help in their afforestation efforts. Voluntary efforts have had greater popular response. The Chipko Movement had notable success in the Chamoli District in Uttaranchal. Eco-development camps and the afforestation efforts they espouse

were expected to be successful. Such camps provided ways and means to educated people to view environment, especially trees, in the proper light. These camps tried to cover the entire country and were a kind of literacy programme on the value of trees and forest to the environment (see the video programme Evergreen Tree at your Study Centre). Saplings were kept and then planted in the forest. Similar efforts were on at Ranchi and in Jamkhad, Maharashtra. So far as the Chipko Movement is concerned two strands were clearly discernible. The first was that of the Chandi Prasad Bhatt group who saw tree felling in the context of the hill requirements as valid. Sunderlal Bahuguna has gone against this position and for him all trees should be conserved in the hills. Both these movements had mobilised a number of social groups. Many demonstrations were held. Due to these pioneers in Indian ecological movements, awareness of the dangers of poor forest levels (below 20 per cent) increased all over the country. Very much more, however, needs to be done in this crucial area (Bahuguna 1987: 238-248).

Forest conservation priorities cannot be determined in isolation from local people and broader patterns of natural resource use, and this must be complimented by policies promoting sustainable and equitable development of the natural resource base as a whole. In acknowledging this factor, the Ministry of Environment and Forests, Government of India issued policy guidelines for the involvement of village communities and voluntary agencies in the regeneration of degraded forest lands on 1 June 1990 under the JFM (joint forest management) programme. Joint Forest Management is a concept of developing partnerships between fringe forest user groups and the forest department on the basis of mutual trust and jointly defined roles and responsibilities with regard to forest protection and development. Under the JFM programme, the user (local communities) and the owner (government) manage the resource and share the cost equally. The effective and meaningful involvement of local communities in evolving sustainable forest management systems is now being looked upon as a significant approach to address the longstanding problems of deforestation and land degradation in India. The linking of socio-economic incentives and forest development has been singularly instrumental in eliciting community participation. The institutional involvement in various forest protection and developmental activities has made promising impacts on the biophysical and socio-economic environment of the JFM areas. Currently, it is estimated that 10.24 million hectares of forest lands are being managed under the JFM programme through 36,075 committees in 22 states. As a follow-up, the Government of India issued guidelines on 21 February 2000 for strengthening of the JFM programme (Ministry of Forest and Environment, Government of India).

Following the lessons learnt from the JFM experiment during the 9th fire-year plan, the Government of India's Ministry of Environment and Forests issued in 2003 the guidelines of its National Afforestation Programme (NAP). The guidelines are to initiate steps for implementing the NAP during the 10th five-year plan. Short term objectives of NAP include regeneration and eco-development of degraded forests and adjoining areas on a watershed basis and also augmentation of the availability of fuelwood, fodder and grasses from the regenerated areas. For more information on this point, read IGNOU courses, PFM-04 and PFM 02.

37.7.3 Subsidy and Conservation

Also active on environmental issues and tree conservation, Madhva Ashish of Mirtola in Almorah, District Kumaon suggested that overgrazing and overpopulation had severely disturbed the ecological balance of the area. According to him, the hill lands, helped by a good monsoon, provide just three months subsistence rations to hill folks. He suggested that consumption of these three months should be subsidised by the government, and thereby all the ecological benefits would accrue to the hill folk. Overgrasing and overcutting lead to making inroads to non-replaceable capital resources. Ashish had also suggested that a light metal ploughshare be invented as a substitute for the present oak tree ones. Thousands of mature oak trees were felled to make this ploughshare. He further observed that the hill problem would not be solved through agriculture. According to him the stopping of hill agriculture and the subsidising of the hill areas nine months of the year were eminently feasible suggestions. The hill population, he felt, can be rehabilitated in various different ways including compensation for crops, work in the forest department, provision of one high yielding stall fed cow, and a milk collecting scheme. Ashish had thus outlined a feasible ecology programme for the hills specially the Kumaon hills. What is less known, however, in that Madhava Ashish has 'adopted' and has been protecting tree cover in and around the Mritola area. Mritola represents one of the most lush and beautiful tree forests anywhere in the country. We each need to follow this example and make trees and forest protection our individual and communal responsibility. This along with government cooperation will lead to a holistic recrudescence (break out afresh) of trees, and ecology. It will gradually but surely redress the imbalance between human beings and nature (Ashish 1981: 25-46).

37.7.4 Further Developments

Meanwhile Chipko-lite organisations have sprung up all over. The most famous of these is the Appiko in Karnataka, Pandurang Hegde.

There have also been efforts by the Government to alleviate the alarming rate of tree felling. The Indian Forest Bill of 1980 qualified people's rights in the forest and over its products. Forest officials and police had been given sweeping powers for confiscation and seizure.

The problem concerning contractors has yet to be solved since this is linked with poverty in the forests and hills. For this reason there was marked opposition to the Forest Bill 1980. There are also ambitious plans for afforestation. Forests are, however, not being destroyed only by local population and contractors. Corruption in the Forest Departments, timber traders and smugglers are all part of this destruction. Wildlife too has to bear the brunt of an ever receding home. The big game like the lions, tigers and elephants suffer first. Over time the entire food chain down to the monkeys and squirrels has to bear with man's inordinate greed, rapacity, and folly. The task is an uphill one and it will take years before we can be complacent. Many game reserves have been started to preserve animal life. This is a good start. But, we must aim at a human attitude in which human beings, nature and the etilogical world (animals in relation to man) share the planet without fear of being exploited and decimated by human society.

37.8 LET US SUM UP

We have seen in this unit that environment and human society are intimately related. We began the unit by describing what is ecology. Here, we specially focused on the relationship between human beings and their environment. We said there is a reciprocal relationship between human beings and nature. We then outlined the approaches in ecology, which explained the human being-nature nexus. While focussing on ecology in the context of Indian society we listed the basic human needs and pointed out the situation in India where the environment is very crucial for the satisfaction of needs and survival of human beings. Here we also explained the state of water and atmospheric pollution in India. While examining the interrelationship between health and environment, we focused on health hazards due to food contamination from preservatives, chemical effluents from industries and overuse of pesticides in food. We then considered the related issues of deforestation and the *Chipko andolan* that was the response to it. Finally, we considered the use of forests in certain states and steps taken via conservation and afforestation to maintain a balance between human beings and nature.

37.9 KEYWORDS

Afforestation Raising seedlings and plant them in order to raise forest trees on forest land

Contamination Poison of a food item with a chemical and make it unfit for consumption

Deforestation Cutting down trees from the forest with no regard for the minimum tree cover required for soil conservation

Determinism The term refers, in the context of their unit, to the view that ecology determines the entire flow of events.

Effluents The toxic waste chemicals thrown by industries into the rivers or over land

Erosion The term refers to the process when topsoil from the land gets torn off and runs away into the gully or hillside and is lost to cultivation.

Pollution The process whereby through chemical preservatives the environment as a whole gets poisoned.

37.10 FURTHER REAPING

Birch, Charles and Cobb, John B. Jr. 1984. *The Liberation of Life: From the Cell to the Community.* Cambridge University Press: Cambridge.

Foley, Gerald and Barnard, Geoffrey 1986. *Farm and Community Forestry*. Natraj Publishers: Dehradun.

Mohan, Madan 2000. *Ecology and Development*. Rawat: Jaipur

Singh, Pramod (ed.) 1987. *Ecology of Urban India. Volume II*. Ashish Publishing House: Delhi

Sinha, S.P. 1986. *Urban Environment and Contemporary Ecology*. The Indian Publications: Amballa Cantt.

Thaper, Valmik 2003. *Battling for Survival: India's Wilderness over Two Centuries.* Oxford University Press: New Delhi

37.11 SPECIMEN ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

i) Ecology is the study of the interrelation between organisms and their environment.

ii) The thinkers of this school feel that the state of ecology is directly linked to the state of technology. This approach emphasises that technology, economics, population form a basic influence on social processes.

iii) The advantage of the Systems Model is that it puts man at the centre of ecological issues. Accordingly the social system selectively exploits the ecology system. At the same time the ecological system adapts to and sustains the social system.

Check Your Progress 2

i) The pollution and dirt that arise from water drains and waste matters from human settlements are at times equal to industrial effluents.

ii) In its natural state the atmosphere provides man with oxygen. However, if this becomes clouded with smoke from cars, factories, stoves and son on it can lead to a source of ill health and disease.

Check Your Progress 3

i) Pesticides affect all vital organs of the body like kidney, liver, heart and thyroid. Headaches, memory loss, body tumor, blurred vision, heart attacks, arthritis, limb swelling are some of the health problems created by exposure to and intake of pesticides.

ii) The hug-the-tree movement or *Chipko Andolan* arose in the then state of UP around 1973 to check the felling of trees and reduction of forest cover. The villagers hugged the trees (ash trees in Gopeswar of Chamoli district) which were to be cut down for commercial use by a sports firm. In 1974 women rallied around the forests and blocked the path leading into the forest.

REFERENCES

(These are given for those students who wish to follow certain points in detail.)

Ashish, Madhava 1981. "The Effect of Overgrazing in the Kumaon". In J.S. Singh, S.P. Singh, C. Shastri (ed.) *Science and Rural Development in Mountains—Ecological Socio-Economical and Technological Aspects*. Gyanoday Prakash: Nainital pp. 25-46

Bahuguna, Sunderlal 1987. "The Chipko—A People's Movement". In M.K. Raha (ed.) *The Himalayan Heritage*. Gian Publishing House: Delhi, pp. 238-248

Barth, Fredrik 1969. *Ethnic Groups and Boundaries*. The Social Organisation of Cultural Differences. Alien and Unwin: London

Barua, Indira et al (ed.) 2002. *Ethnic Groups, Cultural Continuities and Social Change in North-East India*. Mittal: New Delhi

Bottomore, T. 1987. *Sociology: A Guide to Problems and Literature*. III Edition. Alien and Unwin: London

Byres, Terrence, J. 1997. *The State Development Planning and Liberalisation*. Oxford University Press: New Delhi

Carson, Rachael 1971. *Silent Spring*. Penguin Books: Middlesex

Chakarabarti, Balai Chandra 2003. "Panchayat Drama: Where do We Go From Here?" *The Statesman*. June 3

Chaturvedi, H.R. 1987. "Rural Development: Rhetoric and Reality". In K.S. Shukla (ed.) *The Other Side of Development*. Sage Publications India Limited: New Delhi

Chengoppa, R. and Rajihata, C. 1989. "Poison in Your Food". In *India Today* (June 15 Issue), pp. 74-81

Chopra, Ravi 1982. *The State of India's Environment—A Citizens Report*. Centre for Science and Environment, Delhi

Cohen, A. 1974. *Urban Ethnicity*. Tavistock Publications: London

Danda, Ajit K. 1999 (ed.) *Ethnicity, Nationalism and Integration*. The Asiatic Society: Calcutta

Desai A.R. 1984. *India's Path of Development*. A Marxist Approach. Popular Prakashan: Bombay

Desmond, D'Abreo 1985. *People and Forests: The Forest Bill and a New Forest Policy*. General Editor, Alfred de Souza. Indian Social Institute: Delhi

Dubashi, P.R. 1987. Development: An Overview. In K.S. Shukla (ed). *The Other Side of Development*. Sage Publications India: New Delhi

Eshleman, J.R. and Cashion, B.C. 1983. *Sociology: An Introduction*. Little Brown & Co: Boston

Frank, A.G. 1967. *Sociology of Development and Underdevelopment of Sociology*. Catalyst Volume 3: Buffalo

Gadgil, Ashok 1998. Drinking Water in Developing Countries. *Annual Review, Energy and Environment* 23: 253-86.

Gadgil, M. and R. Guha 1995. *Ecology and Equity: The use and Abuse of Nature in Contemporary India*. Routledge: London

Gore, M.S. 1973. *Some Aspects of Social Development*. Tata Institute of Social Sciences: Bombay

Government of India 1952. *First Five Year Plan*. Planning Commission: New Delhi

Government of India 1988. *India 1987. A Reference Annual*. Ministry of Information and Broadcasting: New Delhi

Government of India 2003. *India 2003, A Reference Annual*. Ministry of Information and Broadcasting: New Delhi

Gupta, Dipankar 2000. *Culture, Space and the Nation-State*. Sage Publications: New Delhi

Heredia, Rudi 1986. *Minority Rights and Reservation Policy: Towards Coherence and Consistence. New Frontiers in Education*. Vol. XVI, No. 2, April-June: pp. 60-63

Horton, P.B. and Hunt C.L. 1981. *Sociology*. McGraw Hill: London

Jain, S. 1984. *Standing Up for Trees: Women's Role in the Chipko Movement*. UNASYLVA (FAO, UN Journal of Forestry) 36(146): 12-20

Jain, S. 1988. *Case Studies of Farm Forestry and Wasteland Development in Gujarat, India*. FAO (UN): Rome

Kumar, A. 2001. *Social Transformation in Modern India*. Sarup: New Delhi

Kuppuswamy, B. 1987. *Social Change in India*. Vikas Publishing House: New Delhi (Originally published in 1972.)

McClelland, D.C. 1961. *The Achieving Society*. Van Nostrand Company: Princeton

Mc Intosh and Robert, P. 1985. *The Background of Ecology: Concept and Theory*. Cambridge University Press: New York

Malik, S.L., and Bhattacharya, D.K. 1986. *Aspects of Human Ecology*. Northern Book Centre: New Delhi

Mc Laughlen, Barny 1969. *Studies in Social Movements: A Socio-Psychological Perspective*. The Free Press: New York

Mohan, Madan 2000. *Ecology and Development*. Rawat: Jaipur

Moore, Barrington 1966. *Social Origins of Dictatorship and Democracy*. Beacon Press: New York

Moore, W.E. 1951. *Industrialisation and Labour: Social Aspects of Economic Development*. Cornell University Press: Ithaca New York

Mukherjee, P.N. 1977. "Social Movements and Social Change". *Sociological Bulletin*, Volume 26 (1) March

Ogburn, W.F. 1966. *Social Change*. Dell: New York. (Originally published in 1922)

Prakash, Om, G. Sastry and YVR Reddy 2003. Suitabe Schemes: Impact of Watershed Development of Programme on Conservation of Natural Resources in Rainfed AERs of India. *Wastelands News* XIX (i): 55-59

Pushpa Sundar 1988. "Education and Socialisation of Professional Women: The Case of Women Entrepreneurs". In Karuna Chanana. (ed). *Socialisation Education and Women*. Orient Longman: New Delhi

Punekar, V. 1974. *Assimilation*. Popular Prakashan: Bombay.

Rao, M.S.A. 1979. *Social Movements in India*. Volume I and II, Manohar Publications: India

Rao, M.S.A. 1979. *Social Movements and Social Transformation: A Study of the Backward Classes Movements in India*. Macmillan: India

Rao, M.S.A. 1974. *Social Movements and Social Transformation*. Macmillan: Madras

Shah, Ganshyam (ed.) 2002. *Social Movements and the State*. Sage Publications: New Delhi

Shah, Tushaar, Christopher Scott, Stephane Buechler 2004. Water Sector Reforms in Mexico, Lessons for India's New Water Policy. *Economic and Political Weekly* XXXIX (4): 361-370

Sharma, S.L. (ed.) 1986. *Development: Socio-Cultural Dimensions*. Rawat Publication: Jaipur

Sillitoc, Paul, Alan Bicker and Johan Pottier 2002. *Participating in Development: Approaches to Indigenous Knowledge.* ASA a Monograph 39. Routledge: London

Singh, Y. 1987. "Development in India: Continuities and Contradictions". In K.S. Shukla (ed.). *The Other Side of Development*. Sage Publications India: New Delhi

Singh, Y. 2000. *Culture Change in India: Identity and Globalisation*. Rawat: Jaipur

Soni, Vikram 2003. Water and Carrying Capacity of a City. *Economic and Political Weekly* XXXVIII (45): 4743-4748

Srinivas, M.N. 1986. *India: Social Structure*. Hindustan Publishing Corporation: (India), Delhi. (Originally published in 1969 by the Director, Publications Division, I.E., New Delhi

Srinivas, M.N. 1972. *Social Change in Modern India*. Orient Longman: New Delhi

Sills, David, L. (ed.) 1972. *International Encyclopaedia of Social Sciences*. Macmillan & Free Press: New York

Sundaresh, Aruna 1986. *Constitutional Law and Reservations. New Frontiers in Education*. Volume XVI, No. 2, April-June: pp. 33-36

Thaper, Valmik 2003. *Battling for Survival: India's Wilderness over Two Centuries*. Oxford University Press: New Delhi

Toch, H. 1965. *The Social Psychology of Social Movements*. Methurin Publication: London

Touraine, Alain 1968. *The May Movement*. Random House: New York

Weber, Thomas 1987. *Hugging the Trees: The Story of the Chipko Movement*. Viking, Penguin Books: Delhi

Weiner, Myron 1978. *Sons of the Soils Migration and Ethnic Conflicts in India*. Oxford University Press: New Delhi