UNIT 1 NATURE-HUMAN INTERFACE

Structure

1.0 INTRODUCTION

The humans represent the most developed stage of life form on earth.They, however, appear on earth at a considerably late stage in a long process of evolution. This process of evolution began with the formation of earth some 4600 million years ago and involved the evolution of life forms and nature, both. Many living organisms have come and gone in this process and many changes in nature have simultaneously occurred. A closer examination of this process reveals that there has always existed a close relationship between life forms and the nature surrounding those life forms. With the emergence of humans this relationship assumes a qualitatively different form. It is our attempt to present in this Unit an outline of nature-human relationship. Admittedly nature-human interaction has been a complex process and involves a basic understanding of the different dimensions of nature as well as the unique ability of humans to influence and mould the nature in tune with their own needs. It also involves a similar understanding of human adaptability to the peculiarities and pressures of nature.

As we start on an exploratory tour of nature-human interface in the context of the geographical boundaries loosely set by the Indian sub-continent we begin to see a few features emerging so clearly as not to be able to miss them at all. We see the relationship between human groups and the environment/s assuming the character of interchange i.e., reciprocal exchange between humans and nature, where each influences the other and also gets influenced by the other. We also see the environment of the Indian sub-continent providing a diversity of situations, from deserts to regions of high rainfall and from vast alluvial plains to high mountains and rocky table-land. There is also visible a clear divide, between north India receiving highly productive soils as a result of a continuous process of soil erosion and south India, with fewer deposits of alluvial material and therefore showing greater stability.

It is also to be understood that the historical evidence for the study of nature-human interface has been somewhat irregular with a few periods extensively examined while a few others having not received adequate attention.We have attempted to paint a general picture of the relationship between humans and their environment/s with the help of available archaeological and historical material. The narrative in this Unit begins with the emergence of human groups using stone artefacts and closes with the rise of modern industrial societies when a marked shift in nature-human interface occurs. In discussing human interchange with nature it will be useful to obtain a basic understanding of nature, which, commonly speaking, is used as a term inter-changeable, with environment.

1.1 DEFINING NATURE

Nature is not an easy term to define as it incorporates most of the visible manifestations of geography. Raymond Williams defines nature as, 'the material world itself, taken as including or not including human beings.' Tracing the history of the term he suggests that 'nature' has often been used to describe the 'countryside', the 'unspoiled places', as also 'plants and creatures other than man.' (*Keywords*, 1976, Fontana, pp.184-189). Surely the general sense in which nature has been described relates to environment, where even the human has been an integral component. In the context of our discussion, thus, nature and environment convey nearly the same meaning.In exploring human-nature/environment relationship we consider the natural conditions and influences that affect and sometimes determine the actions of human groups. Over a long period of time in history this relationship operates at two different levels; at one level it wields influence as a widespread ongoing process, and at the other it acquires the form of the relationship of specific human groups to their "immediate environments". For our purpose we do not especially favour any one of the two and provide a narrative that tends to draw information from both as the situation demands.

In the case of the Indian sub-continent a very wide range of climatic and topographic situations prevail to influence the environment.As a result a delicate balance is maintained between extreme environmental conditions which is comparatively easily disturbed and we experience varying degrees of uncertainties extending over one or more climatic zones.In the context of nature-human interface these environmental changes have had their role in determining the development of human history.We shall discuss this in detail in the following section.

1.2 LOCATING MAN

In providing an identifiable status to man vis-à-vis environment our objective has been to start at a point where human groups become discernible as a collectivity.The question of the origin of humans is not our primary concern here.In fact an understanding about the process of evolution of humankind is more important to us as it helps us grasp the simultaneous evolution of man-nature relationship.

Till recently, up to the post-enlightenment era, the concept of a divine origin of nature and humans had been in prevalence.The human beings were also subject to an evolutionary process was a theme strengthened by the theory first proposed by Charles Darwin (1809-1882 A.D.). In his work *The Origins of Species*, Darwin argued that different species had undergone to process of evolution and this evolution was the result of minor variations in the characteristics of the individual members of species. These features were inherited by the successive generations and as a result of this long sequence of inheritance new species were able to evolve and emerge distinctively. Darwin also proposed that the adaptive capacity of species influenced the chances of their survival and he termed it as the process of the 'survival of the fittest'. The evolutionary model had made another important contribution towards our understanding of man as a 'unique animal', an animal who could adapt to different natural conditions and most importantly could modify the nature/environment for its survival.

The process of human adaptation to environmental conditions was accompanied foremost by the introduction of tools and their use by the primitive man. The significance of tools in the study of the evolution of humankind can be realised from the fact that this entire process has been classified in terms of the quality of tools and the nature and quality of the material used in making the tools. Thus the earliest period in human history, also called pre-history, has been termed as Paleolithic. This was followed by Mesolithic, Neolithic, Chalcolithic, Iron Age, and so on. For the convenience of also accounting for implements other than tools, we term this process as the development of artefacts and begin our investigation of man's relationship with nature during this important phase of human activity.

1.2.1 A Maker of Artefacts

The human beings are endowed by nature to be reflective and active. Their biological evolution has given them the capacity to establish adaptive relationship with nature. However, we can only be speculative about the factors and adaptive impetus responsible for the development of human ability to forge artefacts. Indeed this ability must have evolved over a very long period of time and would have begun with the local materials that were easily available and were suited to serve the purposes intended by the objects.

We know from archaeology that the first artefacts made by humans were of stone and had made their appearance more than two million years ago. This had marked the beginning of the Palaeolithic Culture. It was a remarkable occurrence and showed "a high level of forethought and knowledge of materials" on the part of the Stone Age Man "suggestive of acute powers of observation and deduction and of a sensitive awareness of much of the available potential of the world around". Like other animals, the initial mode of sustenance for humans was hunting and gathering. Most of these artefacts were made with the objective of assisting them in their quest for food, hunting and gathering. Stone tools were used primarily for cutting plants, digging root crops, scrapping wood and obtaining honey. There were two broad groups of stone tools for the period: 'core' tools and 'flake' tools. Core tools were those tools which were made from the larger blocks of stone. Flake tools were those tools which were made from the small bits or flakes which would come off a block of stone when it was hit probably for making core tools.The most important core tool was hand-axe. Hand-axes were basically used for processing of meat and did reflect great physical dexterity. In the making of the stone tools here was a definite evidence of the beginning of man's attempt to adapt to the nature by applying his mind and making use of locally available material for better functioning. The appropriation of natural conditions was still confined to the most rudimentary stage, yet the act was very significant for it heralded the process of modification of natural conditions for better management of natural resources.

The Palaeolithic developments were followed by the growth of microlithic tools and this stage is termed as Mesolithic Culture.We are now witness to a greater control of man over the tool-making industry as the tools now become lighter and more efficient.In addition to stone we now find more variety in the use of materials for making microliths.Bone, animal horn, bamboo and wood make an appearance. The quality of artefacts produced during this period is suggestive of an improved technological competence. It is logical to assume that such competence would also have helped grow several other skills of working on materials other than stone e.g., wood, bamboo etc. The knowledge of using fire for clearing grasslands and forests along with these additional skills was a definite advance over the previous stage in so far as the management of natural resources was concerned.

It is around this time that early rock art specimens become available. An analysis of the depictions made in these specimens brings out the fact that the humans had by this time become acutely aware of the animal world and had begun to show signs of seeking refuge, even if temporarily under rock shelters, mounds and other natural sites. This should be considered a significant development in nature-human interface.Here was the beginning of the process of domesticating animals and utilising their power in the service of the mankind.

We must draw a word of caution here before the almost euphoric feelings at having managed nature in an efficient manner than the preceding Palaeolithic stage leads us astray.The fact was that in spite of these developments the humans were even now at the mercy of their immediate environment and were "in a very real sense dominated" by it. What seems closer to reality is a situation that exhibits, on the part of the human groups, a conscious awareness of the environment based on a close relationship with the environment. This relationship was fostered by activities such as "hunting and gathering animals and plants for food; lighting fires for cooking, warmth and protection; perhaps felling trees to make further wooden artefacts (as people are known to have done with stone tools elsewhere in the world); perhaps also burning grasslands and forests to facilitate their hunting activities or improve the grazing for their favoured food animals".

1.2.2 Social Animal

The relationship between nature and man was redefined with the advent of agriculture. Till the beginning of agriculture, the sources of food had only been naturally available and man had no control over these sources. An important contribution of agriculture has been the cultivation of cereals. The fact that the shelf-life of cereals is very long whereas fruits and meat have a limited shelf-life must have added immensely to human capabilities.It is also significant to note that this property of cereals encouraged accumulation which was one of the principal causes for social stratification to emerge and with it a complex society to emerge with many different communities existing within and interacting with each other.

In the initial phase the agriculture was highly unreliable and as a regular source of food did not meet the demands of man. In fact transition from the hunter-gatherer stage to the agriculture stage was a long drawn process. The development of technology/tools to increase the production was also a gradual process and it was only after the development of irrigation technology that agriculture acquired a key role in food production.Initially the agriculture was confined to highly favourable locations with natural irrigation.With the growth of population, however, man was forced to migrate to less-favourable locations necessitating the development of irrigation facilities that demanded larger social participation and better skills of management.

Food security and greater control over agriculture enabled man to have some spare time as agriculture had been a seasonal activity. At the same time demand for better tools for agriculture and technology for irrigation to ensure greater production as well as a relative shortage of raw material for tools (as man moved away from foothills to open plains) forced man to look for other sources/ kinds of materials.This gave rise to the use of metals and their extraction through metallurgy.With the beginning of metallurgy thus, a new stage of development was attained.The discovery of metallic ores once again liberated man from the dependence over nature. The major advantage of metal tools over stone was their reusable character: stone tools once broken could not be used again whereas metal tools could be remolded. However, relative scarcity of ores together with the resources needed in processing the ores, right from procurement to transportation and extraction, made the making of metal tools a labour intensive and in many ways an expensive proposition. An important feature of metallurgy had been the requirement of highly specialised knowledge and expertise thus making it a full-time occupation. Such specialists could be sustained with the help of the available agricultural surplus. In this process we clearly see the emergence of a section of population that was not directly involved with the process of food production, yet was able to sustain itself on the labour produce of others.The "parasitic" character of this section of population had in fact given rise to the possibility of sustaining solely on the basis of the acquisition of special skills without having to participate directly in the process of agricultural production.

The character of the agriculture based societies could now be defined in terms of complex social formations having stratified social and occupational groups within. The growing ability to manage the nature for social needs allowed agricultural societies to start systematic exploitation of natural resources for the benefit of the larger community giving, in turn, rise to socio-politico-economic hierarchies.In this process a gradual alienation of man from the immediate environment was quite perceptible.

It should be noted here that though the emergence and subsequent growth of agricultural societies was a gradual and steady process indicating man's control over nature, there were still numerous instances of the vagaries of immediate environments affecting this growth and thus creating troughs and peaks in the graph of agricultural development in place of an imagined smooth line only indicating consistently onward march. The few archaeological sties that have been investigated in detail yield interesting information. The earliest site is at Mehrgarh located on the Bolan river in Baluchistan.The down-cutting and lateral movements of the distributaries of Bolan are possibly "the outcome of the natural instability of the region" and "due to pressure on the environment caused by human activities such as harvesting grain, collecting firewood, felling trees and herding animals in the immediate locality and in the mountainous areas that form the head waters of the Bolan river". Almost similar is the case of the cities of the Indus civilisation.It is generally accepted that the region has not seen any major shift in the climatic conditions since the emergence of Indus civilisation.Yet "evidence of a period of somewhat increased humidity coinciding approximately with the high urban phase of the Indus cities (c. second half of the third millennium BC)" has also been noted. A point of great significance here is that the return to rather more arid conditions, like the present, appears to coincide approximately with the collapse of Mohenjo Daro, and apparently also with the failure of the wider infrastructure of the Indus urban world".

1.3 NATURE-HUMAN INTERFACE: CHANGING CONCERNS

We have hitherto been describing the nature-human interface in the context of human adaptation to the limits determined by the nature.Till the advent of agriculture the relationship between man and nature was highly tilted in favour of nature, where man was mostly the recipient of the benevolence of the nature. Tools of the lithic ages-Paleolithic, Mesolithic or Neolithic were basically instruments of facilitation towards the benevolence of nature. Man had to manage with the subsistence offered by the nature and could do little to influence the processes or patterns of nature. The subsistence pattern of this age was termed as 'hunters and gatherers' and life-style was nomadic. The society was moving from simple social structure to complex social structure gradually.

A fully manifest complex social structure emerged with the advent of agriculture that helped generate surplus and began the process of urbanisation. Upto this time the relationship between man and nature was to a considerable extent determined by the harshness/benevolence of nature to existing levels of technology.

A qualitative and epoch-making shift in the nature-human interface became evident with the onset of industrial age. The level of technology of industrial age liberated man from physical labour and introduced the exploitation of abiotic sources of energy that replaced human and animal energy. Since ancient past thermal energy had been used in direct applications, but during industrial age it was used to mechanise tools. Industrial age introduced the conversion of thermal energy to mechanical energy, hence expanded the possibilities of its exploitation.The ever increasing demands had also led to the search for newer forms of energy and to the discovery of hydrocarbons, i.e., coal, petroleum products, etc., as their principal source.Unlike earlier renewable sources of energy, though, hydrocarbons, are non-renewable. The introduction of non-renewable sources of energy redefined the relationship between nature and man and the concept of the conservation of natural resources came into existence.

A phenomenal growth in production possibilities and abundant availability of finished goods were two major features of industrial age. The replacement of animate forms of energy with the inanimate forms presented huge possibilities of harnessing natural resources. The technological advancement facilitating better and commercial use of new forms of energy expanded the demand for raw materials as also the markets for finished goods.

Another area where a major impact had occurred due to an extensive use of energy was that of agricultural production. Increased productivity and food security gradually led to a sizeable increase in population. Due to extension of cultivation and population there was now a major strain on forests and other natural resources.It was not that human civilisation had not witnessed the growth of population in the past; but the magnitude of this growth in the eighteenth century was fraught with serious implications.Braudel has attempted to define it in terms of an ecological watershed, i.e., the end of a natural regime that was determined by the characteristics of pre-industrial societies."What was shattered" wrote Braudel, "with the eighteenth century was a biological 'ancien regime', a set of restrictions, obstacles, structures, proportions and numerical relationships that had hitherto been the norm". (Ferdinand Braudel, **Civilisation and Capitalism 15th-18th Century, Vol- I: The Structures of Everyday Life-The Limits of the Possible,** tr. Sian Reynolds, London, 1985). The relationship of harmony and a tacit co-existence with nature now gave way to human endeavour to completely harness and exploit natural resources.

The ever-increasing mechanisation of even the day-to-day activities increased the demand for energy to new heights.An almost reckless use of energy sources of the fossilized form and blind growth of industries of all kinds gave rise to problems of environmental pollution. We are today faced with serious environmental threats like the 'green house effect'.

Another major cause of concern in this regard has been the development of materials not naturally available in the world, i.e., the polymers. The chemical revolution of the 1930s and 1940s developed an artificial material which was not biodegradable, thus difficult to destroy and decompose. At the same time, the wider applications of the material at industrial and domestic front at low cost of production encouraged its wider circulation. Similarly, the question of the viability of nuclear fuel as a source of energy has been a major issue of debate. The production of non-natural radioactive substance for energy production has been a major scientific and technological development but again the decay or the proper and cost effective decomposition of residue has been a major technological failure.

While according due importance to the role of new technologies in the portrayal of a comprehensive picture of human-environment interface, we must not neglect the socio-political considerations. Until 1700, the rights and rewards of exploitation of the natural world lay largely in the hands of an elite aristocracy. The democratic revolutions of the late 1700s, including the American Revolution of 1775-76 and the French Revolution of 1789-1799, triggered a restructuring of the framework of society throughout most western societies. With this change came increasing access of individuals to productive resources, and an increased ability to use them for improving economic and social status. The legitimate rights of exploitation of nature were now extended to individuals at large in society. The 1800s were the culmination of a period of worldwide spread of western culture through colonialism and establishment of world trade. The western system of environmental exploitation was thus spread widely, so that it became the operational system even in areas where the basic philosophical view of human and nature was quite different. (Ranajit Guha, *History: At the Limit of World History*, New Delhi, 2003.)

Human acts were henceforth seen as socially constructed and man got located at the centre of creation. As a result the relationship between nature and man was redefined. The breakdown of 'biological regime' led to an exponential growth in human population. Initial demand of labour by the early industrial revolution and relative food security sustained this growth.At the same time, scientific knowledge along with technological development provided a world vision where technology was portrayed as a solution to all human problems especially hunger and poverty.

These are the few concerns that tend to redefine nature – human interface.We, however, cannot afford to remain insular to these developments in the name of preserving a pristine man-nature relationship.We must be open to new perspectives in our understanding of society and scientific developments. Daniel B. Botkin (*Discordant Harmonies*: *A New Ecology for the Twenty-first Century,* New York, 1990) says that 'We must distinguish between merely the persistence of some kinds of life and the maintenance of a biosphere that is desirable to human beings' (p.182), inherent in it is his vital question that nature is not constant and even the change is not constant, thus the only way to interact with nature is to enlarge our understanding of environment and its functioning at the same time to realise the limitations of human capabilities to manage nature according to his wishes.

1.4 SUMMARY

Most of the writings on environmental history deal with the interaction between society and environment through the analysis of socio-economic impacts. We now know that interaction between environment and society has also been mediated by the technology, which helps in the appropriation of environment for social/individual good. It is the level of technological development, which influences the extent of human intervention in the functioning of environment, and determinates the nature of human comprehension of their environment.

Since the beginning of universe and more so with the evolution of mankind as thinking animal we have been witnessing the change in nature's landscape caused or at least influenced by humankind. Some of the important technological introductions influencing the environment have been the beginning of agriculture and discovery of iron. These introductions led to far reaching changes in the landscapes and thereby influenced the functioning of environment. Similarly, industrial revolution has been a landmark technological introduction for the appropriation of environment. It is in this way that a comprehensive picture of man-nature relationship should be investigated. At the same time it is also true that even at the present level of scientific development we cannot claim that we have been able to comprehend fully the functioning of environment.

1.5 EXERCISES

1) Describe the features of nature-human interface during Palaeolithic and Mesolithic Cultures.

2) In what ways did the beginning of agriculture influence the man-nature relationship? Discuss

3) Why is the beginning of the industrial age considered as marking a major shift in nature-human interface? Elaborate.

1.6 SUGGESTED READING

Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-first Century*, New York, 1990.

Ranajit Guha, *History: At the Limit of World History*, New Delhi, 2003.

F. Braudel, *The Perspectives of the World* and *The Structures of Everyday Life*, Vols. I & II respectively of *Civilisation and Capitalism 15th-18th Century,* tr. Sian Reynolds, London, 1985.

Ramchandra Guha, *Environmentalism*, Delhi, 2000.

D.K. Chakrabarti, *India, An Archaeological History*, Delhi, 1999.

[All the quotations in this Unit, unless otherwise noted, have been gratefully taken from *Bridget Allchin*, 'Early Man and Environment in South Asia 10,000 BC-AD 500' in *Nature and the Orient*, ed. Richard H. Grove, Vinita Damodaran, Satpal Sangwan, Delhi, 1998.]

UNIT 2 INDIAN LANDSCAPE

Structure

2.0 INTRODUCTION

We have discussed in the preceding Unit the contours of nature-human relationship in the historical context and have found that a detailed understanding of the Indian landscape is an inescapable necessity.We therefore intend to familiarise you, in the present Unit, with the Indian Landscape and discuss in detail the complexity of the relationship that exists between physiographic features of a place and its society. The focus here is on the evolution of settlement patterns in India and the emergence of ecologically sensitive zones.

India is a vast geographical region and assumes the scale of a sub-continent. It has diverse climatic and bio-geographic features sustaining a wide pattern of human settlements.The patterns of living, material culture and consumption behaviour of these settlements differ in response to diverse ecological settings.It is therefore, worthwhile to examine the landscape features in India in relation to patterns of human settlements.

2.1 PHYSICAL FEATURES

A detailed description of the physical features of India will enable you to understand better the visible differences in the topography of the different parts of the country.It will also help you see the underlying environmental factors that also determine the relationship between the physical geography of any region and its settlement patterns.The location and expanse of India's landforms (plains, plateaus, hills and mountains) have played a significant role in influencing her past history.Since associated features such as climate, land-use, means of transportation, distribution of population, etc. directly relate to history the study of physical features in relation to man and his needs is vital.

India can be divided into the following four major physiographic divisions:

- A high mountain barrier formed by the Himalayas in the north and the Eastern Highlands in the east;
- The Plains of Northern India or the Ganga-Yamuna Doab;
- The Plains of Peninsular India, south of the North Indian plains, also known as the Indian Plateau; and
- The Coastal Lowlands fringing the Plateau of Peninsular India.

These four regions are distinctly different from one another in respect of their surface configuration. The Himalayas are young fold mountains with great rise, highly uneven surface, very steep slopes, little level land and young river valleys. Against that Peninsular India is an old shield block having plain areas, relict mountains and old river valleys. The Plains of Northern India are flat and alluvial without much local relief except bluffs of the old banks of the rivers and are of recent origin. The Coastal Lowlands are flat with deltas and land generally rolling.

2.1.1 The Himalayas

The Himalayas form a highly rugged and continuous stretch of high mountainous country, which flanks northern India for a considerable length and runs from the Brahmaputra gorge in the east to the Indus in the west. They cover an area of nearly 2,500 km. in length and 150 to 400 km. in width. Rising abruptly from the plains, the Himalayas rest against Ladakh district of Jammu and Kashmir and the Tibetan Plateau in the form of an arc-like rim. They are one of the youngest fold mountains on the earth. Uplift of the Himalayas, at irregular intervals has helped rejuvenate the rivers.The Himalayas exhibit practically all those land forms which develop when strata is intensely folded. However, intermontane plateaus and large-sized basins are conspicuously absent in these intensely folded mountains. The Vale of Kashmir, about 135 km. long and 40 km. broad, is the only large level strip of land in the Himalayas. In general, the Himalayas consist of three main ranges – the Siwalik Range along the southern margin, the Great Himalaya along the Tibetan border and in between these two is the Lesser Himalaya. Additionally there is a range in the east known as the Eastern Highlands.

The Siwalik Range

This range has low parallel ridges made up mainly of boulder and clay and these ridges are the foot-hills of the Himalayas. From a breadth of nearly 50 km. in the west, it narrows gradually towards east and loses its identity in the Bengal Duars. The height of these ridges usually does not exceed 1,220 metres.Most of these ridges had formed after the formation of the Himalayas, thus they obstructed the courses of the rivers draining to the south and west and created temporary lakes in which debris brought by those rivers was deposited. As the rivers had cut their courses through the Siwalik Range, the lakes were drained leaving behind plains called

Duns. One such plain formed as a result of the draining of lakes is **Dehra Dun** (600 metres above sea-level), in Uttaranchal.

The Lesser Himalaya

These ranges rise north of the Siwalik Range and being deeply cut by rivers are highly rugged and ill defined.They are more clearly defined in their expanse towards west where they are known as the Dhaola Dhar, the Pir Panjal and Nag Tiba. The Mahabharat Range (Nepal) and the Mussorie Range (Kumaun Himalayas) are two other ranges of the Lesser Himalaya that run as continuous ranges for long distances. These ranges vary a lot in height but are generally less than 3050 metres above sea-level. Some of their peaks rise to heights of even more than 4570 metres particularly branches closer to the Great Himalaya and are also known as Himachal. The Lesser Himalaya are about 80 km. in breadth.

The Great Himalaya

Also known as *Himadri*, it is the longest continuous range among the Himalayas. It is also the highest range in the world with an average height of 6100 meters. The top of this range, about 25 km. wide, is dotted with numerous snowy peaks. The highest peak of the world, the Mount Everest (8848 metres), is situated at the northern border of Nepal. The other notable peaks in descending order are Kanchenjunga (8598 metres), Makalu (8481 metres), Dhaulagiri (8172 metres) and Nanga Parbat (8126 metres). In the north-west the Great Himalaya ends in Nanga Parbat (8126 metres) whereas in the east it culminates in Namcha Barwa (7756 metres) close to the Brahmaputra in Tibet (Brahmaputra is known as the Dihang, in this section of the Himalayas). The Great Himalaya is snow-bound throughout the year and creates glaciers which descend to a height of 2440 meters above the sea-level in Jammu and Kashmir and about 3960 metres in the east. At their lowest limits, glaciers melt and ensure continuous supply of water to the rivers of North India. During early summer when there is no rain in the plains, the water in these rivers has a particular significance as it is tapped for irrigating the parched land during the dry months.

Being snowbound for larger part of the year, this range is forbidding and can be crossed only by a few passes. These passes also become inaccessible during winters when the range is snow-bound. Journey through these passes is hazardous and strenuous as they are generally higher than 4570 metres above sea-level. Pack animals like mules, yaks and goats were used earlier in the absence of metalled roads for carrying goods across these passes. The Burzil Pass and the Zoji La in Jammu and Kashmir the Bara Lacha La and the Shinki La in Himachal Pradesh, the Thaga La, the Niti Pass and the Lipu Lekh Pass in Uttar Pradesh and the Nathu La and the Jelep La in Sikkim are some of the prominent passes to cross the Great Himalaya. This range has served as a natural barrier between India and Tibet (China).In addition to its being an insurmountable barrier, this range shuts off almost completely the icy cold-winds of inner Asia in winter and confines, again on account of its formidable height, the moisture laden monsoon winds for the benefit of India.

In the northern part of Jammu and Kashmir there is another high mountain range called the Karakoram. It is a trans-Himalayan range, which runs roughly in the east-west direction. Some of the peaks of this range rise above 4620 metres. The second highest peak in the world, K-2 (8611 metres), which happens to be the highest peak in the territory of India, rises majestically like a cone in the midst of other slightly less high peaks of the Karakoram Mountains. This range merges in the Pamir Knot in the west. This bleak, desolate, lofty mountain waste, snow-covered throughout the year like the Great Himalaya, protects India from the very dry winds of Central Asia.

The Eastern Highlands

These mountains consist of hill ranges which pass through the north-eastern state of Arunachal Pradesh and run in north-south direction in the form of a crescent. To the north lies a high mountainous land called the Dapha Bum (highest point 4578 metres). From the southern end of the Dapha Bum starts the Patkai Bum. It forms the international boundary between India and Burma for some distance southwards and then it merges into the Naga Range. Saramati (3926 metres) is the highest peak of the Naga Range. The Patkai and the Naga ranges form a watershed between India and Burma. Further south, this mountainous belt is called the Manipur Hills (generally less than 2500 metres in elevation) in Manipur State, the Mizo Hills in the state of Mizoram and the Tripura Hills in Tripura State. The ranges are folded and alternate with valleys. This range and valley character of the topography has developed a special drainage pattern known as trellised drainage. Simply speaking it is a type of multichannel drainage which criss-cross to form a lattice pattern. The ranges and the valleys run generally in north-south direction. They are covered with thick forests and are difficult to cross. Passes are very few.

The sources of the three important rivers of India, namely, the Brahmaputra, the Sultej and the Indus have their sources near Lake Manasarowar (Tibet) situated to the north of the Great Himalaya. The source of these rivers varies in height from 4570 to 4875 metres. The Great Himalaya which is about 1.5 km. higher than the level of the river sources is cut across by these rivers to form very deep narrow gorges. According to the view of some geographers and geologists, these rivers are older than the mountains they cross. These rivers began entrenching their courses in these mountains when they began to rise slowly. Gorges deeper than 3 km. are not uncommon. The deepest gorge (5180 metres deep) is found in the course of the Indus where it crosses the Himalayas near Nanga Parbat. A few other rivers such as the Bhagirathi, the Alakananda, the Karnali, the Gandak, the Arun Kosi, the Tista and the Manas have completely cut back their courses in the Great Himalaya and have thus formed very deep gorges. These rivers, for some distance, run parallel to the mountain ranges before they descend on the Plains of Northern India. Along the river courses at some places occur river terraces, which show that the uplift of the Himalayas at intervals has rejuvenated the rivers.

2.1.2 The Plains of Northern India

These plains stretch in the east-west direction between the Himalayas in the north and the Deccan Plateau of Peninsular India in the south. They form a continuous stretch of alluvium land varying in width from 500 km. (Punjab and northern Rajasthan) to 240 km. (east Bihar Plain). The Sutlej Plain in the west, the Ganga Plain in the middle, and the Ganga Delta and the Brahmaputra Valley in the east constitute these plains. The desert in the west of the Aravalli Range being largely a plain is also included in the Plains of Northern India. These plains continue to the west beyond the Punjab and Rajasthan and converge with the Indus Plain in Pakistan. Measuring about 650,000 square km., these are amongst the largest plains of the world and they account for one-fifth of the area of India. These are primarily level plains without any interruption except for a few outliers of the Aravalli Range. The most prominent of these outliers can be seen in the vicinity of Delhi. They form isolated low hills or ridges and emerge out of the surrounding alluvium as islands. This region was formerly a deep trench, six to eight km. in depth, which was formed as a foredeep when the Himalayas rose as fold-mountains. Uniformity in the level of these plains is mainly due to two facts (a) deposition took place in water and (b) no earth movement disturbed their flatness later. In the drier parts of the western fringe of Haryana and neighbouring parts of Rajasthan, deposition of windblown dust accounts, to some extent, for the formation of these level plains. Numerous ravines turning the fertile alluvial land into unusable lands break the southern fringe of the Ganga Plain, particularly between the Chambal and the Son.

The courses of the rivers in these plains create several meanders. In the rain deficient parts of Punjab, Haryana, and Uttar Pradesh these rivers have been tapped for irrigation without which famines could not have been eliminated from this densely peopled plain tract. Along with canal irrigation, hydroelectric power has also been developed for power supply to industries and for domestic use. The rivers are liable to sudden and disastrous floods during the rainy season. Owing to flatness of the plains and large loops of meanders, the rivers are sluggish and fail to carry away water quickly after heavy continuous rain, which leads to a situation of severe and sudden floods.In some areas of high water-table, the flood waters may stand for a few months and thus impede the sowing of rabi crops. In winter, the volume of water is so small that the rivers appear misfits.

2.1.3 The Indian Plateau

It is also called the Plateau of Peninsular India as it stretches south of the alluvial Plains of Northern India. It looks like a large triangle with its apex in the south at Kanya Kumari.It is far older than the Himalayan mountain ranges and is formed essentially of the ancient igneous rocks. The earth movements have brought some changes in the landscape of this otherwise stable block of the earth's crust. These movements were vertical and resulted in the formation of faults along which some areas sank forming faulted basins or rift valleys. This occurred sometime during the Gondwana period when drainage of the adjoining area flowed into these basins, deposited sandstones, clays and shales (finely stratified stone) which subsequently turned into sinking of the basins, and formed the coal beds and lay preserved. The valleys of the Damodar, the Mahanadi and the Godavari roughly mark the position of the Gondwana region. The Narmada and the Tapti valleys leading to the Arabian Sea are rift valleys formed long after the Gondwana period. The Narmada Rift valley continues to the north-east and is occupied by the river Son. North of the Narmada-Son is the Malwa Plateau, which extends to the Aravalli Range in the west and Bundelkhand region in the north-east. The Malwa Plateau is inclined towards the north and is formed by horizontally bedded sandstones, limestones and shales laid down during the pre-Gondwana period. It is suggested that during this era the Malwa Plateau was submerged under the sea.

South of the Satpura Range, the peninsula is called the Deccan Plateau. It is believed that large-scale volcanic eruptions took place in the Cretaeous period which spread far and wide over the Indian Plateau covering completely the land forms existing at that time. Repeated flows of melted basalt from fissures built up a basaltic plateau. The basalt so deposited has, however, been eroded away by rivers from a large area and is visible only in Maharashtra, southern Malwa Plateau and large parts of Kathiawar and covers an area of 520,000 square km. at present.The sub-regions of the Indian Plateau are described below.

The Aravalli Range

It runs in the northeast-southwest direction from Delhi to the north-eastern fringe of Gujarat State. Between Delhi and Ajmer, it can be characterised by a chain of detached and discontinuous ridges running also in the northeast-southwest direction and forms basins of inland drainage here and there. The range is almost continuous south of Ajmer.The highest peak of the Aravalli Range is situated in Mount Abu.

The Vindhya Range

The Narmada Valley is flanked in the north by a steep sided escarpment (long steep face of plateau) formed due to presence of the Malwa Plateau. This escarpment, considered wrongly as a mountain sometimes, is known as the Vindhya Range and runs roughly north-eastwards along the northern fringe of the Narmada-Son for about 1200 km. The height of the escarpment generally averages less than 610 metres. The western part of this range is covered with lava. The eastern part of this range, not covered with lava, is known as the Kaimur Hills.

The Satpura Range

It starts from the West Coastal Plain and runs eastwards between the Narmada and the Tapti-Purna rivers and continues up to Amarkantak covering about 900 kms. Its western extremity is known as the Rajpipla Hills and the easternmost part as the Amarkantak Plateau and in the middle we can find the Mahadeo Hills. Throughout its length, the Satpura Range has steep sided plateaus of elevations varying from 600 to 900 metres. The eastern part of the Amarkantak Plateau known as the Maikala Range overlooks the Chhattisgarh Plain. Dhupgarh near Pachmarhi is the highest point of the Satpura Range. The Rajpipla Hills and the Pachmarhi Plateau are deeply dissected with a strong local relief. This range is covered mostly with thick layers of basalt. It has two important gaps; one can be reached by the Bhusawal Khandwa rail section and the other can be reached by Jabalpur Balaghat rail section.

The Chhattisgarh Plain

It is a basin drained by the Upper Mahanadi. It lies to the east of the Maikala Range and low Khairagarh Plateau separates it from the Wainganga Valley. The basin is laid with nearly horizontal beds of limestone and shales and is enclosed by hills or plateaus. It is a large area measuring about 73,000 square km.

The Chota Nagpur Plateau

It lies to the east of the Rihand. It includes the Bihar Plateau and the adjoining eastern fringe of Madhya Pradesh with Purulia district of West Bengal. The Ranchi Plateau in the south, the Hazaribagh Plateau in the north along with the Rajmahal Hills in the north-east constitute important physiographic sections of the Chota Nagpur Plateau. In the same region, the Ranchi Plateau lies to the south of the Damodar. It is in fact a group of plateaus elevated to different heights. The surface of the plateau, which is mostly rolling, is occasionally interrupted by conical hills. Parasnath in the eastern part is the highest point. The north-eastern edge of the Chota Nagpur Plateau is termed as the Rajmahal Hills and it runs in the north-south direction. Consisting mostly of basalt, these hills have been dissected into separate plateaus.

Other Sub-Regions

In addition to the above we can trace the rocks of the Indian Plateau in Meghalaya where it forms a rectangular block known as the Shillong Plateau or the Meghalaya Plateau. The western part of this plateau is called the Garo Hills whereas the central part is known as Khasi-Jaintia Hills and the eastern part as Mikir Hills.The central part of the Khasi Hills is a table-land and Shillong town is situated on it. This table-land is the highest part of the Meghalaya Plateau. Moving to the central India, we can locate Tapti Valley which lies to the south of the Satpura Range. To the south of the Tapti Valley is another east-west range commonly known as the Ajanta Range, which again is formed of basalt and has an appearance, at the top, of that of a plateau.

The eastern side of the Indian Plateau is bounded by the hills called the Eastern Ghats. Several rivers break these Ghats from the East Coast, namely the Mahanadi, the Godawari, the Krishna and the Penner, before they fall into the Bay of Bengal. The Nallamala Hills between the Penner and the Krishna and Bastar-Orissa Highlands between the Mahanadi and the Godavari are prominent blocks of the region. South of the Krishna, height of the Eastern Ghats is generally less but north of the Godavari, it is higher and rises to 1680 metres near Vishakhapatnam district. Mahendra Giri in Orissa with the height of 1501 metres is the second highest point. The Deccan is fringed in the west by the Western Ghats also known as the Sahyadari, which run from the lower Tapti Valley to the south as a continuous range and merges with the Eastern Ghats in the Nilgiri Hills. The Western Ghats rise abruptly from the western coastal lowlands and rise to an average height of 920 metres in Maharashtra and above 1000 metres in Karanataka State with Doda Betta as the highest peak of the Nilgiri Hills.

As the Deccan plateau slopes gently towards the east consequently the rivers Godavari, Krishna, Penner and Cauvery flow to the east. These rivers and their tributaries have carved broad valleys leaving highlands between them. These highlands form long low ranges particularly in the Deccan region of Maharashtra, Andhra Pradesh and northern Karnataka. The range lying to the north of the upper Godavari valley is called the Ajanta Range whereas one lying between the Bhima-tributary of the Krishna, and the upper Godavari is called the Balaghat Range. These ranges provide in between, broad valley plains extending about 450 metres.

In the extreme south are the Cardamom Hills. These hills are gneisses (Coarse-grained rocks of quartz, mica and felspar) and schists a (foliated rock presenting layers of different minerals) and separated from the Nilgiri by a gap called the Palghat Gap. The Cardamom Hills' prominent peaks are named as the Palni Hills and the Anaimalai Hills to the east. The Anaimalai Hills with Anai Mudi the highest peak at 2695 metres above sea-level are the highest in South India. These hills end almost abruptly in the Plains on either side.

2.1.4 The Coastal Lowlands

The Plateau of Peninsular India is fringed with narrow coastal lowlands. Raised beaches and wave-cut platforms above the high water mark signify that these lowlands are essentially the emerged floors of the seas adjacent to the land. After the emergence of these lowlands, fluctuations in sea-level, though limited to small areas, have brought some changes in the general surface features of the littoral (shore areas). The west and east coastal lowlands are described below:

West Coastal Lowlands

The physiography of West coastal lowlands is varied. It contains marshes, lagoons, mud-flats, peninsulas, creeks, gulfs and islands. The Rann of Kutch, the peninsulas of Kutch and Kathiawar and the Gujarat Plain are the major physiographic regions.

The Rann of Kutch lies to the north of Kutch. Earlier a gulf and now a vast desolate lowland it was formed due to the deposition of silt brought mainly by the Indus in the past. Its surface is only slightly above sea-level and is interspersed with mudflats, marshes and creeks.It is covered with shallow water during the rainy season and is being continuously filled up by the silt brought by the rivers. There are a few islands in the Rann, with Bela, Khadir and Pachham islands as the only ones of significant size.

Kutch, once an island, lies to the south of the Rann of Kutch. It is an arid area with generally broad sandy terrain along the coast and the Rann of Kutch and bare low rocky ridges in the interior. Kathiawar is located to the south of Kutch. It is hilly in the central part and elsewhere it is a rolling plain. Gorakhnath in the Girnar Hills in Junagadh is the highest peak in Kathiawar. The Gir Hills extending in the east-west direction lie to the south of Kathiawar and are connected with a broad hill-mass lying further north in the central part of Kathiawar which runs north-south forming a low narrow dissected range. In the north-east there is a belt of low country which is marked by Lake Nal and Marshes.

Along with several small rivers, long rivers like, the Tapti, the Narmada, the Mahi and the Sabarmati deposit enormous load of sediments in the Gulf of Cambay leading to siltation of the gulf. This has resulted in the creation of a broad fertile alluvial plain north of Daman extending towards north up to the Aravalli Range and termed as the Gujarat Plain. South of Daman, the coastal lowland narrows to a width of around 50 km, which occasionally broadens by a few kilometres at places where streams have gnawed back into the steeply rising Western Ghats. Between Daman and Goa the western littoral is called the Konkan. Coastal lowlands of Goa and the Konkan, to the south of Bombay are marked with the low hills separated by river courses which form creeks near the sea. The fact that the drowning of the lower courses of the rivers has taken place clearly suggests that there has been some recent submergence, though on a small-scale, of the coast, north of Marmagao.

Coastal plain in the vicinity of the Palghat Gap and in the south of Kerala is relatively broad reaching to a width of 96 km. Off-shore bars have enclosed lagoons which run parallel to the coast in southern Kerala and are known as Kayals. These lagoons receive water of a large number of rivers before discharging that to the sea with which they are connected by narrow openings. Formation of lagoons and off-shore bars indicate

INDIAN LANDSCAPE

Different Colours Indicate Various Landscape features

MOUNTAIN RANGES

INDIAN FORESTS

Different Colours Indicate Various Types of Forests

INDIAN – SOILS

Different Colours Indicate Various Types of Soils

that there has been a slight emergence of southern coastal plain not in the very distant past.

The West coastal lowland south of Surat is drained by several small rivers, which become torrents during the monsoon. In the normal course these torrents should have formed deltas. However, as at this time strong sea-waves also develop due to south-west monsoon winds and these waves having an unusually great scouring power, the mouths of the rivers are desilted and thereby impede the formation of deltas on the west coast. Instead of deltas, long off-shore bars which enclose lagoons, particularly in the south, develop as suggested above.

East Coastal Lowlands

East coastal lowlands is broad compared to the western lowlands and it is broadest in Tamil Nadu where its width ranges from 100 to 120 km. North of the Godawari Delta the coastal lowland is narrow as the Eastern Ghats closes on the sea. At some places it is as narrow as 32 km. in width. Since the Plateau of Penninsular India, especially of the Satpura Range, is tilted to the east, all rivers of the Deccan with the exception of the Tapti flow eastwards and reach the Bay of Bengal. These rivers have spread alluvium over almost whole of this plain and have built large deltas at several places. Sea waves being far less furious than those impinging on the west coast, the sediments brought by large rivers – the Mahanadi, the Godavari, the Krishna and the Kaveri have formed deltas. These deltas being fertile and properly irrigated are densely peopled. At some places spits, lagoons and off-shore bars have also developed along the coast. The coast is fringed at some places with dunes. Mangrove forests grown along the seaward front of the deltas have been a major characteristic. As the sea is shallow near the emerged lowland coasts, deep natural harbours except Bombay and Marmagao are absent along both the coasts.

2.2 VEGETATION

The Indian sub-continent has been witness to a very long period of human activity. During the course of this activity the vegetation cover present in the earliest time has been considerably modified. As a matter of fact, little trace of this vegetation except on the higher reaches of the mountains is to be seen today. If one has to imagine the features of the natural original vegetation, one would most definitely be struck by the fact that it essentially was a tree vegetation or forest cover. Over several millennia of human activity involving clearance and degradation of this forest cover, today only about one fifth of the total area of India is regarded as under the forest, treated as the protected forest. Half of the protected forest area has been designated as the reserved forest where all kinds of degrading activity are prohibited. In any case the least degenerated forests in India have to be found in the Himalayan region and one of the chief reasons for their preservation is the inaccessible terrain.

The situation described above was not the same in historical past.There is evidence to suggest that central Panjab and the Ganga-Yamuna Doab was covered with vast forest at the time of Alexander's campaign.A notable feature of Indian forest, according to spate and Learmonth, is that "the floral landscape is rarely marked by an absolute preponderance of one species or even an assemblage of species". Further "(the) nearest approaches to this condition are the Himalayan rhododendron belts (a tree having flowers of blood-red colour), the semi-desert vegetation of the northwest, and bamboos locally in the south and the northwest, usually on old clearing" [O.H.K. Spate & A.T.A. Learmonth, *India and Pakistan*: *A General and Regional Geography*, Indian Edition, New Delhi, 1984, p.74].

The vegetation cover of India has been classified on the basis of the types of trees present.Accordingly, it has been divided into the following five categories:

- Moist Tropical Types
- Dry Tropical Types
- Montane Subtropical Types
- Montane Temperate Types
- Alpine Types.

This classification is based on the study conducted by H.G. Champion in 1936 and slightly modified subsequently [see *India and Pakistan*, p.77].

Moist Tropical Type

The forest of this type is basically the rain forest that is wet and evergreen or semi-evergreen. It is found in the high rainfall areas where the dry season is short. In places where the dry season is either intermittent or more prolonged the forest becomes semi-evergreen. The tree cover in the forest of this type is very dense and very high. It is found along the Western Ghats to the south of Mumbai and in Assam. Perhaps, in the past, the coastal areas in Orissa and Bengal were also covered with this kind of forest, but have been denuded now.

Dry Tropical Types

This type grows in areas which have moderate rainfall and that too concentrated in a short period of time.The remaining dry season that is fairly prolonged harbours the growth of this type.The area occupied by the forest of this kind extends in central and Peninsular India as also along the Siwaliks in Himachal Pradesh. The trees grow up to a medium height and permit the undergrowth of shrubs and spiny vegetation.

Montane Subtropical Type

The subtropical types are rain forests having a stunted growth. The two main areas where they are found are the Nilgiris and Anaimalai-Palani Hills in the south. It may have covered the Satpura and Maikal Hills and Mount Abu in the past, though most of it has now vanished.

Montane Temperate Type

This type of forest extends in the lower reaches of Himalaya where the rainfall is moderate though regular. The main trees found are oaks, chestnuts and laurels. It also grows pines, cedars, silver firs and spruces. Rhododendrons and some varieties of bamboo are also seen in good numbers in this forest.A notable feature of this type of forest is that it supports exportation of timber wood.It is also prone to frequent fires.

Alpine Type

This type grows in the middle levels of Himalaya. The main types of trees and vegetation are silver firs, juniper, pines, rhododendrons and birches. The forest types in India and their geographical distribution has been depicted in the map appended here.

2.3 SOILS

Soils support vegetation as also agriculture and have therefore been of vital importance in giving Indian landscape a definite view. The traditional classification of the soils in India, as noted by Spate and Learmonth, was in four main categories: alluvium, regur (black cotton soils), red soils and laterite. We have already taken note of heavy alluvium deposits in the Indo-Gangetic plains as a result of erosion and river floods occurring at frequent intervals. An early attempt to classify soil types was made by the Russian scientist Z. J. Schokalskay in 1932. This was essentially an attempt at synthesising the existing knowledge and its value lay in the fact that it prepared ground for systematic soil study. In India a Soil Survey was set up in the year 1956, and it has been working since then to map the soil distribution pattern in India. We have given here a map on the pattern of soil distribution in India but it is based on Schokalskay's study as the Soil Survey of India work has not been completed.

Soil conservation has been an important environmental concern as it sustains vegetation and agriculture both. Many human activities have directly and indirectly resulted in soil erosion in a major way causing in some cases an irreparable loss of the soil for posterity. Since consolidation has to precede conservation, the task becomes more difficult as persuasive measures requiring cooperation on larger scale need to be adopted. Soil fertility and soil productivity are other related issues but they need to be addressed by scientists primarily.

2.4 PERCEPTIONS OF LANDSCAPE

The description of the physical features of India provides the ideal backdrop to examine the social perception of landscape as it evolved since ancient times. The beginning of civilisation in India is traced to the semi-arid region of Sind. The river valleys of the arid region provided suitable conditions for the emergence and growth of a society based on agriculture. At that time the 'technological constraints' forced humans to notventure to the densely forested areas of Ganga-Yamuna Doab and the foothills of the Himalayas. It is only in the early Vedic literature that glimpses of the expansion of human settlement from the north-western India towards the Ganga-Yamuna Doab are provided in ample measure. A shift from the semi-arid region to more wet regions of Ganga-Yamuna Doab was a clear manifestation of the different needs of the settlers. The nomadic character of the new settler necessitated movement towards a greener region and with the 'advent of iron' settlement in the densely forested region became a reality. This was also the beginning of an assault on the forest frontiers. Gradually the agriculture spread, forests shrank and empires began to take shape.The period also witnessed the establishment of republics along with monarchical kingdoms. It is interesting to note that whereas the monarchies were concentrated in the Ganga plain, the republics, most of which pre-dated the monarchies, were ranged round the northern periphery of these kingdoms in the foothills of the Himalayas, perhaps due to the fact, that it was easier to clear the wooded low-lying hills than the marshy jungles of the plain. It also suggests that there had been continuous interaction between the settled agriculture and the adjoining forest areas, a fact substantiated by Kautilya. He visualised forests and mountains as providing effective barrier against the enemies. He also supported management of forests to generate revenue as well. Thus we can suggest that forests and mountains were perceived in terms of their economic and strategic significance.

It should be noted that the landscape was visualised not only in terms of the economic and strategic significance but also its aesthetic value that was appreciated. Ancient literature is full of references where landscape has been eulogised in terms of the bounty it provided and the visual pleasure it offered. In the ancient Tamil poetry, love of man and woman is taken as the ideal expression of 'inner' self as well as outer world. The moods of separation and union are described by borrowing certain attributes from the wider natural world and placed within the rituals of the poetry. There are four kinds of "place"; each is presided over by a deity and named for a flower or tree characteristic of the region:

- *Mullai,* a variety of jasmine, stands for the forests overseen by *Mayon*, the dark-bodied god of herdsmen;
- *Kurinci* (pronounced *Kurinji*), a mountain flower, for the mountains overseen by *Murukan,* the red-speared god of war, youth and beauty;
- *Marutam*, (pronounced *Marudam*), a tree with red flowers growing near the water, for the pastoral region, overseen by *Ventan*, the rain-god; and

1 *Neytal (*pronounced *Neydal*), a water flower for the sandy sea shore overseen by the Wind God.

A fifth region, *palai* or desert-waste, is also mentioned. *Palai* is given no specific location, for it is said that any mountain or forest may be parched to a waste land in the heat of summer.It is named for *Palai*, supposedly an ever-green tree unaffected by drought. (A.K. Ramanujan, *The Interior Landscape: Love Poems from a Classical Tamil Anthology,* Delhi, undated).

Information about landscape is also available for the medieval period.A close examination of the Persian sources of the medieval period reveals that the region of Ganga-Yamuna Doab then had a different landscape. During Alauddin's reign, the region between Delhi and Badaun was densely forested unlike the vast expanse of agriculture spanning the area today with only sparsely wooded areas in between.Alauddin had given orders for clearing the forest to make the passage safe for the merchants in particular and travellers in general. However, it seems the vanishing act suffered by the forest here, began in the thirteenth century. Munhta Nainsi, the seventeenth century courtier of the Marwar state, while describing the mountains of Mewar region specially mentions the availability of water on mountains. Similarly, we have information on the political boundary of states defined along the courses of rivers. An interesting landscape detail can be seen in the following example. In the medieval period the territory between the two warring states of Mewar and Marwar were defined according to the cultivation of specific trees.The *anwla* plantation was seen as demarcating the Mewar region whereas Marwar was identified with the *babool* tree, suggesting a broad division of the territory in terms of the semi-arid and wet regions.

Landscape was visualised not only in terms of the kind of agriculture it could sustain, but also in terms of the animal the region could harbour. Historical works of ancient, medieval and even British period carry sufficient references to suggest that certain landscapes were defined in terms of the wild animals found there. Books like *Man-eaters of Kumaon*, tend to project a particular image of the region based on the availability of certain species of animals in the region. Francis Zimmerman, in his seminal work, *Jungle and the Aroma of Meats*, has constructed the details of the landscapes on the basis of the type of animals found in various regions.

The landscape experienced a different kind of change with the beginning of the colonial period. India's biological diversity was scientifically documented by the British. But it is also true that the policies of the colonial rulers greatly altered the character of the Indian landscape. Demand of timbre, initially for the ship-industry and later on for making the sleepers for the fast expanding railways, forced an unmanageable demand on the wood. Interior landscapes were penetrated to secure wood. When the impact of this reckless act became imminent, the cutting of diversified natural forests was compensated by the cultivation of monoculture of commercially viable species. This penetration and promotion of commercial varieties changed the entire landscape of the region. Similarly, propagation of plantation economy in the southern and north-eastern part of the country led to extinction of natural forest cover replaced again by the monoculture of the commercial plants.

It is not only the forest cover, which provides a glaring testimony to the alteration in the landscape of the region. Creation of canal networks in parts of upper India and eastern India led to drastic change in the landscape of these regions. Rohan D'Souza has pointed out the changes in the Orissa delta due to construction of canals in the initial phase and later on railways to protect the imperial interests.

2.5 SUMMARY

The general features of Indian landscape and the changes in these features in the historical period have determined the types of human settlements in different areas and their subsequent growth. Annual deposition of rich alluvial soil in Indus gave rise to civilization and settlements that lasted in that region for nearly two thousand years. It was only when the need for expanding the agricultural base of the settlement was felt that a shift to the forested region of Doab occurred.There was then an expansion in the agricultural frontier and a simultaneous contraction in the forested areas. Unlike this the more settled South India saw the emergence of more clearly demarcated environmental regions in the form of *Mullai, Kurinji*, *Neytal* and *Marutam*. In a scenario of this kind the colonial control ushers in a process of major change in the landscape. The priorities change dramatically and development overtakes all other considerations. The landscape changes and often results in irreversible losses of vegetation forms. The lesson for us is: developmental priorities of a democratic country like ours should be decided keeping the concerns of environmental conservation and factors giving rise to degradation in the foreground.

2.6 EXERCISES

1) Trace the northern boundary of India and name the passes, which connect India with Tibet along with their location.

2) Name the major physiographic divisions of India and give an account of the surface features of the Himalayas. Describe the main surface features and drainage of (i) the Plains of Northern India and (ii) the Indian Plateau.

3) How does the surface configuration of the east coastal lowland differ from that of the west coastal lowland?

4) Describe the vegetation of India with special reference to the forest.

2.7 SUGGESTED READING

Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-first Century,* New York, 1990.

Gopal Singh, *A Geography of India,* Delhi, 2003.

R.L. Singh (ed.), *Regional Geography of India,* Delhi,2003.

Romila Thapar, *History of India*, Vol I, Penguin, 1966.

D.K. Bhattacharya, *Ecology and Social Formation in Ancient History,* Calcutta, 1990.

(We gratefully acknowledge that the source of the maps given in this Unit is O.H.K. Spate and A.T.A. Learmonth, *India and Pakistan: A General and Regional Geography,* Indian Edition, 1984, New Delhi.)

UNIT 3 SOURCES OF STUDY

Structure

3.0 INTRODUCTION

History of Environment is basically an exploration of society-nature interaction.The focus of this Unit is to do a general survey of the major writings on the environmental history of India. It is an interesting fact that the initial writings in the genre of environmental history focused primarily on the history of the humans without in any significant manner according space to environmental considerations. It was with the growth of ‘scientific revolution’ and ‘enlightenment’ in Europe that a shift in history writing became evident and the story of evolution, taking into consideration the environmental factors, began to find a discernible place. However, it was only in the period after the first world-war that historical writings incorporating geographical factors as influencing/shaping historical developments appeared. A systematic exploration in this direction started with the establishment of *Annales* School in France. It was here that the trend was initiated of investigating history in the wider context of the prevailing environmental conditions. Similarly, movement against the pollution provided space to environmental concerns in history writing in America. ‘But despite all this, it is also the case that only in the past twenty-five years or so have historians methodically pursued a systematic exploration of this interchange (interchange of humans with their natural environment), in the process establishing a distinct branch of history: environmental history’ (Brian Fay, ‘Environmental History: Nature At Work’ *History and Theory, Theme Issue, Environment and History,* Vol. 42, No. 4, December 2003 p.1).

In this Unit our focus is on the writings on environmental history of India. We have attempted a broad survey of the available major literature and have tried to discern, as clearly as possible, the trends therein.It should be noted that no single text serves the purpose of encapsulating all or most of the aspects and for this reason a detailed bibliography is attached for the enthusiasts.

3.1 SURVEY OF LITERATURE

“The words ‘environment’ and ‘ecology’ have been subjected to extensive efforts at definition during the past twenty years or so. Already it has been found necessary to allow them space to breathe. So it is also with 'environmental history' or even 'Environment and History'. As with most commitments, it is possible to have 'hard' and 'soft' positions. The 'hard' might suggest that environmental history necessarily involves an examination of environmental dynamics through human agency in which the change is quantifiable in some shape or form. A softer approach would suggest, perhaps, that change could be inferred from even where data are not available. Interactions with environment may also be frozen in narrow time-scale where change is less significant. Relevant sections of legislation are all part of environmental history."

The above attempt to define environmental history by the editor of the *Environment and History* (John M. Mackenzie, Editorial, *Environment and History*, Vol, VII, No. 3, August, 2002) clearly reflects the dilemma of the present day historians working on environmental issues. A closer examination of the writings appearing under the rubric of 'Environmental History' makes it clear that the documentation of the ecological changes/ disturbances caused by the introduction of colonialism have dominated the discourse though there are a few important aberrations too.Most of the works on environmental history have located their study to analysing the disruptions in the traditional way of living as caused by forces and consequences of industrialisation. In the case of India these disruptions were caused by colonialism and some have continued even after independence. In general historians working on modern era have, along with economic exploitation, explored the exploitation of natural resources by the colonial power to cater to the interests of the mother country. The loss of natural flora and fauna and explanations of the causes and effects have been the major concerns of the environmental historians working on modern India.Further concerns of historians can be located in the debate initiated by the revisionist school of history writing and subaltern's attempt to explore the role of and impact on the marginal groups of society, largely ignored in the conventional history writing.

3.1.1 Methodologies

The above stated principles and concerns have been the defining features of the environmental history and these have been most vigorously put into practice in the case of forestry. Deforestation and associated climatic change has proved to be a vibrant zone.The conflict over classification of traditional rights and claims of tribals and their relationship with the state polity, initially with pre-colonial state and later on with colonial state have been useful add-ons. The domination of these issues in the environmental history can be gauged by the following acceptance by the editors of *Nature and the Orient*: "We make no apology for devoting so much of the book to the history of the relationship between forests, people and the state, and to the history of the discourse and ideology of colonial forestry in India, Burma and Malaysia. At the peak of its power the Indian Forest Department, for example, directly controlled over one-fifth of the land area of South Asia. Moreover, the forest history of the subcontinent and South Asia varies enormously from area to area, and we feel it necessary to highlight these differences and make a start at producing a series of detailed and empirical environmental histories, concentrating quite deliberately on the forest sector".(From 'Introduction' in *Nature and The Orient*, Delhi, 1998).

The systematic beginning of environmental history writing in India that also set the tone for future writings is invariably associated with Ramchandra Guha and Madhav Gadgil's seminal monograph *This Fissured Land* written in 1992. The authors suggested that in pre-colonial India, resource utilisation was in harmony with nature and resource sharing among various strata of the society was very cordial. The caste society with different claims on different resources led to a state of equilibrium in turn providing stability to the resource demand and supply. Caste was seen as consisting of endogamous groupings that were each marked by a particular economic activity and a particular ecological niche. However, perhaps unintentionally, the notion of self-sufficient villages was also justified by such arguments. The analysis of the various environmental movements were explained in terms of disruptions caused by the British as it was argued elsewhere that in pre-British time 'there was little or no interference with the customary use of forest and forest produce' [Ramchandra Guha,'Forestry in British and post-British India: A Historical Analysis', *Economic and Political Weekly*, 20 (1985), p. 1893]. A romanticised image of the human-environment interaction in the Indian context was thus portrayed by Guha & Gadgil.

The transition from the study of events and watershed occurrences to the study of processes and explorations of deeper continuities from an ecological point of view was a gradual process. In this the concern shifted to asking how and why certain kinds of livelihood patterns or production methods survived and how others were transformed. By replacing the study of events thus the processes had begun to occupy the center-stage.

The relative neglect of the colonial impact on the land by professional historians made it an obvious field for early inquiry. Moreover, early writers were more concerned with the protection of environment as they had been actively supporting the cause of conservation of environment. Thus they looked for evidences of popular protests against the exploitation and often neglected the contrary evidence. South Asian works have often focused on certain themes at the expense of others: the forest rather than agriculture, movements of A*divasis* and marginal peasants rather than changing responses of urban dwellers, histories of irrigation as opposed to conflict over water-rights, etc.

There have been a few exceptions though to this general trend. Sumit Guha has tried to bridge the gap between pre-British and British period. His area of study has been the region dominated by Marathas where rich repositories of Maratha documents have been put to excellent use. At the same time he has also avoided the illusionary divide between forest and agriculture and notions of ethnicity in the wider context of environment.He has demonstrated with fresh evidence that tribal polities did not evolve in isolation (Sumit Guha, *Environment and Ethnicity*, Cambridge, 1999).

Further, Sumit Guha has pointed out that the large areas of Western plateau (Maharashtra) outside the rain drenched Konkan coast were rendered treeless even during the heydays of Marathas. The pattern of living has modified the environment of the region as he demonstrates that the use of fire and the keeping of cattle were practiced here for at least forty centuries, if not more. In the process a thorny forest region was transformed into seasonal grass-land: the ecology was re-shaped in major ways. The fluidity was more than matched in economic terms. Dry spells could lead to a resurgence of herding.

In the attempt to analyse the deeper continuity Sumit Guha has relied upon archaeological as well as anthropological evidences to substantiate historical evidence thereby stressing the significance of processes rather than watersheds or events.

He has argued that it is important to keep in mind that in South Asian past relatively small area was under permanent tillage and the much larger percentage of land was often in the state of transition at least in the pre-modern period. In the analysis of state's perspective of land it has been pointed out that even in pre-British period 'the rulers, like the Marathas, saw the forest as an obstacle: tree cover multiplies the danger from robbers, rebels and tigers'. Jungle clearance has been equated in terms of fresh revenue possibilities though it had been an arduous and difficult task.

In another work, by Nandini Sinha for the region of Mewar (*State Formations in Rajasthan: Mewar during the seventh- fifteenth centuries*, Delhi, 2002) similar themes have been explored.She asserts that forested and hill regions were integrated into wider imperial systems of South Asia. Moreover the panorama of economic activities in any sub-region was far more diverse than is often realised. There were no clear-cut stages or phases like hunter-gatherer, herder, settled cultivators and artisan and city dweller.

3.1.2 Colonial Period

It is important to note that the whole discourse of colonial historiography has been and its later proponents have tried to analyse history in terms of 'evolutionary' time scale where succession from primitive to tribal to chieftaincy to state has been a unidirectional and mutually contradictory process (Ranajit Guha, '*History At The Limit of World-History*, New Delhi, 2003. He has highlighted the limitations of modern historiography in terms of over concern for 'statism'). In this context Ajay Skaria's writings deserve serious consideration as there the notion of wild has been seen in terms of opposition to civilised. The relationship between tribal people and state has also been located in terms of interaction between civilised and primitive.

Ajai Skaria highlights the general negligence of marginal areas and laments the lack of importance given to traditional issues. He tries to locate the problems of marginal issues in the context of politics of growth and finds that the same is important for the construction of ideas such as jangali/tribal/primitive. He questions the notion whereby tribals were equated with 'wild' and 'primitive' and settled agriculture (under the patronage of state) with civilisation. He also explores the inter-dependence between state and tribal polities where revenue rights and authority were shared in a complex web of relationship.There has now been an attempt to question the notion of a uniform British policy all across India and recent researches have pointed out that there was a serious divergence of views on policies related with the forest/land/ agriculture. (Ajai Skaria, 'Being Jangali: The Politics of Wilderness', *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 193-215.Also Ajai Skaria, *Hybrid Histories: Forests Frontiers and Wildness*, Delhi, 1998.)

Sivaramakrishnan's work is a further advance on the issue of forests and the colonial policy. He tries to locate the issue within the context of the debate that ensued with the attempt to formulate Private Forest Bill between 1865 and 1878. Underplay of various social, economic and environmental concerns made the whole debate so complex that ultimately the bill could not be formatted. The major issues involved in this debate were property rights sanctioned by permanent settlement and that now any attempt to withdraw or curtail the same would lead to greater resentment. These forests were often termed as Jungle Mahal, hence accepted as private property. This was the period when forests were sought after due to wood, which was in great demand because of railways. Initially with the formation of permanent settlement it was expected that marginal lands would also be put to better and positive uses but it was not the case in eastern India, so there was a demand for a private forest policy. There were conflicting issues at stake. On the one hand attempt was made through permanent settlement to maximise land revenue but soil conservation and forest produce were also important. The other conflict visible was the claims of the raiyat over the forest produce, which were recognised by tradition. The landlords on the other hand argued that it lead to degradation of forests and soil erosion. Conversion of private forests to protected forests would lead to the denial of claims to raiyat but would meet the simultaneous demand generated by expanding railways further complicating the issue of traditional claims *versus* commercial exploitation. The importance of his approach lies in a thorough exploration of conflicting interests vis-a-vis natural resources. There were several claimants and the state had to consider several probabilities before arriving at any formal policy. He also examines the debate over environmental considerations.It was not only scientific knowledge (about forests) which participated in the debate but various self interests also tried to appropriate the issue and mend the policy in their favour. (K. Sivaramakrishnan, 'Conservation and Production in Private Forests: Bengal, 1864-1914', *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 237-264. Also see K. Sivaramakrishnan, *Modern Forest*).

Similarly, Ravi Rajan points out the internal divisions in the colonial perspective. The so-called colonial policy has not been a monolithic structure and there were quite evident heterogeneous views. The author has very clearly pointed out internal divisions in colonial policy by examining the deliberations at the Empire Forestry Conference on two crucial colonial agro-ecological policy concerns, shifting cultivation and soil erosion, during 1920 to 1950. The problem of conservation of forest- wild had been of immense significance especially in the 1930s due to the experience of 'Dust Bowl'. Examples from West Africa were cited to point out the benefits of shifting cultivation but it was put aside by citing the nature of forests in India. 'The political damage caused by shifting cultivation was its inducing nomadic habits on parts of the local population, discouraging agricultural progress and facilitating the evasion of taxes'. The problems caused by shifting cultivation were not only of tax evasion but the larger issue of timber trade/supply to cater to the needs of British was also at the centre-stage . The problem of soil erosion was caused by the cutting of forests for commercial use and the clearing of land for agricultural purposes. It was further fuelled by the ever-increasing population pressure and overgrazing. To tackle the problem, scientific studies were encouraged, but, 'given the social roots of the technological experts, it was asserted that the nature of their technical intervention was by no means value neutral'. (Rajan S. Ravi, 'Foresters and the politics of colonial agro ecology: The case of shifting cultivation and soil erosion, 1920-1950', *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 217-236).

The reconstructions of forest histories also need to pay close attention to local and regional peculiarities. Ajit Menon has pointed out that 'the forest-dependent communities view land in terms not so much of ownership but of use.' He suggests that the process of colonisation depends both on the state's ability to take over large areas of land and the ability of local communities to shape the state's initiatives to at least some extent. It is significant that the manner in which state policies reach local communities in the Kolli hills continues to be determined by the latter's reception and response. [Ajit Menon, 'Colonial Constructions of 'agrarian fields' and 'forests' in the Kolli Hills', *The Indian Economic and Social History Review*, 41, 3 (2004), pp 315-337].

The attempts to challenge the portrayal of adverse role played by British by arguing that it was the British who initiated systematic forest conservation policy in India is another significant area of Indian environmental history. It has been argued that, "the original 'greens' in India were in fact colonial officials.Colonial forest policy … was rooted in an enlightened understanding of environmental issues developed in particular by a group of remarkable Scottish medicos serving in the colonies, who sought initially to understand the connection between climate and health, but very quickly became experts in botany and ecology. They argued that there was a close connection between deforestation and environmental desiccation and pressed strongly for state-led conservation of forests. Through their pressure, the earlier *laissez-faire* attitude towards forests was replaced from the mid-19th century onwards by active management and control". (From David Hardiman's review of *Nature & The Orient in Economic and Political Weekly*, issue dated July 3-9, 1999).

The state-led conservation of forests was legitimised under the guise of imparting modern knowledge or banishing the forest-dwellers from their habitat for harming the forests. A balance between agriculture and forests could be achieved by identifying lands suited to the agriculture and marginal land could be developed as forests. The primacy of agriculture was thus quite evident. The availability of ground water was also a related issue often combined with the soil erosion. At times forest growth was considered harmful for ground-water as it sustained itself on the ground water only. (Rajan S Ravi, 'Foresters and the politics of colonial agro ecology: The case of shifting cultivation and soil erosion, 1920-1950', *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 217-236.)

It clearly brings out the fact that colonial concerns with respect to forests were principally guided by covert economic considerations though overtly predominated by the objective of conservation. The debate over conservation of environment was traced to the literary traditions of romanticism where nature in its pristine form was aspired. The environment was to conserve to protect the environment in its natural conditions. Similarly, the aboriginals of the forests were to be protected so as to conserve the primitive form of environment. (Archana Prasad, *Against Ecological Romanticism: Verrier Elwin and the Making of Anti-modern Tribal Identity*, New Delhi, 2003.)

Another area of exploration has been the analysis of the various policies having a bearing on the environmental issues. Vasant Saberwal has made a major contribution in this field. He argues that 'there is growing recognition within the academic ecological community of the complexities of ecosystem functioning and the limits to our predictive and explanatory capabilities with regard to large-scale ecological phenomenon'. His explanation brings it out that the concerns for conservation evolved over a long period of time along with the growth in the scientific knowledge about environment. The role of the state in the appropriation of scientific knowledge in support of its claims by the state has also been pointed out by him. He writes: "This essay examines the chronological progression of the desiccation debate, and I have located my analysis in the broader scientific context within which these ideas were articulated during the late 19th and early 20th century. I explore the connection between a scientific paradigm of a given era, and bureaucratic use of this discourse on Himalayan degradation, the institutional context within which the discourse has taken place, has in a sense, shaped or directed the discourse. Over-time, one observes a two-way process whereby bureaucracies may use science to inform a particular rhetoric; at the same time bureaucratic rhetoric comes to influence the scientific discourse itself, and thereby the very nature of science". ['Science and the Desiccationist Discourse of the 20th Century', in *Environment and History* 4, 3 (1997), pp. 309-43].

The changing history of the encounters of humans and animals has become another field of growing interest, both in terms of changing elite taste and of ground level conflicts and co-existence. In this context, *The End of Trail: The Cheetah in India* (Divyabhanusinh, New Delhi, 1999) stands out. The author has attempted to trace the history of Cheetah in India, its origin, spatial distribution, attitude towards the animal, gradual erosion of space for the big animal and finally the extinction of the specie. It is an important contribution that helps in a comprehension of complex relationships between fauna and the society, especially the explanation that the extinction of the animal was caused by the side-effect of the larger historical process and not as a direct process of elimination of the species as it was for other 'big games'.

The picture will be sharper if we simultaneously examine the work of Mahesh Rangarajan. ('The Raj and the natural world: The war against 'dangerous beasts' in colonial India', *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 265-299.) Rangarajan has analysed how and why certain types of animals were directly targeted and consequently became extinct. Apparently, the very simple process of agricultural expansion has resulted in the gradual erosion of space for big animals. The shrinkage of the hunting area forced the animals to move in the closer proximity of the humans resulting in violent encounters. The availability of technology placed society of the early colonial period in a better position to combat the 'dangerous beast'. How these dangerous beasts became dangerous and how human action liberally contributed in this was not the concern of the contemporary society. At another level the article also traces the possible political uses of this controversy as it became a tool to secure the right to carry arms even if it was prohibited by the civil authority.

Understanding of environmental issues through in depth regional histories has become the other area of exploration. The interplay of regional identity and ecological niche has come into sharper focus than in the past. It is interesting that there have been a few detailed micro-histories of a particular range of hills, a watershed or a valley system, a reserved forest or a princely reserve.

There have been several useful works on pastures, fields and forests of colonial and contemporary Rajasthan. But except for passing references in studies of agrarian production few have examined the dynamics of water management in Rajasthan prior to 1800. (Ann Grodzins Gold & B.R. Gujjar, *In The Times of Trees and Sorrows: Natural, Power and Memory in Rajasthan*, Durham, Duke University Press, 2002; N.S. Jodha, *Life on the Edge: Sustaining Agriculture and Community Resources in Fragile Environments*, New Delhi, Oxford University Press, 2001). Primary concern of Jodha has been to examine 'the changing status and usage pattern of natural resources… and the possibilities of arresting their negative trends characterising these changes'. P.S. Kavoori, (*Pastoralism in Expansion: The Transhuming Herders of Western Rajasthan*, Delhi, Oxford University Press, 1999) has explored the issue of 'common property resources' by examining the conditions of the pastoralists in the contemporary Period. Similarly, R. Thomas Rosin has found a relative shortage of the ‘common grazing land’ and the stress over the sedentary lifestyle has reduced the opportunities for the pastoralists. By the same token, it also reduce the opportunities available with the peasantry in times of drought and famine. (R. Thomas Rosin, *Land Reforms and Agrarian Change: Study of a Marwar Village from Raj to Swaraj*, Jaipur, Rawat Publications, 1987). Similarly, for the later period, conflicts over natural resource use have been extensively investigated, i.e., forest protection and conservation *versus* extension of settled cultivation. (Rajan S. Ravi, ‘Foresters and the politics of colonial agro-ecology: The case of shifting cultivation and soil erosion, 1920-1950’, *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 217-236. K. Sivaramakrishnan, ‘Conservation and production in private forests: Bengal, 1864-1914’, *Studies in History*, Vol. 14, No. 2 n.s. 1998, pp. 237-264).

There are several studies highlighting the problems with the British policies with regard to the forest management where monoculture has been a major issue and the exploitation of natural resources for a distant elite who was least concerned with the social impact of such policies, a matter of great concern.

The other strand in these studies for the forested region has been the analysis of impacts on the tribes living on the periphery of the settled agriculture. It is significant in the sense that since the tribes were not adhering to the practice of settled agriculture the British were not able to tackle the tribes. (Sumit Guha, *Environment and Ethnicity in India, 1200-1991*, Cambridge University Press, Cambridge, 1999.) The resistance offered by these tribes to the British policies have been extensively examined and it has been argued that British were unable to comprehend the complex functioning of their social relationships.In most of the cases, the problem can be located in a difference of vision of landscape shared by the British and the reality of Indian landscape. In other words, the nature of political intervention influences the nature of colonial discourse on ethnicity, environment and resource exploitation.

3.1.3 Pre-Colonial Period

The broad survey of the writings on the environmental concerns in India cannot ignore the contributions made by historians working on pre-colonial period. The issue of marginal has been addressed with special reference to pastoral, tribal, hunter, etc. Francis Zimmermann has examined ancient texts to construct the ecology of the period. He has questioned the practice of equating the term *Jungle* with the forest. Zimmerman has explored the suggestive ecological references from the ancient texts where animals are classified in two groups: *jungla* “those of the dry lands,” and *anupa*, “those of the marshy lands” and pointed out that by closely examining such texts we can infer a great deal about the ancient ecology. (Francis Zimmermann, *The Jungle & the Aroma of Meats: Ecological Themes in Hindu Medicine*, London, 1989. Similar trends are visible in Roger Jeffery ed., *The Social Construction of Indian Forests*, Manohar, New Delhi, 1998).

Following more conventional path, Aloka Parasher-Sen has tried for the Mauryan period to 'understand how the state perceived the forest dwellers and sought to subordinate and assimilate them. Geography and the perceived existence of the hostile tribes defined the frontiers of the empire and both had to be mastered for the expansion and integration of the state'. [Aloka Parasher-Sen,'Of tribes, hunters and barbarians: Forest dwellers in the Mauryan period', *Studies in History*, 14, 2, n.s. (1998). pp.173-191.Also Shereen Ratnagar, 'Pastoralism as an Issue in Historical Research', *Studies in History*, 7, 2, n.s. (1991). pp.181-193]. The other major concern has been the study of social formations and it has been influenced by the methodologies and tools deployed by anthropology and archaeology. (R. Ray, *Ancient Settlement patterns in Eastern India*, Delhi, 1987, M.L.K. Murthy, 'Environment, Royal Policy and social formations in the Eastern Ghats, South India', *Indian History Congress*, Delhi, 1993, pp. 615-631, D.K. Bhattarchaya, *Ecology and Social Formation in Ancient History*, Delhi, 1990). Ranabir Chakravarti has highlighted the role of hydraulic management in the process of settlement in ancient period, ('The Creation and Expansion of Settlements and Management of Hydraulic Resources in Ancient India', in Richard Grove, Vinita Damodaran and Satpal Sangwan, (eds.), *Nature and the Environment*, Delhi, 1998, pp.87-105).

Few writers have probed the significance of pre-colonial water systems (David Ludden,'Ecological zones and the cultural Economy of irrigation in Southern Tamilnadu', *South Asia*, Vol.-I, No. I, 1978, p. 1-13. and Burton Stein, *The New Cambridge History of India, Vol. 2, Vijayanagara*, Cambridge, Cambridge University Press, 1994; *Peasant State and Society in the Medieval South* India, Delhi, Oxford University Press, 1980); this is especially true of north and northwest India. In most of these studies scholars have stressed the role of traditional village community in construction and maintenance of irrigation mechanisms. David Hardiman suggests, that 'small-dam systems of irrigation existed in the past which were sustained over long periods of time… by community based control.' (David Hardiman, 'Small Dam Systems of the Sahyadris' in David Arnold and Ramchandra Guha eds, *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia*, Delhi, Oxford University Press, 1995. pp. 185-209). In the same vein Elizabeth Whitecombe has argued that irrigation ''works were financed by loan capital. Hence, in the sanctioning of constructions the emphasis was necessarily placed on the prospect of their remunerativeness." ('The Environmental Costs of Irrigation in British India: Waterlogging, salinity, malaria', in David Arnold, and Ramchandra Guha eds. *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia*, Delhi, Oxford University Press, 1995. p. 237-259). David Mosse has examined the interplay of 'developmental politics' to explain the level and process of state intervention. The role of community based programmes to tackle contentious issues like management and allocation of 'common property resources' like water bodies, etc. have also been examined. (David Mosse, *The Rule of Water: Statecraft, Ecology and Collective Action in South India*, New Delhi, Oxford University Press, 2003.pp.1-27). Water systems have been examined by R.J. Fisher, (*If Rain Doesn't Come: An Anthropological Study of Drought and Human Ecology in Western Rajasthan*, Delhi, Manohar, 1997) and Tripta Wahi, ('Water Resources and Agricultural Landscape: Pre-colonial Punjab', in Indu Banga ed., *Five Punjabi Centuries: Polity, Economy, Society and Culture, c.1500-1990*. Delhi, Manohar, 1997).

As we move further back in medieval India we discover a general dearth of scholars focusing on environment and on man-environment interaction.We may refer to the two initial chapters in *the Cambridge Economic History of India*, Volume I (ed. Tapan Ray Chaudhuri and Irfan Habib, CUP, 1982) by Irfan Habib and Burton Stein on 'The Geographical Background' (especially of North India) and 'South India: Some General consideration of the Region and its Early History' respectively as studies located on the fringe of environmental history. Another study, by Harbans Mukhia, entitled 'Was There Feudalism in Indian History?' also explores influences of environmental factors on human settlement and social formations as a sub-theme and not as the central subject. (Presidential Address, Medieval India Section, *Indian History Congress*, 1982). In fact closest to the field of environmental history is Shireen Moosvi's useful study 'Ecology, Population Distribution and Settlement Pattern in Mughal India in 1989 [Man and Environment, XIV (I), 1989, pp 109-116].One can also refer to an article by Mohd. Afzal Khan published in 2002 ['Environment and Pollution in Mughal India *Islamic Culture*, LXXVI (Vol.76), No.1, January 2002, pp 101-116].

A serious influence on the man-environment studies in medieval India has been that of the *Annales*. Influences of environment on the social formations have been a major area of exploration for the *Annales*. Since the very beginning of the movement, we can trace the attempts made by contributors to explore the newer kinds of sources to analyse the role played by environment in historical developments. They have tried to place the role of environment in the wider settings of social formations and have not remained confined to the colonial impact only. They also attempt to transcend the barrier of medieval and modern history and have been more comfortable with the whole range of human activities in place of mainly the political history.

Harbans Mukhia is credited with making *Annales* popular in India by translating the writings of French historians along with Maurice Aymard (*French Studies in History*, Vol. I- *The Inheritance* New Delhi 1988 and Vol. II- *The Departure*, Sage, New Delhi 1990). The influence of the *Annales* tradition is visible in an important contribution made by Chetan Singh. He has explored the relationship between environment and society in Western Himalaya: "…But my project rested on the belief that there were some long established and well understood relationships between society and its physical surroundings. … Such fundamental relationships did, indeed exist: a society could hardly have survived for any length of time without them. It was, however the clear-cut enunciation of these relationships that was missing. This required the deliberate elaboration both of socio-economic processes and specific ecological environment within which they operated". (Chetan Singh, *Natural Premises: Ecology and Peasant Life in the Western Himalaya 1800-1959*, Delhi, 1998).

Similarly, Mayank Kumar has also attempted to examine the interaction between environment and society in medieval Rajasthan. He has questioned the notion that the traditional societies always practiced the methods aimed at a prudent use of natural resources and has cited several cases of exploitation of nature by traditional societies in Rajasthan. He also cautions that the magnitude of exploitation of natural resources did multiply manifold under the impact of Industrial Revolution, (*Environment and Society in Medieval Rajasthan,* unpublished Ph.D. thesis, Jawaharlal Nehru University, New Delhi, 2001).

In any attempt to track the interaction between humans and environment one should be careful to avoid the notions of geographical determinism. It is a major cause of concern for the historians dealing with middle ages. Febvre suggested that 'there were no necessities, only possibilities. A river might be treated by one society as a barrier, yet as a route by another.' (Peter Burke, *The French Historical Revolution: The Annales School, 1929-89*, Cambridge, 1990). Similarly, one should not over stress the role of human agency in influencing the environment. Ramchandra Guha and David Arnold have suggested: "Moving more firmly within the parameters of environmental history *per se*, there is the study of human engagement over time with the physical environment, of the environment as context, agent, and influence in human history. Here, nature figures unabashedly as human habitat, but in a dual capacity. On the one hand are ranged those elements of nature-climate, topography, animal and insect life, vegetation and soils-which directly or indirectly shape human activity and productivity. In affecting land-use and subsistence, they help to promote or prohibit specific forms of social structure, economic organisation and belief systems. They also extend the margins of historical analysis and bring centre-stage a 'cast of non-human characters' normally ignored, at least until recently. …But the relationship is a reciprocal one, for man more than any other any other living organism also alters the landscape, fells tree, erodes soils, dams streams, kills off unwelcome plants and predatory animals, installing favoured species in their stead". (David Arnold & Ramchandra Guha, 'Introduction: Themes and Issues in the Environmental History of South Asia', in David Arnold & Ramchandra Guha (eds.), *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia*, Delhi, 1995, p.2.). Such works would have to delve into a wider set of sources: folksongs and legends, music and lore, locating these against the changing backdrop of human-nature encounters. This would mean looking at both culture and nature, howsoever defined, in new ways.

3.2 SUMMARY

The above survey of the literature can at best be treated as cursory as it is not possible to examine all or even most of the writings on environment within the frame of a Unit. Recently, we have witnessed the growth of anthropological works to examine the contemporary social understanding of past environments. At the same time there has been an ever-growing trend of field-study based works conducted to examine the feasibility of development policies with respect to environment. Here a survey has been conducted to map out the beginning of writings on the environment of the past. It also examines the change in the methodology adopted to explore the hidden past and ecological context suggested by the sources. It is also for you to realise that the writings on environmental history simply demand closer examination of evidences and search for the non-human components of our past.

3.3 EXERCISES

1) Discuss briefly the nature of writings on environmental history in the colonial period.
2) Examine the characteristic features of the literature on environment focusing on the pre-colonial period.

3.4 SUGGESTED READING

Agarwal, A. and Sivaramakrishnan, K. eds., *Social Nature: Resources, Representations and Rule in India*, Delhi, 2000.

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Buchy, M, *Teak and Arecanut: Colonial State, Forests and People in the Western Ghats*, *1800-1947,* Delhi and Pondichery, 1996.

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Grove H. Richard, Damodaran Vinita and Sangwan Satpal, eds., *Nature and The Orient*, Oxford University Press, Delhi, 1998.

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Jeffery R. and N Sunder, eds., *A New Moral Economy for India's Forests? Discourses on Community and Participation,* Delhi, 1999.

Jeffery Roger (Ed.), *The Social Construction of Indian Forests*, Manohar, New Delhi, 1998.

Ladurie, Emmanuel Le Roy, *The French Peasantry- 1450-1660*, tr., Alan Sheridan, Aldershot, 1987.

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Poffenberger, M. and B. McGlean, eds., *Village Voices, Forests Choices: Joint Forest Management in India,* Delhi, 1996.

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Rangarajan, Mahesh, *India's Wildlife History: An Introduction*, Delhi 2001.

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UNIT 4 RESOURCE USE AND HUMAN SOCIETIES

Structure

4.0 INTRODUCTION

Growth of human societies has been linked inextricably with various resource-use practices. Each important stage in the growth of human societies has discovered and used new resources and adopted practices to facilitate the extraction of resources from the nature. Unlike other species of animals, the man has been especially endowed with a prowess for using nature's resources in innovative ways. This has given rise to relationships between human societies and environmental resources that sustain on a delicate balance and have the propensity of yielding disastrous results in the eventuality of excesses being committed on either side. The special place acquired by man in nature and the emergence of social forms that have adopted resource-use practices making an impact on eco-environmental systems has been a major historical development. The present Unit focuses on this historical development. The main areas examined here relate to the:

- understanding of the nature of environmental resources that have been brought into social use;
- analysis of resource-use practices with reference to their impacts on human societies;
- crises resulting from reckless use of environmental resources; and
- growth of the concept of resource conservation.

The unit prepares the ground work for a more detailed analysis of the distinct stages of social evolution and the emergence of related resources-use practices. This analysis becomes the subject of study in the next two units of this Block and in the subsequent Blocks.

4.1 NATURE OF RESOURCES & SOCIAL USE

Earth is a unique planet as it contains natural resources that have given rise to numerous life forms and have created an environmental system that has sustained and is compatible with this diversity of life forms. The reserves of these natural resources on the earth are enormous and along the route of the progress of human societies different kinds of resources have been harnessed by the man. There has, in fact, been a complex interactive relationship between human requirements in accordance with specific stages of culture and the development and use of natural resources. During the course of this interaction the ambit of 'natural resources' has been constantly changing and with that the relationship between man and his environment (use of gender being in the generic sense) has also been changing. The general understanding of the term 'natural resources' until close to the beginning of the modern age was that they consisted of useful, and therefore valuable, commodities. Practically they comprised the raw materials which could be purposefully used by human societies. This meant, essentially, that things like water, air and the light and heat emitted by the sun, and forests, land, wild life, fishes, and minerals were natural resources commonly brought in use by the humans. The modern age broadened this concept to include, as natural resources, the entire natural environment including all living and non-living things. For our purpose, however, a simple classification of natural resources has been adopted that divides them into the categories of renewable and non-renewable resources. In this division the resources which regularly multiply or get renovated are considered as renewable; the resources which are available in a fixed quantity, howsoever large, are considered as non-renewable. Non-renewable resources do not possess the inherent property of multiplication or periodic renovation. We discuss them in the following sub-sections.

The basic source of all our material goods is natural resources.

Natural resources are raw materials and energy obtained or derived from the environment.

Natural laws govern the occurrence and development of natural resources. The resources renew themselves over various lengths of time. For example, it takes millions of years for minerals to form, hundreds of years for soil to develop, and tens of years for trees to mature.

4.1.1 Renewable Resources

The natural resources which have the ability to regenerate are generally considered as renewable resources. An outcome of this ability is that the use or consumption of such resources is replenished and after a certain time the reserve is again available for use. The renewable resources are mostly the living resources such as plants, forests, wildlife etc. They also include such natural resources as the solar energy, air, and water because of their almost inexhaustible supply.

In addition to the above there are also natural resources that are bestowed with the property of renewal but with a relatively long time taken for accomplishing replenishment. In the context of social use of natural resources they are considered as least renewable resources or may even be considered as non-renewable. The length of time needed for replenishment is known as the cycling time. The resources having a short cycling time are renewable and those resources that have very long cycling time are non-renewable.

Renewable resources those which are replenished through relatively rapid natural cycles (e.g. trees). However, even these resources are finite when demand for them outpaces the period necessary for natural regrowth or replenishment

The sustenance of human life and its further growth has been largely dependent on renewable natural resources. The most clearly identifiable natural resources that have enormous regenerative capacity are solar energy, water and air. Life has been dependent on them so much that we generally do not count them in the category of renewable resources. In addition, we have two more renewable resources that have played an extremely significant role in the development of human societies – the plants and animals, and the landscape. We shall discuss them in the context of their use by human societies and shall also examine the resultant interrelationship.

Solar energy, water and air form a triumvirate that has helped the germination of human life as also all other life forms and has been responsible for its further progress in an immeasurable manner. If we take human time scales as our point of reference, we find that solar energy has remained an inexhaustible resource as it has met all human needs since the evolution of human life. It has provided energy in the form of light and heat and has helped regulate a climatic cycle that is the source of all vegetational growth and other support systems found vital for life. Solar energy is capable of being captured directly or through conversion in other forms. It was only after the beginning of science in organized manner that conversion of solar energy in other forms became possible. The solar energy has been available to man so naturally and in such uninterrupted form that any documentation of its social use is almost totally absent. We can only assume that the light and heat emitted by sun have been in perennial use by human societies for daily chores, for drying the ripened crops and for regulating their routine works. In fact human societies have, from immemorial times, recognized sun as the single most important resource for light and for heat. A diversification of the use of this resource, however, could only be made viable in the modern age.

Water is generally considered a perennial natural resource as it meets some of the vital requirements of life on earth. The humans are no exceptions in the matter and use water for sustaining life as also for a variety of other purposes. Considering the critical importance of this resource the nature has been very generous in providing water in ample forms and ways. The growth of human societies had been, for a very long time, contingent upon the natural availability of water. In fact water has been one of those key resources that have been managed by human societies from a very early time in its history. Drinking water and irrigation requirements have more often than not determined the contours and pace of development. In this process man learnt, quite early, the methods of converting non-usable water into usable water. As a natural resource water has also enabled man to generate energy and use this energy to power mechanical devices. As a matter of fact the availability of water has been in such abundance in nature that a kind of recklessness in its use crept in human habits. Over several millennia of the abuse of water resources a situation of supply-crunch has emerged now. Several regions of the world as also of India have been suffering from severe shortages of water.

One of the most important renewable resources has been the plants and the animals. Right from the beginning man has lived on a food consisting of animal meat and the plant fruits. The availability of food in different measures in different regions of the country has determined the pattern of settlement and growth of human societies in those regions. Later, in this process, human societies learnt and developed the art of agriculture and adopted semi-permanent and permanent settlements as habitats. The environmental conditions favouring agriculture determined the emergence of community settlements. These settlements were organized in accordance with specific agricultural conditions. The human endeavour was to grow crops to maintain a regular and adequate supply of seeds and to breed animals with the purpose of not allowing their stock to diminish. Agriculture soon became a basic form of human activity and the land for agriculture became one of the basic resources. It provided food to man and fodder to animals; it provided raw materials for ancillary activities such as clothing and shelter and other agro-activities. The agricultural resources were dependent on environmental conditions such as topography, soils, and water-supply and were regularly replenished through cropping activity. In this process sometimes the environment was allowed to deteriorate and the resources to diminish. This obviously had a major impact on contemporary societies as some even became extinct unable to cope with the changes.

Historically, the location of human settlements was strongly influenced by the environment. They were sited near sources of water and other natural resources, at crucial transportation points and in well-protected or easily defensible areas. The presence of commerce and industry is also a significant factor in the location of settlements.

The practice of agriculture reshaped the man-nature relationship. The supply of food resources was now assured and societies could take up other developmental activities. The landscapes occupied by agricultural societies underwent a major change and in innumerable cases the original vegetation was completely replaced by crops grown by the human societies. All this had a profound impact on the environment and various natural combinations of plant and animal life that had contributed to the original environmental conditions were altered permanently.

4.1.2 Non-renewable Resources

There are some resources that are replenished through extremely slow natural cycles (several thousands of years). Such resources can therefore be considered as non-renewable for all practical purposes. Since the rate of formation of these resources is very slow, each time they are used some depletion in their reserve does occur. The rate at which they are used, therefore, determines whether they are likely to last long or diminish sooner. The main non-renewable resources which human societies have been using since the most remote past are metals and mineral resources and soil. The metals and minerals are sometimes available on or near the surface or otherwise have to be mined. The soil is formed over hundreds of years as a result of a complex inter-action between organisms and the physical surface of the earth. Climate also plays a significant role in soil formation.

Productive soils are complex mixtures of interacting gases, water, minerals, microbes and organic matter.

The metals and minerals are seldom available in pure form in nature and are mostly extracted from below the ground or from the hills in the form of ores. This implies the availability of knowledge and a certain level of the development of technology of extraction. The earliest use by man of these resources has been documented with the help of archaeology and shall be subjected to a more detailed discussion in the next section. Here we would like to note that rock was perhaps the earliest material harnessed by man for use in daily chores. This period was the longest in the development of human societies and is called as Palaeolithic period. Most of the minerals known to us today have been discovered very recently in comparison to the time period occupied by the stone using human societies. The metals as a resource first became known to man in the period often characterized as the Chalcolithic period. The earliest evidence of the use of a metal by human societies relates to copper and bronze. The use of iron as a resource followed the copper-bronze period. The use of metals was a significant stage in the development of human societies as it became the harbinger to a host of critical developments in the subsequent periods that altered the relationship between man and environment. An important property of the metals is that the use of most of them does not result in any considerable destruction of their resources. The metals constantly change form and their malleability allows their use in a variety of applications.

Mineral resources are continually being formed by geologic processes, but the rate is so slow that we can rely only on those deposits already in existence. The current rate of mineral use far exceeds the rate of formation. Mineral resources are thus considered non-renewable.

Soils provide a basic support to most of the terrestrial life forms. They are also an important source of nutrients for aquatic life. The process of soil formation involves the breaking of rocks by natural actions such as that of wind, rain, sunlight etc. The rock particles so obtained then combine with vegetation and animal life to form soils. It is clear that soils at different places are different and they also have varying properties. This variation shows its impact on the fertile properties of soils. The vegetation supported by soils accordingly show a great diversity. The growth of human societies has thus been linked with the nature of soils; in some places the soils have supported crops and have helped the transformation of wandering human groups into settled societies, and at other places the less responsive nature of soils for vegetational and crop support has given rise to nomadic and non-sedentary societies.

Land is an essential component of environment. It harbours soil, water, air, life form and the systems within which they interact. Land is an important source of food and water. It is the structural component of all terrestrial habitats.

Soils have the tendency to suffer from the acts of erosion by wind action or by the rains. Whereas agriculture has been seen as the outcome of a major use of soil resource by human societies, it has also resulted in the destruction of the natural plant cover thereby exposing the soil to erosion. In such cases the desert like conditions spread and agricultural area begins to dwindle at varying pace. Soils have also been degenerated from incessant human activities without any consideration for permtiting regenerative lean periods so vital for recuperating the fertile properties. The grimness of the situation resulting from this degeneration can be ganged from the fact that human settlements have been forced to abandon the place and resort to migration. The problem of the loss of soil fertility has been faced by humans from a very early time and various solutions have been practiced to combat the situation. Coterminous with these solutions have been the different stages of the growth of human societies as will be discussed in **Block 3**. As a natural resource, therefore, soils have been of critical significance to the humans and

In tropical countries certain types of soil, when exposed to the sun for extended periods, can turn into laterite, a rock-like earth covering, unsuitable for agriculture.

Severe soil erosion by wind or water has affected many areas of India. Soil erosion can be controlled through a variety of forestry and agricultural practices. Planting trees on barren slopes, contour cultivation, strip cropping, terracing and building diversion channels are some examples of such practices.

have been subjected to a widespread and diverse use by human societies from very early in human history.

4.2 RESOURCE-USE PRACTICES AND THEIR IMPACT

We have seen above how natural resources are distinguished between renewable and non-renewable categories. We have also noted the fact that human existence and the growth of human societies has been contingent upon the use of these natural resources. Over a long period of time human societies had developed different practices for use of natural resources. These practices varied from place to place and invoked, from long experience of resource-use, several sub-processes that helped human societies in their further development. We discuss these sub-processes briefly before taking up a historical sketch of resource-use practices by human societies and their impact.

Perhaps it had become evident to human societies, through repeated acts of resource extraction and observation, that a purposeful resource-use involved the application of one or more sub-processes for better reclamation of natural resources. Broadly there were five sub-processes that could be applied singly or in combination with others depending upon the specific requirements of the local conditions. These are described below:

- Adoption of measures that enhanced the reclamation of the resource and at the same time prevented any wastage of the resource taking place;
- Adoption of techniques that allowed reclamation of a resource that had not been rendered useful until then;
- Organising systems that ensured the most appropriate uses for specific resources thereby optimizing their utility;
- Discovering more viable replacements/alternatives in place of rare and scarce resources; and
- Inventing methods and techniques that helped the reprocessing and reutilization of by-products or once wasted resource materials. The resource-use practices adopted by human societies were in different measures mediated by these sub-processes at different times. We shall study them in a historical sequence in the ensuing sub-sections.

4.2.1 Pre-agricultural

The most important natural resource put to a widespread use by the humans was stone. At a very early stage in the evolution of human societies the use of stone as a material for shaping some of the basic tools was discovered. We do not know the precise time when this discovery was made. But we now know with some certainty that the early tools crafted from the naturally available stone consisted of hand-axe and the cleaver (a tool used for breaking the grains), and various types of chopping tools. As stated by Allchins, "We still have very little general cultural information, as tools of this period have only rarely been found in caves in the Indian sub-continent, and almost never with the kind of occupation deposit which indicates regular habitation" (Bridget and Raymond Allchin, *The Birth of Indian Civilization*, England, 1968, p.53).

The main sites from where finds of early tool making stage have come are at Soan valley in Pakistan, Narmada valley in Central India (Adamgarh, Jabalpur and Maheshwar), Nevasa in Godawari valley in Maharashtra, Gundla-Brahmeshwaram area in Pennar valley in Tamil Nadu, and Attirampakkam and Gudiyam cave near Chennai in Tamil Nadu. It is evident that these sites are few and scattered far between. The main occupation of early stone tool societies was hunting animals and gathering fruits and seeds for food. The human groups using such tools were ably assisted by their implements in their occupation. The tools were of a crude nature but seemed to work well in the given situations. The types of stones used in making these tools were mainly sandstones, quartzites and shales. Regional variations are noticeable both in the incidence of different varieties of stone tools and in the types of stones used in making these tools. The process through which the tools were made has been described by Allchins: "In order to make tools large flakes or pieces of quartzite had been removed from the parent rock. It was not always clear whether this had been done by striking the rock with another stone – an operation which would require great strength – or by fire-setting, that is lighting a fire against the rock and so causing large pieces to breakaway from the main body. Perhaps both methods were used. Some tools, usually cleavers, can be seen to have been made from flakes which had been struck off larger blocks of raw material (no.3 & 4 in the figure given here). But in the case of many tools all traces of a primary flake surface or a bulb of percussion, if they were ever there, have been lost in the removal of further flakes, in the process of giving the tool its final form" (Bridget & Raymond Allchin, *op.cit*, pp.63-4). In the early stone tool manufacture the chief resource-used was quartzite. It seems where quartzite was not available in good supply, other varieties of rocks were used. It is also evident from the process described above that reprocessing and reutilization of wasted resource was a common sub-process employed in tool making. The flakes, which were the by-products of the manufacture of core tools, were utilized on a large scale. In the subsequent stages of stone tool making the flakes were used as the main objective of the tool makers and they became the intrinsic part of stone tool manufactures. This stage, obviously, focused on tools that were smaller in size and therefore used mainly rocks called crypto-crystalline silica, commonly called agate and jasper or chalcedony. Stones of this type give flakes of smoother surface. One of the main sources of this stone was the river pebbles. We could now relate the sites of stone tool making settlements as being located in river valleys. An important point for our consideration relates to the manufacturing process of these tools. According to one particular view the flakes from pebbles could only be obtained by using a wooden hammer, in which case the resource-use practice seems to undergo a definite shift as it employs a combination of materials.

The flake using stage of stone tool making was followed by the microlithic tradition. Here the tools were mainly made of blades of stones. These blades were parallel-sided and were prepared from cores. They were attached to wooden pieces in different combinations to make a variety of tools. The shapes of these blades leave little doubt that they were made by chiselling the core stones with the help of a bone or hard wooden point struck with a hammer. Clearly, at this stage the human societies had become conversant with the use of natural resources other than rocks or stones. This other natural resource was wood and it had begun to be used for more purposes than merely for fuel. The sites using microlithic devices were no more confined to a few places or regions. A wider dispersal of this tradition had taken place as microliths were also found from eastern parts and deep south.

4.2.2 Agricultural

The beginning of settled agriculture marks a significant phase in resource-use practice. There is a clear shift in favour of soil as a natural resource and the use of stone for making tools also undergoes a change with much greater variety coming into vogue. In the early stages of agriculture plots of land were cleared of all vegetation and the seeds sown to grow the crops. Since an optimum deposit of soil was necessary for growing the crop on plots of land, agriculture had begun to get localized. Areas where fresh deposits of soil would come periodically either as silts from floods or from decayed matter were obviously preferred. A new resource-use practice in the form of tending the soil now became known to human societies. This was also the beginning of a revolutionary change in the use of natural resources by humans as road to boundless growth had begun to be traversed.

The early evidence of agriculture on the Indian sub-continent comes from Baluchistan. The settlements are small in size and seem to focus on areas where good cultivable soil was richly available. This soil was periodically replenished by the floods in the two main rivers, Loralai and Zhob and the valleys of these rivers were thus available as fertile grounds for practicing agriculture. The beginning of settled life soon resulted in the adoption of the practice of domesticating animals. As a resource the animals could now be reared and used for a variety of purposes in addition to their being a source of food. We have evidence of the domestication of sheep, goats and oxen in the early period of agricultural development. Dog, it may be noted, had already been domesticated. In a subsequent phase we get the additional evidence of the domestication of ass. Clearly plants, grown from seeds periodically on fixed areas and domesticated cattle became the two main natural resources that were now widely used by human societies. From wandering habits of man hunting and gathering food for sustenance there was now a change as fixed settlements of human populations had taken precedence. Man’s dependence on stone tools of the earlier period also underwent a change as the new requirements necessitated the development of smaller tools that were more versatile in their use. The agricultural sites yield tools made of blades of chert, jasper or chalcedony, rubbing or grinding stones, lunates, bone awls (small pointed tool for pricking) spatulas (instrument having broad blades, used for picking up powder etc.) and beads in steatite, lapis-lazuli and frit.

In addition pottery also begins to appear from this period onwards. This pottery was both handmade and wheel-made and was decorated with painted designs. Materials other than stones, such as bones, clay and sand were now used by the man. The realm of resource-use practice got widened and simultaneously, with the growth of a more complex structure of human societies, greater variety of natural resources began to be used by these societies.

The early practice of agriculture opened several new possibilities. Permanent settlements helped develop community life and broadened the areas in which humans could meaningfully engage. In fact the change from hunting-gathering activities, which had occupied the major portion of time, to settled agriculture was a quantum shift. The near assured availability of food supplies gave man time to employ in other activities. Rapid advances were made as semi-permanent dwellings were made, spinning and weaving was practiced and crops were sown, tended to, and harvested and grain consumed as also stored as seeds for the new season agricultural operation. The stage was set for the rise of civilization.

The necessity to expand the agricultural area along the alluvial deposits in river valleys opened the flood plains of such large rivers as the Indus and its tributaries for the civilization to germinate and flourish. In places like Harappa, Mohenjodaro, Dholavira and Lothal large centres of civilization developed. These centres were all urban in character and almost solely dependent for their agricultural supply on the seasonal alluvial deposits of the rivers along which they had grown. They had, however, developed several new resource-use practices. Use of bricks in making houses was a remarkable feature. The bricks were of two types – burnt and mud-bricks. A whole new variety of crops were now grown which included wheat and barley, leguminous plants, field peas and dates. Oil seeds had also become known as there is evidence of the use of sessamum and mustard. In addition to the domestic cattle we have evidence of keeping the domestic fowl. Cotton was also grown and there is evidence of woven cotton cloth. Another remarkable change had occurred in the area of tool making. Early use of metals is most clearly evident. A range of tools made of copper and bronze have been found from the excavated sites. Along with the blades of stone the metal tools seem to have equipped human groups with much greater competence in reclaiming natural resources. We also have evidence that subsidiary tools had been developed such that good skills in craft work could now be achieved. The use of a very thin drill to perforate tiny beads, as seen in Lothal, is a good illustration of craft skills. The seals from the Harappan sites are also of great interest to us. The seals are available in such plenty that seal-making appears to have become an important craft. According to Allchins, “The seals were sawn from blocks of steatite and cut as intaglios, then toasted in a small furnace to harden and glaze the surface. Their importance was doubtless linked in some way with their role in trading activities, but for the modern observer of even greater interest are the short inscriptions in the unknown Harappan script and the subjects of the intaglio, many representing scenes of a cultural or religious character” (Bridget & Raymond Allchin, *op.cit.*, p 135).

The early, copper and bronze using, civilization, that had held a sway mainly over the north-western and western region of the Indian sub-continent declined by about 1500 B.C. No single cause responsible for this decline has been clearly established. We however speculate that a combination of factors may have been responsible. In this the cause suggesting a change in the environmental conditions of the region definitely interests us. Gregory L. Possehl says: “There was an abandonment, or severe depopulation, of a number of important Indus settlements …. There was also a disruption in Indus economy. The production of a wide range of special materials, … was curtailed …. The art of writing was no longer practiced. Long-distance trade was reduced… (*The Indus Civilization, A Contemporary Perspective*, Vistaar edn., New Delhi, 2002, p.237). A steady deterioration in the climate and environment of the region is often cited as one of the important reasons for the above to happen.

4.2.3 Iron Age

The decline of copper-bronze civilizations and the emergence of iron using human societies should not be necessarily linked sequentially. Significant from the point of view of resource-use practice is the fact that the knowledge of the use of iron almost dramatically changed the scenario of the use of natural resources by human societies. Perhaps the foremost change was effected in agricultural practices. What had, in the earlier period, remained a river-bank bound agriculture was now transformed into open-field based agriculture. We had noted in the preceding section that soil as a resource had been successfully used by human societies in the early stages of the growth of agriculture. But at that time a natural restriction had limited the growth of agriculture – in the absence of a hard material to over turn crusty upper surface of virgin soil only soft alluvial soil could be used for agriculture. Since regular alluvial deposits were mainly a feature of the rivers in semi-arid & north-western and western India, most of the agriculture of that period was spread along river valleys in these regions. The introduction of iron, especially in the plough share, provided man a fresh and new opportunity to work on virgin areas. Consequently agriculture spread in totally new region which afforded irrigation facilities – this region was the Ganga-Yamuna doab. Soon it expanded eastwards and from there to other areas of the country. In the subsequent historical development of human societies in India agriculture mostly remained the principal natural resource and the patterns of its use often determined the course of further developments.

We have in the form of Vedic literature a very rich source providing information on resource-use practices of contemporary societies. It tells us that the range of crops grown had expanded considerably as it included wheat, barley, millet and rice. These crops were grown on newly cleared lands reclaimed from the forests in the plains of Ganga and Yamuna. Such large scale clearance had become possible due to the use of iron. The other metal resources that had become known were tin and lead. Cattle-keeping had been practiced regularly. The pottery was pre-dominantly "wheel-thrown" and a "remarkable degree of standardization" was also achieved (Bridget & Raymond Allchin, *op.cit.*, p.212). The society had become fairly complex and a set of defined code had emerged as the regulating principles of social interaction and conduct. The significance of iron as a resource had remained undiminished and greater possibilities of growth had become associated with the varied use of iron.

4.3 SUMMARY

The resource-use practices discussed above make it dear that for a very long time the general perception of the human societies regarding natural resources was that their reserve in nature was limitless and therefore reclamation of natural resources could be practiced without any serious consideration for their conservation. In fairness to the pre-modern societies, however, it should be said that their resource-use practices were generally not geared at methods of reckless consumption. Irreparable damages were avoided and the general human impact on the ecology and environment was not one of destruction of natural habitats. The resource-use practices clearly show an interrelationship between the nature of resource-use and the form of human societies. We shall study more details of this process in Blocks 3 & 4.

4.4 EXERCISES

1) What do you understand by the terms 'renewable' and 'non-renewable' resources? Discuss.

2) Examine the main resource-use practices during the pre-agricultural period.

3) What major changes were experienced by human societies in India as a result of the use of iron? Elaborate.

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UNIT 5 HUNTING-GATHERING

Structure

5.0 INTRODUCTION

Hunting-Gathering is generally considered that earliest stage in the social evolution of human groups for which evidence for organized community life appears with a regularity. The bulk of this evidence is archaeological in nature and it is supplemented by anthropological data. Records of the any other kind, with the exception of painted depictions of community life, are not available. The archaeological evidence, it must be said, is rich and is quite useful in reconstructing an account of the hunting-gathering stage of society. The archaeological method accounts for both ethnographic connotation and technological context and thus helps us understand the features of hunting-gathering stage in a fairly detailed manner. We plan to initially examine the nature of evidence and subsequently use this evidence to reconstruct, as far as helped by the evidence, the characteristics of hunting-gathering societies. It is our intent to simultaneously understand the eco-environmental context in which hunting-gathering societies emerged and flourished. We also aim at trying to understand regional variations among hunter-gatherers and the subsistence pattern of regional groups among the hunting-gathering societies.

It is an interesting feature that the time span occupied by the hunting-gathering societies is overwhelmingly long as compared with minuscule span shared by all the subsequent stages of social evolution. During the hunting-gathering stage the human groups were totally dependent on natural resources for their sustenance as they did not possess any knowledge of agriculture with the help of which they could have grown their food. Hunter-gatherers collected their food from the natural surroundings in which they lived. This food consisted of fruits, edible roots, forest produce such as honey and berries, and at places fish and birds. In addition they also hunted animals for meat.

This complete dependence of hunting-gathering societies on resources obtainable naturally from their environment during the major part of human existence has curious implications. It means that the way they acquired their food determined the attitude of hunter-gatherer communities to their environment. Again, since these communities lived in groups and were not necessarily homogenous, considerable differences in traditional attitudes and practices appear to have existed. Another significant feature of the early human groups on the Indian subcontinent is that distinct social stages at different levels of cultural and technological development have often co-existed and survived for a long time. Thus hunter-gatherers, nomadic pastoralists, shifting cultivators and even settled agriculturists have survived in self-contained co-existence. There have been some regional variations which are a result of divergent climatic and environmental conditions. Even with regional variations these communities have survived as self-contained social groups. As a matter of fact this kind of interchange with environment has attributed a peculiar character to South Asian life - styles.

5.1 NATURE OF EVIDENCE

The most plentiful material remains connected with hunting-gathering communities are stone tools and implements. In fact the other material, if any, might have been of perishable type and therefore has not survived. Stone being a hard imperishable substance has succeeded against all natural odds and has revealed to us the information on hunter-gatherers. This principal evidence is ably supplemented by the pictorial depictions made by hunting-gathering communities of later periods. These have survived on the walls, ceilings etc. of the cave shelters that were seemingly used by these communities. No other records pertaining to them have survived and we have to bank almost solely on the surviving assemblages of stone implements and tools for reconstructing the living patterns of hunting-gathering communities. In this task we are greatly helped by the methods, techniques and reconstructive devices developed by the archaeologists and the anthropologists, though this also entails some limiting possibilities.

The bulk of the evidence relates to stone tools and implements which were crafted by the contemporary people for their use. These tools were made of selectively chosen stone material. They were also crafted with a definite purpose and with an economy of effort and material both. The assemblages of these stone tools survive at specific locations which conform to one or more requirements of their manufacture. Besides the availability of suitable material, the other considerations were perhaps an abundant supply of water and food. The archaeologists unearth this material evidence and relate it with the cultural context of its assemblage so that the seemingly mute stone tools assume a vibrant character. This makes it possible to reconstruct the main contours of contemporary societies, that is the life-styles of the hunting-gathering communities. In the process we are further helped by the pictorial depictions made by the hunting-gathering people as they give us an idea about the economy and society of the pre-historic people. These pictures which apparently are visual expressions of the occurrences in the life of contemporary communities, on a detailed scrutiny communicate for more intense tidings. Together they – the material evidence of stone tools and implements and the rock art – help us recreate the ambience of hunting-gathering communities in much sharper focus than ever before.

The emergence of the stone age is generally attributed to the Pleistocene period – that began at about 1.8 million years ago. We would have been lucky to possess material remains in a state of pristine preservation from such a remote past. But that was not to be. This remoteness has in fact been a disadvantage as environmental changes during the in between period have disturbed the context of the stone tool assemblages. Our evidence on stone tools and implements has therefore to be weighed carefully for its value in reconstructing the social life of the contemporary humans. V.N. Misra suggests: "Because of the length of time involved and the changes in landscape and climate, most of the early (Pleistocence) sites have been either obliterated or disturbed by natural and human agencies. Also, the contemporary biological material which could tell us about subsistence, ecology, technology, structures, etc. has in most cases not been preserved. What has survived is a plentitude of stone tools, often dislocated from their original context, and buried in secondary deposits. Such archaeological material has very limited value for cultural, ecological and chronological reconstruction, though there are some relatively undisturbed surface sites which could be usefully exploited for palaeoecological reconstruction using the present as a key to the past. From the beginning of the Holocene the preservation of both sites and biological material is better. But, in the final analysis, precise information for cultural and ecological reconstruction can come only from excavated primary archaeological sites. The number of such sites is, however, as yet very small. The cultural and ecological reconstruction of early hunter-gatherer societies which follows has therefore to be seen against the background of these limitations" ('Stone Age India: An Ecological Perspective' in *Man and Environment*, XIV(I), 1989, p.17).

The stone tool assemblage pertaining to the hunting-gathering communities have been classified by the archaeologists as belonging to two major stages of evolution – the Palaeolithic stage and the Mesolithic stage, based on a set of noticeable differences between the two. Since stone tools and implements are the principal evidence providing leads into the social structures of hunting-gathering communities, the evolutionary features discernible from these differences are of great value. They may help us understand, at least, the outer contours of hunting-gathering societies and their interchange with their environments.

The Palaeolithic stage relates to the early period of the use of stone tools by human groups. Even here the manufacture and use of stone tools has not been a static process. Significant evolutionary changes are quite visible within the stage. As stated by Allchins, "the Palaeolithic industries of the Pleistocene can be divided into three major groups, on the basis of the shape, size and methods of manufacture of the principal artifact types. The Lower Palaeolithic is characterized by hand axes, cleavers, chopping tools, and related artifact forms. Middle Palaeolithic industries are characterized by smaller, lighter tools based upon flakes struck from cores, which in some cases are carefully shaped and prepared in advance, the Upper Palaeolithic by yet lighter artifacts, and parallel-sided blades and burins".(Bridget and Raymond Allchin, *The Rise of Civilization in India and Pakistan*, CUP, Great Britain, 1982, p.33). It is clear that the sequential order of the three sub-stages indicates a continuous process of technological development which must have adjusted with the contemporary environmental setting.

The Mesolithic stage appears after the end of the Upper Palaeolithic period. It is generally considered as a transitional phase between the Palaeolithic period and the beginning of agriculture during the Neolithic period. There was rise in temperature and the climate became warm and dry. The climatic changes affected human life and brought about changes in fauna and flora. The technology of producing tools also underwent change and the stone tools of microlithic variety were used. "A progressive change and development in the stone industry towards smaller, more delicately made and varied artifact types" was distinctly noticeable, (Bridget & Raymond Allchin, *op.cit.*, p.79). Man was still in the hunting-gathering stage but there was a shift in the pattern of hunting from big game to small game hunting and fishing and fowling also began to be practiced. These material and ecological changes are also reflected in rock paintings.

5.2 GEOGRAPHICAL SPREAD

At present the general agreement among the archaeologists and anthropologists is that the early emergence of man in India belongs to the Lower Palaeolithic stage. The geographical expanse in which the stone tools belonging to this stage have been found runs over the entire country except a few areas. The region of its spread is mainly covered by the Siwalik hills in north-west India and Pakistan and upto Chennai in the South. The area from where stone tools of the Lower Palaeolithic stage have not been found mainly consists of Western Ghats and the adjoining coastal region, north-east India, and the plains of the river Ganga.

On the basis of their typology, the stone tools and implements of the Lower Palaeolithic stage have been classified into two technological traditions – the Sohanian and the Acheulian. The Sohanian tools mainly consist of choppers, flakes and cores and the Acheulian tools mainly consist of cleavers, hand-axes, scrapers and blades. This difference is notable since it indicates a difference in the eco-environmental settings of the two traditions. Likewise the absence of Lower Palaeolithic tools from a few regions, as indicated above, also suggests a peculiar environmental setting not conducive for the growth of this stage.

The Sohanian tools were first reported from the Sohan river which is a tributary of the Indus. "The faunal remains from this deposit included the horse, buffalo, straight-tusked elephant and hippopotamus, suggesting an environment characterized by perennial water sources, tree vegetation and grass steppes," (V.N. Misra, *op.cit*. p.18). The Acheulian tools have been found so extensively that it is suggested that the "first effective colonization of the country was achieved by the makers of the Acheulian culture." The hunter-gatherer populations practicing this tradition were adapted to a wide variety of ecozones. These zones ranged from semi-arid western Rajasthan, Saurashtra and Gujarat alluvial plain to sub-humid dry as well as the moist deciduous woodland zones of Central India, the Deccan Plateau, Chhota Nagpur plateau and the Eastern Ghats and the south-east coast (Cf. V.N. Misra, *op.cit*, p.19).

There is a particularly dense and rich concentration of the sites of this tradition in central India and in the southern part of the Eastern Ghats. The reason for this concentration seems to be a favourable environment – adequate rainfall giving rise to good vegetation cover which in turn sustained a rich variety of wild animals. This also explains the absence of Acheulian sites from Western Ghats, north-east India and the Ganga plains. In the Western Ghats and north-east India perhaps heavy rainfall resulted in the growth of such dense vegetation that human settlements became difficult. The absence from Ganga plains is explained by the paucity of stone as raw material for making tools and implements.

The next major change was the emergence of the Middle Palaeolithic stage. The hunter-gatherers of this stage occupied largely the same regions and the same habitats as occupied by the Achculian tradition. The only regions which showed sparse occupation were western Rajasthan and the Mewar region and Gujarat plain. Most of the "Middle Palaeolithic occupations occurred at open-air sites along perennial as well as seasonal streams, along hill slopes and on stable dune surface… and in rock shelters as in Central India." (V.N. Misra, *op.cit*., p.21).

At about 10,000 years from now the Upper Palaeolithic stage appeared accompanied with arid climate and sparse vegetation and animal life. This restricted the food resources of hunters-gatherers and with that the population might also have fallen. There is a noticeable sparsity of sites in Rajasthan and Gujarat as also in Central India. Only in the Eastern Ghats do we notice more extensive occupations. Some of the sites in this area are exceptionally large covering nearly five acres and yielding an assemblage that runs in thousands.

The Mesolithic hunting-gathering communities are generally considered the last of the group, a successor of the Upper Palaeolithic stage and the predecessor and sometimes a coexisting community with the agriculturists. The Mesolithic sites far out number all the other sites of the preceding periods. The density of these sites, it may be noted, also increases greatly.

The main areas occupied by Mesolithic people covered the arid and semi-arid plains of western Rajasthan and north Gujarat, the rocky Mewar plateau, hills and forests in central India and Orissa, the Chhota Nagpur plateau and Deccan plateau, the Mumbai coast and Telengana plateau and Eastern Ghats. Some of those territories are also occupied by Mesolithic people that had remained uninhabited in the previous periods. These included the Ganga valley, Damodar valley, the Kerala coast and the Southern Tamil Nadu coast. The forest-covered alluvial plains of the Ganga valley were effectively colonized by the Mesolithic pioneers. Nearly 200 sites of this period have been located in the south central part of the valley in Allahabad, Pratapgarh, Jaunpur, Mirzapur and Varanasi districts. (Cf. G.R. Sharma, V.D. Misra, D. Mandal, B.B. Misra and J.H. Pal, *Beginnings of Agriculture: Excavations at Chopani – Mando, Mahadaha and Mehagara*, Allahabad, 1980.)

The diversity in occupation available from this period has been aptly described by V.N. Misra: "Mesolithic communities exploited a greater variety of habitats than their predecessors. In the Gujarat plains they settled on sand dunes on the shores of interdunal lakes and in the Mewar plain on elevated rocky ground as well as on river bank dunes. In the woodland zones of the Vindhyas and the Kaimur Range they occupied caves and rock shelters as well as open-air locations. The limestone caves in the Kurnool district of Andhra Pradesh were also occupied during this period. In the wooded ecosystems of the interior Peninsula there are numerous sites right in the habitat of the shifting cultivators of the present day. Along the west coast, near Bombay, the Mesolithic groups settled on the tops of hills and rock outcrops near the sea coast. Near the tip of the Peninsula, on the east coast, there are occupations on coastal sand dunes (*Teris*). These coastal occupations are suggestive of marine food exploitation. Likewise, the occupations on the shores of ox-bow lakes in the Ganga valley (e.g. Sarai Nahar Rai, Mahadaha and Damdama), those close to water falls in the Telangana plateau (e.g. Gauri Gundam and Pochara), around Chitrakot Falls in Bastar, and in the riverine niches of the Eastern Ghats indicate considerable dependence on aquatic food resources," (V.N. Misra, *op.cit*., p.25).

5.3 CHARACTERISTICS

The popular perception that hunting-gathering communities lived a primitive life closer to barbaric behaviour is a far-fetched imagination. Based on the stone tool assemblages, the sites of their find, and the pictorial depictions available at rock shelters it is possible to deduce important details. Some of the characteristic features that emerge from this indicate that hunters-gatherers lived a social life that was composed of family, local groups and wider social ties beyond the immediate family/ local group. The stone tools and implements associated with them strongly suggest that the more notable ones came from large factory sites, each of which would have catered to a large area, and as suggested by Allchins, "perhaps also been used by communities of many different kinds and sizes." Further, "The means of distribution of this high quality raw material must have been either through many people visiting the site or by those living near it having a system of exchange with people from other groups. There are examples of trade or exchange from many early settlements, which overlap in time with Mesolithic communities" (Bridget & Raymond Allchin, *op.cit.*, pp. 62-3).

The information on stone tool assemblages and the pictorial depictions at rock shelters collated together present an interesting scenario. Alchins say that "dancing scenes in the caves of Central India depict gatherings which must have included quite a number of families or bands. Occasions such as these are known to have provided hunter-gatherers in many parts of the world, including groups in Central India, South African Bushmen and the Australian Aborigines, with the means of exchanging objects of interest and value, and also of strengthening wider social ties, beyond the immediate family or local group. Therefore it seems highly probably that they did so in the case of the Stone Age inhabitants of many parts of India. Such gatherings would also facilitate the passing on of stone working and other techniques" (Bridget & Raymond Allchin, *op.cit.*, pp. 63).

Accounting for different stages of stone tool manufacture we find that the quality of stone tools and implements evolved with each succeeding stage coming into existence and along with this the interchange between hunting-gathering communities and their environments also got altered. The stone tools of the Palaeolithic period were used for different functions which besides hunting and butchering also included shattering and breaking open bones for taking out the marrow. These tools were also used for digging the roots and tubers and in some cases for making other tools. In the succeeding periods the heavy tools of the core-variety such as choppers gradually went into oblivion. Their place was taken by tools mainly made of flakes and blades. Several kinds of scrapers, points and borers now came into vogue. The sites now preferred places which provided quartz and basalt as the basic raw material. Clearly, many of these tools were used for making spears with the help of which the animals could be hunted from a distance. Pictorial depictions on the rocks clearly give scenes where animals were killed with the help of several spears thrown by the hunters-gatherers, from distance without making a direct physical contact.

The microlithic stone tools suggest a distinctly changed behaviour. The hunting was now undertaken with the help of devices that were the proto-types of traps, snares, nets. It is suggested by V.N. Misra that the hunter-gatherers of this period also used the gum of several species of Acacia, lacquer from the nests of tree ants, and a kind of milky juice which hardened on exposure to air into a black catechu–like substance for hafting purposes. Similarly, various strands of thin cords were made into a net for fishing (V.N. Misra, *op.cit.*, p.24).

The characteristics of the Mesolithic hunting-gathering communities are vivdly presented in the pictorial depictions in caves and rock shelters in the Vindhya Region and Kaimur Hills. "The hunting scenes at Bhimbetka and other caves and rock shelters show the hunt of a variety of game with spears, bows and arrows, all tipped and barbed with microliths, hunters chasing (in one scene there are 80 individuals in the expedition) and cornering the game; shooting arrows at the prey; transporting the kill (to the home base); butchering; fishing by using net traps (26 varieties of fish have been recorded in the rock painting); and trapping of small game, birds, rats and turtles (See Nos. 526). Women are shown participating in cornering the game. Other food gathering activities shown in the paintings are collection of fruits, women carrying baskets full of fruits; honey collection; and using rubbers and querns.(V.N.Misra, *op.cit.*,p.26).

Another significant feature connected with this stage relates to the evidence on the mode of the disposal of dead. The practice of burying their dead appears in the archaeological record for the first time from the Mesolithic stage.

5.4 REGIONAL VARIATIONS

The discussion given above must have made it clear to you that the hunting-gathering communities existing during the Palaeolithic and Mesolithic stages were by no means homogenous communities sharing in common all the characteristics. The surviving evidence, in fact, makes a strong case for considerable regional variations among them mediated largely by the interchange between the hunting-gathering communities and their specific environmental settings. In this section we shall examine this interchange and shall make an attempt to delineate the consequent regional variations.

In the Lower Palaeolithic stage we have already noted the existence of two different strands of hunter-gatherers – the Sohanian and the Acheulian, and their different environmental setting. While Sohanians remained located in the valleys of the Himalayan flank, the Acheulians adapted to a wide variety of ecozones and within these broad zones occupied microhabitats that show quite a diversity. The camping sites of Acheulian hunter-gatherers were located:

- along lakes and pools in wide flood plains of shallow meandering streams;
- on stable dune surfaces and on extensively exposed gravel beds;
- in rock shelters in Central India;
- in the open, along perennial as well as seasonal streams; and
- on gravels in peninsular rivers.

Similarly the regional variations in Acheulian hunter-gatherers did also come about based on the raw material used for tool making. While quartz and quartzite were the most preferred material, use was also made of dyke basalt as in western Maharashtra and even limestone as in Karnataka and coarse grained granite as in northern Bundelkhand.

The middle Palaeolithic stage developed at a time when glaciations in high northern altitudes was taking place. This had given rise to conditions of strong aridity in regions bordering the cold northern altitudes.

Rajasthan, Mewar and Gujarat had come under the spell of aridity and therefore show sparsely located sites belonging to the hunter-gatherers. The valleys of central Indian rivers, Chambal, Narmada & Son along with their tributaries abound with camping sites of hunting-gathering communities.

Some notable changes in tool making technology also took place during the Middle Palaeolithic stage. The use of bifaces declined and flakes and blades took over. "These were made by the application of retouch, that is, by finely trimming the edges of parent flakes by the removal of tiny thin flakes or chips." (V.N. Misra, *op.cit*, p.21). The use of quartz and quartzite, and basalt was slowly shifted to include the use of chert and jasper and fine-grained siliceous rocks. An important point to remember here is that transport of raw material over long distances for tool making had come to be practiced even if in rudimentary form. The hunting-gathering communities regularly visited the sites of tool factories from where they collected finished tools.

The regional variation became more clearly discernible during the Upper Palaeolithic stage as they got associated with some significant environmental changes in the Indian sub-continent. A major part of Rajasthan suffered from the drying up of Himalayan drainage. Except for the north-western corner of the state between Jaisalmer and Ramgarh there developed sand deposits and sand dunes. Similar aridity engulfed the other northern and north-eastern areas. The green environment now survived in the peninsular India. There was thus a notable shift in the hunting-gathering communities' camping sites towards south. The main stone tools from this stage were scrapers, burins and retouched blade tools. From a site in Kurnool Caves an assemblage of bone tools have also been found. The ecosystems in South were rich in plant foods like fruits, nuts, bamboo shoots and grain and leafy vegetables and mushrooms. Another significant feature of these sites is that some of them yield evidence on fishing, both riverine and marine and the exploitation of other aquatic foods such as prawns, crabs, tortoises etc.

As we have seen in the earlier sections our understanding about Mesolithic stage is rich. The distribution of sites belonging to the hunting-gathering communities of this stage has been quite wide and a large number of these sites have also been investigated. The principal regional variants come from the Thar desert – Aravalli Hills area in north-west, and Gujarat – Central India, Ganga plain in Uttar Pradesh, and Karnataka and Tamil Nadu in peninsular India. We shall briefly discuss here the principal sites belonging to these regional variants.

Budha Pushkar and Bagor are two most important sites from the Rajasthan area. Budha Pushkar is a fresh water lake and has a unique distinction of supporting habitation beginning with the harbouring of a concentration of microlithic sites to the present day. Analysis of the finds indicates that the microlithic sites here were primarily living or camping sites. It also suggests an overlap with the subsequent semi-urban chalcolithic stage. Bagor site is to the east of the Aravalli hills situated on a dune

Lower Palaeolithic Sites in India

Middle Palaeolithic Sites in India

Upper Palaeolithic Sites in India

Mesolithic Sites in India

Rock painting from Jaora near Bhimbetka depicting a hunter with basket or carring net filled with different animals from the forest and river (After Neumayer 1983)

Morhana Pahar, Central India: rock painting of chariot ambushed by men on foot (After Bridget & Allchin, 1982)

Rock painting from Jaora near Bhimbetka depicting women engaged in catching rats (After Neumayer 1983)

on the bank of a seasonal tributary of Chambal. The key findings from this site are:

- a distinctive mincrolithic factory;
- human burials of the dead;
- evidence of huts with paved floors;
- evidence of domesticated sheep and goat, different species of deer, wild boar, jackal, rat, monitorizard, river turtle and fish;
- pottery and three copper arrow heads.

It is also suggested that over a period of time the hunting-gathering communities associated with this site shifted to crop based agriculture as their mode of living.

The Gujarat region site is at Langhnaj. It shows a cultural sequence similar to the Bagor site. The Central India sites are located on small hills and give evidence on the making of tools and implements and waste material left after finishing the tools. There are several larger sites which fit the size and features of factory sites. Perhaps these larger sites were serving the communities coming there from distant places.

The situation in the Ganga plain in Uttar Pradesh was different. An important site located at Sarai Nahar Rai appears to have been a site under occupation by communities that lived their permanently. It is suggested that such communities received their supplies of tools and implements from central India sites and had thus developed a pattern of relationships between two geographically different regions.

The peninsular sites in Raichur and Bellary districts of Karnataka yield interesting evidence. They seem to use raw material predominantly consisting of milky quartz. It is argued by Allchins that this was "in part due to the granite rocks underlying so much of the country, in which quartz veins and dykes are readily found. The jaspers and chalcedonies so common in the volcanic rocks farther north are in short supply, but they do occur in places and they are present in some river gravels. Both earlier and later peoples undoubtedly found these sources, but many of the southern microlithic assemblages are almost a hundred per cent quartz" (Bridget & Raymond Allchin, *op.cit*, p.86).

5.5 SUMMARY

The Pre-historic societies of hunter-gatherers are studied on the basis of archaeological remains with the help of anthropological theories. The Palaeolithic and Mesolithic ages represent the hunting-gathering stage of social evolution. The Palaeolithic Culture has three phases in terms of the nature of stone tools and changes in climate. The handaxes, cleavers, choppers and chopping tools are predominantly early Palaeolithic artifacts. The Middle Palaeolithic tools are mainly flakes. The Upper Palaeolithic Culture is characterized by burins and scrapers.

The Mesolithic age started around 8000 B.C. and the age is associated with changes in climatic conditions. There was further technological development reflected in the production of microliths and small stone tools. The Mesolithic tools are mainly the blade, core, point, triangle and lunate.

Faunal remains give us considerable idea about the subsistence pattern of palaeolithic and Mesolithic people. During the palaeolithic age people were primarily in the hunting and gathering stage. People seem to have hunted large and middle size mammals such as elephant, ox, nilgai, deer, wild boar and a variety of birds. At the same time they also exploited the plant foods like fruits, seeds etc. The hunting-gathering pattern continued during the Mesolithic age. Some animals like wild goat, fox etc. appeared during this time. From the Palaeolithic age to Mesolithic Age, there seems to have been a shift from big animal hunting to small animal hunting and fishing. The pre-historic paintings give us insight into the economic, social and cultural life of the people. By the time communities reached the peak stage of microlithic industry they developed their ecological knowledge base to make a transition from hunting-gathering mode to animal husbandry and settled agriculture, possible.

Budha Pushkar and Bagor are two most important sites from the Rajasthan area. Budha Pushkar is a fresh water lake and has a unique distinction of supporting habitation beginning with the harbouring of a concentration of microlithic sites to the present day. Analysis of the finds indicates that the microlithic sites here were primarily living or camping sites. It also suggests an overlap with the subsequent semi-urban chalcolithic stage. Bagor site is to the east of the Aravalli hills situated on a dune with changes in climatic conditions. There was further technological development reflected in the production of microliths and small stone tools. The Mesolithic tools are mainly the blade, core, point, triangle and lunate.

Faunal remains give us considerable idea about the subsistence pattern of palaeolithic and Mesolithic people. During the palaeolithic age people were primarily in the hunting and gathering stage. People seem to have hunted large and middle size mammals such as elephant, ox, nilgai, deer, wild boar and a variety of birds. At the same time they also exploited the plant foods like fruits, seeds etc. The hunting-gathering pattern continued during the Mesolithic age. Some animals like wild goat, fox etc. appeared during this time. From the Palaeolithic age to Mesolithic Age, there seems to have been a shift from big animal hunting to small animal hunting and fishing. The pre-historic paintings give us insight into the economic, social and cultural life of the people. By the time communities reached the peak stage of microlithic industry they developed their ecological knowledge base to make a transition from hunting-gathering mode to animal husbandry and settled agriculture, possible.

5.6 EXERCISES

1) Examine in detail the nature of evidence pertaining to hunting-gathering communities.

2) Carefully describe the geographical spread of hunting-gathering communities and the main stages of their expansion.

3) Write an essay on the characteristics of hunting-gathering communities and give an idea about any notable features found by you.

4) How do regional variations in the hunting-gathering sites relate with eco-environmental settings? Explain with the help of details provided in Section 5.4.

5.7 SUGGESTED READING

Bridget and Raymond Allchin, *The Rise of Civilization in India and Pakistani*, Great Britain, 1982.

V.N. Misra, 'Stone Age India: An Ecological Perspective' in *Man and Environment*, XIV(I), 1989, pp 17-64.

S. Settar, Ravi Korisettar ed. *Prehistory, Archaeology of South Asia*, Vol.I of *Indian Archaeology in Retrospect*, New Delhi, 2002.

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UNIT 6 NOMADIC PASTORALISM

Structure

6.0 INTRODUCTION

As we examine the history of the patterns of human settlement on the Indian subcontinent we are struck by an early stage among the human groups which directly relates with the nomadic ways of living. Since this stage is associated with the practice of pastoralism we generally call it nomadic pastoralism. The origins of this type of living, like the other early stages of human social formations, are covered with haze. We have to depend on the tools of archaeology and anthropology to be able to reconstruct the early phase of nomadic pastoralism, though the gaps in information are wide and the available evidence is mostly reticent.

The nomadism among these human groups was primarily determined by the pastoral requirements of wandering in search of suitable forage. Similarly the pastoralism among them was guided by the urge to have a regular supply of food – the animal meat undisturbed by the vagaries of weather. This conjuncture gave rise to nomadic pastoralism as a definitive stage in human societies coexisting with other social groups since their emergence. It is our attempt to piece-together available evidence, both archaeological and anthropological, pertaining to nomadic pastoral communities and present a coherent account of the interchange that worked between these communities and the environments in which they survived and became functional. This account, perforce, will be a sketchy narrative but that is the constraint which we cannot overcome at the present state of our knowledge about these communities.

6.1 EMERGENCE OF PASTORALISM

The early evidence on human groups and their habitats suggests that the animals found in the vicinity were hunted for food assisted by stone tools and implements employed in butchering and skinning besides of - course in hunting. Whenever the animal population in the area depleted, the group was obliged to move to locations which provided sufficient supply of animals again. The species of animals so hunted for food are not very clear. The fossil remains found from the Narmada region indicate six varieties viz. *Sus namadicus*, *Bos namadicus*, *Elephas hysudricus*, *Equus namadicus*, *Hexa-protodon namadicus*, and *Stegodon insignis-ganesa*. All of these species lived from the Middle Pleistocene age (about one million years before the present). Similarly fossil find at Pravara river (a tributary of Godavari) yields evidence on *Bos namadicus*, *Equus namadicus* and *Elephas namadicus*. These species can be roughly equated with varieties of wild ox, horse and elephant which later became the domesticated species. The hunting human groups often got their animals from the same herd where the concentrated mostly on larger members of the herd. In this process sometimes the young members of the herd were captured alive and kept in cages. This practice seemed to have germinated the idea of taming animals and from here would have originated the practice of pastoralism.

Definitive and direct evidence on the origins of pastoralism is not available. We can only be speculative and reconstruct the situation based on reasoned imagination. It seems the hunting-gathering communities had begun to focus or some species of large animals for diet fairly early and in this process wild sheep and goats were intensively hunted. In this act younger members and female members in the reproductive category were spared so that this source of food would not dry up. The chance capture of a few younger animals and the experience gained in taming them suggested a completely new way of leading life - through assured supply of animal food. This would also have given rise to an increased element of dependence – in fact mutual dependence between humans and animals.

It has been suggested that three main factors in the life style of hunter-gatherers would have helped domestication of animals to begin as a regular practice. These were:

- the movement of the animal populations becoming constrained/ restricted due to several environmental factors, thus increasing the possibility of their capture and confinement by human groups;
- possibilities of breeding the animals under conditions of captivity, thus helping human groups maintain some optimum population for use for dietary purposes regularly;
- control of the feeding of the animals in captivity to improve their breeding and stock. (Cf. Richard H. Meadows, 'Osteological Evidence for the Process of animal Domestication' in *The Walking Larder*, ed. Juliet Clutton-Brock, London, 1989 as used by Brian M. Fagan, *People of the Earth, An Introduction to World Prehistory*, First Indian Reprint, 2004, p.226).

The archaeological evidence for early domestication of animals is both rare and fragmentary. Mostly it is not possible to clearly distinguish between the bones of wild and domesticated animals. The process of domestication was quite prolonged and the earliest evidence on domestication, relates to dog but that surely was not for food. By general agreement it is now believed that sheep and goats were the early species that were domesticated for dietary purposes. An important factor that would have played a significant role in domesticating animals was the behaviour of the animals. As suggested by Andrew Smith (*Pastoralism in Africa, Johannesburg, 1992*) 'the first domesticated animals came from better-disciplined wild herds in arid environments, where it was easier to control the movements of animals' (Cf. Brian M. Fagan, *op.cit*, p.227). Some animals, because of their behavioural habits, were very difficult to domesticate. The sheep and goat are comparatively small animals and had good herd habits. It may therefore have been easy to keep them under captivity, the habits of living in herds helping the captured flocks take to conditions of captivity. Continued contact with humans who tended them in captivity also resulted, over a period of time, in the growth of a 'symbiotic relationship with people' as suggested by Brian M. Fagan (*op.cit*). Once breeding in captivity started it was easier to slaughter surplus males for food. This breeding in captivity also helped humans discover their utility for milk purposes and such by-products as skins for clothes and tents and leather for other purposes.

Availability of grasslands for herds to use as pastures has also been suggested as a factor of great significance in the emergence of pastoralism. The following detailed passages by W.A. Rodgers ('Environmental Change and the Evolution of Pastoralism in South Asia: A Discussion', *Studies in History*, Vol. 7, No.2, n.s., 1991, pp. 199-200) illustrate this point clearly: "Many of the species of pastoralist livestock originated in South Asia such as zebu and taurus cattle, buffalo, camel, sheep and goats. They would have been hunted for meat and other products (hides, bones) along with other species. Their typical diurnal and herding habits would have made hunting relatively easy. As most of these species prefer open, well-watered country, it is likely that they were a resource important enough to defend from other groups of people. This would have led to some form of territorial ownership.

Much has been said about India's lack of grasslands. There are climatic and edaphic grasslands, at extremes of cold and aridity or shallow soil or deep waterlogging. Basically any habitat which will not support trees or shrubs becomes a grassland. These grasslands have supported distinct large grazing herbivore communities, with several endemic species. But these are still a small proportion of India's land surface, most of which supports a wooded vegetation, forest woodland, or shrubland.

The presence of a tree layer does not eliminate grasses; there can still be a significant grass cover under the trees. Whilst traditionally one associates African pastoralism with grasslands, the Massai of East Africa being a prime example, not all pastoralist livestock populations browse as do sheep and cattle in Indian conditions.

The severe nine month dry season typical of the Deccan and Western Ghats in peninsular India cannot produce a grass cover of sufficient palatability to maintain medium size herbivores. Browse becomes an essential part of the diet. Browse consists of palatable herbs, often legumes, shrubs such as ber (*Zizyphus* species), and fallen tree litter. These browse components, and grass standing crop, are more abundant in open wooded communities than under closed forest. The dense moist deciduous forests have little fodder at ground and shrub layer levels, and their carrying capacity for terrestrial mammals is low compared to open thorn bush and dry deciduous communities.

It is perfectly feasible, therefore, to imagine pastoralist people in India's forests. We see this today with the Jammuwalla buffalo herders in the once dense Shivalik and Himalaya forests, depending on lopping tree leaf; and in drier Aravalli and Saurashtra hill forests, with distinct Gujjar communities lopping trees and shrubs for mixed cattle and buffalo herds."

It has been suggested by Brian M. Fagan that the beginning of the practice of domestication had a far-reaching impact from the eco-environmental perspective. "Domestication implies a genetic selection emphasizing special features of continuing use to the domesticator. Wild sheep have no wool, wild cows produce milk only for their offspring, and undomesticated chickens do not lay surplus eggs. Changes in wool bearing, lactation or egg production could be achieved by isolating wild populations for selective breeding under human care. Isolating species from a larger gene pool produced domestic sheep with thick, woolly coats and domestic goats providing regular supplies of milk, which formed a staple in the diet of many human populations" (*op.cit*, pp.225-6).

In India the most clear evidence on the domestication of animals comes from the site located at Adamgarh hill in the Narmada valley. The site is in fact a rock shelter that contains stone tools and other remains from the Mesolithic stage. A thick layer of black soil varying in depth from 50 to 150 centimetres contains microlithic tools, animal bones and pottery. "The animal bones found in the excavation include the domestic dog (*Canis familiaris)*, Indian humped cattle (*Bos indicus*), water buffalo (*Bubalus bubalis*), goat (*Capra hircus aegagrus*), domestic sheep (*Ovis orientalis vignei* Blyth race *domesticus*), pig (*Sus scrofa cristatus*). There are also remains of a number of species of wild animals. These are Sambar, Barasingha and Spotted deer, hare, porcupine and monitor lizard. Wild and domestic animals are represented in approximately equal proportions, and a few of the bones of cattle, pig and spotted deer are charred" (after R.V. Joshi as described by Bridget & Raymond Allchin, *The Birth of Indian Civilization,* Penguin, 1968, p.83).

Another very interesting evidence, that comes from the pictorial depictions made on rock shelters, relates to the use of domesticated horses for hauling wheeled vehicles. There are a group of rock shelters known as Morhana Pahar group located close to Mirzapur in Uttar Pradesh. The drawings on one of the walls show two spoke-wheel chariots. One chariot is shown as drawn by two horses and another by four horses. There is a group of men having bows and arrows and spears and trying to stop the chariots. The site has yielded microlithic tools.

6.2 PASTORALISM AND NOMADIC COMMUNITIES

We have discussed above the genesis of the practice of pastoralism at some length and have seen how animals were tamed and reared by some hunting-gathering communities. We shall now make an attempt to understand why certain human groups adopted pastoralism as their life-style and became nomads. This questions assumes greater significance in view of the fact that animal keeping was also a very common practice followed by settled agriculturists who had adopted a mode of living in which pastoralism was given an ancillary status.

A convenient starting point for understanding the factors that may have given rise to nomadism among pastoralists as against a properly settled mode of living among agriculturists is to draw a comparison between the two modes of sustenance. The pastoralists and the agriculturists depend on land and water resources for their sustenance. The agriculturists utilize the productivity of the land for raising crops periodically with the help of irrigating potential of nearby water sources. The pastoralists too utilize the productivity of the land but depend on nature to replenish the consumed resource. The herds of animals kept by them use the resources of land as pastures for grazing purposes but pastoralists do not resort to any adopted measures for rejuvenating the forage on fixed areas of land. In the like manner the water resources are directly used without any focused effort to manipulate them. Thus the sedentism required for manipulating land by the agriculturists is not needed in the case of pastoralists. The constant requirement of additional pasture land for the herds maintained by pastoralists makes it an imperative on them to be always moving, in search of new pasture areas from one place to another. This gives rise to nomadism and early pastoral practices tend to get associated with nomadic communities.

The nomadic pastoralists kept animal herds as their resource base and depending upon the size of regularly available pasturage maintained the size of their herds. The pastoral economy was more individualistic than agricultural economy. The major community issue among nomadic pastoralists might have been the management of pastures invoking strict regulations about their use with respect to the periodicity of usage and seasonal rights of usage. The nomadic pastoralists, says Romila Thapar "generally had a fairly conventional organization, with marginal variations. The family formed the core and patrilineal descent was often traced from a common ancestor" (*Early India*, Allen Lane, 2002, p.58).

Ecological and seasonal factors seemed to have played a central role in the life of nomadic pastoralists of the early period. Unmanageable distances traversed in search of good pasturage and water sources would have had a destablising effect on the group. This would have given rise to some kind of territoriality, howsoever loosely delineated. Subsequently, interaction between different territorial groups may also have been possible as much as a conflict over territorial jurisdictions. In this context one may speculate on Morhana Pahar rock painting showing the way-laying of two chariots by men equipped with bow and arrow and spears as perhaps indicative of territorial trespass.

6.3 NOMADIC PASTORALISM AND SETTLED COMMUNITIES

Hunter-gatherers slowly evolving into a pastoral culture and agricultural sedementism have been simultaneous processes. How did the pastoralists adopt a nomadic mode of living has been discussed in the preceding section. It is evident that the nomadic pastoralists did not live in isolation of other communities and would have maintained a relationship with them. It is suggested by Romila Thapar that some "pastoralists were nomadic…while others were semi-sedentary, occasionally practicing a minimal agriculture as well. Most pastoralsits were part of a system of exchange that brought them into contact with cultivators and others" (*op.cit.* p.57). The archaeological sites yielding evidence on domesticated animals suggest that the size of the herd maintained by pastoralsits was not unduly large, was within manageable limits and therefore prone to developing "active symbiotic relations with neighbouring groups producing cereals" (D.K. Bhattacharya and Deepra Bhattacharya, 'Agro-Pastoralism in contemporary Ethnography: Its Relevance in Explanation of Archaeological Material in India' in *Archaeology and Interactive Disciplines*, ed. S. Settar and Ravi Korisettar, New Delhi, 2002, p.164).

The relationship between pastoralists and cultivators was of advantage to both. The cereal requirements of the pastoralists were fulfilled by the farming communities. The additional labour intensive work of growing food-crops was therefore conveniently avoided by the pastoralists. They could give most of their time to keeping the animal herds in order. In return the agriculturalists received a regular supply of meat, wool and hide. Over a period of time there would take place a multiplication: in the variety of animals partially in response to a demand created by the agriculturists. The herd was also encouraged to visit the post-harvest fields so that the stubs left behind the harvesting operation would be cleaned and the droppings of animals would serve the purpose of manure. The periodic visit of nomadic pastoralists to the agricultural settlements would have resulted into the nomads taking up grazing services for the livestock maintained by the cultivating groups. The agricultural fodder was perhaps an item of exchange for this service in addition to a few other commodities.

It is interesting to note that a different environmental situation obtaining in peninsular India gave rise to a different kind of development. Though the area is generally rugged the drainage pattern of the main rivers has been such (from west to east) that pasture land in patches but in excellent condition has been available all over. The settlements in this region exhibited a high imperative of maintaining a large population of cattle right from their inception. Livestock maintaining was in fact not as much a problem as depending entirely on farming. As suggested by Bhattacharyas "Cattle pen and ashmounds found in some of these sites can indicate that animals kept were large enough in number to require circular grazing (leaving the area of dwelling for a year round search for pasture). Such periodic migrations bring the pastorals in contact with settlements of higher culture through which products of craftsmen find their way in them" (*op.cit.*, p.166).

6.4 SUMMARY

In summary we are giving some of the generalizations, in reworded form, proposed by Bhattacharyas for pastoral communities (*op.cit*, p.162). The communities adopting pastoralism as a mode of living generally looked for large pastures around their habitat. They would even migrate to new habitats in search of good pastures resulting into nomadic habits finding a place among pastoralists. The demographic status of pastoral communities was such that agriculture was not generally attempted. Rainfall therefore had only a minor role to play against being a key feature for the settled agriculturists The maintenance of large animal herds was labour intensive but was manipulated with the help of the elastic nature of resource. When needed the herd was reduced in size through gifts or repayments to agriculturists. The size would soon be restored through reproduction. A kinship network based on lineage seems to have guided the pastoral communities.

6.5 EXERCISES

1) Discuss the factors giving rise to pastoralism in early history.

2) Write a note explaining the emergence of nomadism among pastoralists.

3) Examine the nature of relationship between nomadic pastoralists and settled agriculturists in early history.

6.6 SUGGESTED READING

Bridget and Raymond Allchin, *The Birth of Indian Civilization, India and Pakistan before 500 B.C.,* 1968.

Bridget and Raymond Allchin, *The Rise of Civilzation in India and Pakistan*, Great Britain, 1982.

Romila Thapar, *Early India, From the Origins to AD 1300*, Allen Lane, 2002.

S. Settar & Ravi Korisettar, eds, *Archaeology and Interactive Disciplines,* Vol.III of *Indian Archaeology in Retrospect*, New Delhi, 2002.

Brian M. Fagan, *People of the Earth, An Introduction to World Prehistory* First Indian Reprint, 2004.

Peter Rigby, *Persistent Pastoralists, Nomadic Societies in Transition,* London, 1985.

UNIT 7 ORIGINS OF AGRICULTURE

Structure

7.0 INTRODUCTION

The beginning of agriculture, considered to be a momentous event in nature-human interface, is generally associated with the Neolithic revolution. The ground stone artefacts of this period which were well-rounded and had smooth long edges made the cultivation of soil an easier process. Once man took to agriculture several very significant changes followed that may be legitimately called as heralding the beginning of a new phase in man's relationship with environment. Human dependence on the resources of nature for survival ended. Production of cereals like barley, wheat and rice allowed them to get their own food. They also began to domesticate some species of animals – both for supplies of milk and meat as well as for harnessing their labour for various purposes. This was a completely new relationship with environment and its resources.

We deal in this Unit with the origins of agriculture. We discuss the transformation of hunter-gathers societies in societies that began to cultivate cereals and took to other associated developments in agriculture. Thus the characteristic features of the Neolithic revolution and related evidence along with the patterns of agriculture in West Asia and the Indian sub-continent come under specific focus.

7.1 NEOLITHIC REVOLUTION

The changes introduced in the stone artefacts that made smooth surfaces, and well-rounded and symmetrical shapes possible were of such far-reaching consequences that they were termed as ringing a remarkable shift in the stage of human evolution. V. Gordon Childe called this stage as 'the Neolithic Revolution' as he noted that the impact of the new stone tools and artefacts on human life was of enormous significance. (cf. *Man Makes Himself*, London, 1936). "Childe argued that once Neolithic tools began to be made, they would in turn make it easier to cultivate the soil. This would come about when humans (probably women, since in the gender division of labour they did the gathering of seeds and roots, while the men mainly hunted) discovered that they might not confine themselves to collecting wild grains, but increase their food supply by themselves putting seeds in the ground. Ground stone axes would help cut trees to clear the ground much better than the earlier rough tools; and with the sharp stone tips of digging sticks (as primitive hoes), the ground could be better softened to take in the seed. Smooth and sharp spear-heads and arrowheads would also make it easier to hunt, and so reduce the distances that hunters had earlier to traverse in tracking down game.

"Other developments would take place, not directly attributable to Neolithic technique, but certainly to agriculture. As cultivation became more widespread, domestication of cattle would be put on a firmer foundation. Stubble on the fallows would be available as fodder for cattle, which would supply both milk and meat, and so help to reduce dependence on hunting. Settled agricultural communities, inhabiting villages, could now arise. These communities would in time be able to produce a surplus, that is, grow more food than the producers themselves required for their bare subsistence. Use of clay and mud-brick construction would enable the surplus grain to be stored. Such surplus could then also be appropriated by non-producers, establishing their right by force, the right in time confirmed by cult and custom. Classes, private property and the state now made their appearance, based on such expropriation of the surplus" (Irfan Habib, *Prehistory*, *op.cit*., pp.48-50).

There has been some debate on the use of the word "revolution" to denote the onset and continuance of the Neolithic stage of culture. Since the general time span of this stage is considered to be from c.7000 to c. 3800 BC, it is argued that the spontaneity associated with the word revolution may not be quite applicable on a time span lasting for more than 3000 years. However, as suggested by Irfan Habib, "we need to compare the pace of change achieved during the Neolithic Revolution with the pace witnessed earlier. The previous Mesolithic age, characterized by microliths, had a span of some 25,000 years in the major part of India, with man still remaining basically a forager and hunter. In less than one-eighth of that time all this was changed, once Neolithic techniques had appeared in Pakistan's western borderlands, around c.7000 BC. It is this relative shortness of the Neolithic phase, along with the immense changes it brought about in man's social life, that makes it deserve the term 'revolution'"(*Prehistory*, *op.cit*., p.50).

The domestication of plants and animals a characteristic feature of the Neolithic stage of culture set on course a self-sufficient food producing economy. The inhabitants obtained assured supply of food through cultivation of cereals and they also began the practice of domesticating animals. A remarkable change in their life-style took place. Not dependent solely on the environment for food resources necessitating a periodic shift in their places of habitation in search of fresh supplies of food, the human groups now began to lead a more settled and sedentary life.

7.2 EARLY AGRICULTURE AND ENVIRONMENT

The beginning of agriculture, as we have said earlier, was an event of very far reaching consequences. It was also an event that had demarcated a definite shift in human relationship with environment. As a matter of fact a marked change had taken place in the environmental conditions obtaining in the part of the world with which we are concerned. A perspicuous description given by Bridget and Allchin explains this circumstance. They write: "At the end of the Pleistocene [the prehistoric period marked by great fluctuations in temperature with glacial periods followed by interglacial periods], approximately ten thousand years ago, climatic conditions more or less similar to those of today were established in West and South Asia. This provided the setting for man to make a number of important advances in his control of the environment, and set in train a series of events which led ultimately to the appearance of the first urban societies in both regions, some six thousand years ago. Perhaps the most fundamental advances were the domestication of several breeds of animals and plants" (Bridget & Allchin, *Rise of Civilization in India and Pakistan*, *op.cit*, p.97). Clearly, conducive environmental conditions and availability of necessary material support through Neolithic Revolution helped the practice of agriculture to germinate and allowed it to take roots.

In this region agriculture first began in West Asia and from there it spilled over into South Asia. The evidence available today suggests that the people of Syria and Palestine were the first to practice agriculture. They were known as Natufians "after a camp-site in the Wadi-el-Natuf, in Jordan", and "used sickles of small flint blades set with gum into the grooved shafts of bone. The blades were finely notched and set in a line to make a continuous saw-edge. The silica in the grass or corn stalks had polished the edges of the flints into a bright lustre from constant use. On the flat rock floor at the cave mouth were hollows made by pounding the grain into flour, and stone mortars were found for the same purpose" (M.S. Randhawa, *A History of Agriculture in India*, Vol. I, New Delhi, 1980, p.101). The techniques described here "could have been knocking at India's doors as early as 10000 BC, if one relies", says Irfan Habib, "on a stray carbondate (latest calibration) for a stratum of Neolithic tools without pottery ('a ceramic' or 'pre-ceramic') obtained from Ghar-i Asp or Aq Kupruk II in northern Afghanistan; more certain seems to be the date of c.7500 BC obtained from the nearby site of Ghar-i Mar or Aq Kupruk I" (*Prehistory*, *op.cit*., p.50). Surely the agricultural techniques from West Asia had diffused over Afghanistan from where they had to cross over into the Indus system.

This early agriculture had a profound impact on human-environment interface, as stated earlier. As a result of a complex interplay of sedimentary societies with their environments new social and economic structures emerged. The process of their emergence and their characteristics have been described by the Bridget and Allchin with good effect and we shall quote them at length: "When man first started to cultivate crops and to herd his own domesticated animals, an increased interest in fertility and in magical means of promoting it appears to have become an almost universal aspect of culture. It may well be that this interest gave rise to some of the most important new concepts in the whole of religion, namely, belief in an afterlife, in resurrection after death, and belief in the transmigration of souls and the cycle of rebirth. Throughout the length and breadth of India there are found today, at the folk level, rites and festivals which are intimately associated with the changing seasons, the sowing and harvesting of crops and the breeding of cattle and other livestock. There is also a whole pantheon of local gods and goddesses some of whom remain unassimilated while others have been absorbed at different levels into the sanskritized hierarchy of gods of the 'great' or classical Indian tradition. There can be no doubt that a very large part of this modern folk religion is extremely ancient and contains traits which originated during the earliest periods of stock raising and agricultural settlement.

"Also associated with permanent settlement were a series of new crafts involving important technological discoveries. Among these were the manufacture and use of pottery, in time to become ubiquitous as a trace of human occupation; and the discovery of the smelting of copper and its alloys, and their use in the manufacture of tools and weapons. The stone industries of the early settlements throughout South Asia show considerable variations from site to site and from one region to another. They also vary from one cultural level to another at sites with prolonged occupation such as Amri and particularly Mehrgarh. At the latter there were local supplies of bitumen which survives in the excavation and, being used in hafting, allows us to see how stone artefacts form component parts of different tools. In all cases the lithic blade industries of the early settlement are closely related to those of the regional Mesolithic sites with which they share sources of stone and basic technology. The regional, cultural and chronological variations are in the types of artefacts made from blades and flakes, and in their relative proportions. All assemblages at this stage are varied and clearly intended to serve many purposes" (*The Rise of Civilization in India and Pakistan*, *op.cit.*, p.99)

7.3 EARLY AGRICULTURE: REGIONAL DISPERSAL

The successful exploitation or domestication of several species of wild plants and the consequent rise of sedentary settlements were processes that showed multiple patterning over such a large geographical area as South Asia. Moreover climatic divergence and similar differences over physical environment were supportive factors of such a patterning. Different plants and resultant crops found favour in different regions. The early agriculture of the region South Asia can be divided into several sub-regions each showing some variation from others. The evidence of early agriculture in sub-regions has been discussed in the following sub-sections.

7.3.1 Baluchistan

Baluchistan forms the border region with the Indus system. The spill-over of agriculture from West Asia via Afghanistan had taken place in this region before it reached the Indus system. The environmental conditions obtaining in this region are, therefore, of interest to us as that is likely to explain in the emergence of agriculture there. As stated by Bridget and Allchin, "The climate (in this region) is one of extremes, the summer temperatures being very high, and the winters often very cold, with snow lying for up to two months in the higher valleys. Given these climatic conditions, the choice of habitations for communities of the Neolithic period must have depended primarily upon their suitability for varying pastoral and agricultural requirements. As the rainfall is generally less than 10 inches per annum, mainly falling in the winter months, water for men and animals was obviously a prime necessity in site location. Because of the scarcity of water, settlements were never large, unless they coincided with a good permanent spring or source of water. This scarcity also set strict limits upon the production of crops. Consequently a pastoral element in the economy has predominated and has certainly been well represented up until the present day. There are signs that in Baluchistan, in prehistoric times, attempts were made to retain rain water in surface drainage tanks, behind earth or stone embankments" (*The Rise of Civilization in India and Pakistan*, *op.cit.*, p.100).

The suitability of this region for the growth of agriculture has also been testified by others. Possehl writes: "A number of scholars have observed that the Afghan-Baluch region is environmentally and ecologically very much akin to the entire Iranian Plateau and the uplands of the regions bordering the Mediterranean [which is considered the place of origin of agriculture in the world]: It has a steppe-like quality with pistachio, juniper, and almond tree cover, along with the hard cold winters in which wheat and barley evolved. It is also within the range of the winter westerlies, which bring moisture, often in the form of snow, to the Near East on across the Iranian Plateau to the Punjab and Western Sindh. What this tells us is that the Afghan-Baluch region is a perfectly reasonable place for both wild barley (which is documented) and wild wheat to have been found" (G.L. Possehl, *The Indus Civilization, A Contemporary Perspective*, New Delhi, 2002, p.23).

The two major sites of interest to us in this region are Kili Ghul Muhammad and Mundigak. Kili Ghul Muhammad has yielded evidence relating to the domestication of cattle-sheep, goat and oxen and of mud-brick houses suggesting sedentary way of life. The site seems to have developed in several phases and pottery too appears in a later phase supporting settled way of life for its inhabitants. Mundigak, the other site, also provides evidence of permanent settlement. Initially the houses were like oblong cells made of pressed earth but subsequently larger houses began to appear. They were made of sun-dried bricks and had more than one enclosed living room. Bridget and Allchin write: "Domestic hearths are found from the beginning, and ovens, presumably for baking bread, are situated at first outside the houses, and later, possibly in the court yards" (*The Rise of Civilization in India and Pakistan*, *op.cit*., p.102). The details suggest that organised agriculture and the associated permanent settlements had become a conspicuous feature of Baluchistan region. These developments could serve as a precursor to the beginning of agriculture in the Indus system.

7.3.2 Indus System

As a geo-historical entity Indus valley is quite well known. We have called the same entity with the name Indus system to make it a little more flexible and give us the facility of including some of the fringe areas to make our description cogent.

The environmental conditions of the Indus system have been graphically described by Bridget and Allchin. They write: "The Indus plains offer a very different environment from the upland villages of Baluchistan. The picture that we see today, even despite modern flood control measures, of a highly unstable river, constantly changing its course within a wide flood plain, and laying down quantities of silt in the course of its annual inundation over large areas of the plain, was probably the same in many respects at the time of the earliest settlements on the edge of the plain. The rate of accumulation of silt throughout the period (approximately 180 cm per millennium for the plain as a whole, or 250 cm near the river's banks) has been such that not only must many features of the valley have become submerged, along with any early sites associated with them, but the plain itself must have expanded in area, increasing the extent of highly fertile alluvial soil. The main channel of the Indus flows through a wide alluvial flood plain which, with the recession of the annual inundation of June to September, is of great fertility. Wheat and barley sown at that time ripen by the following spring, without either ploughing or manuring of the ground. The banks of the river and of its subsidiary channels are not cultivated and must then, as now, have supported a dense gallery forest. These forests were until recent times rich in game, and must have provided attractive hunting grounds. So too must the plains beyond the active flood plain, for they would have produced a rich and varied grassland vegetation and have provided grazing for wild no less than for domestic animals. Once the agricultural potentials of the new alluvium were realised, and means were discovered of overcoming the problems of protecting settlements on the flood plain from inundation, an entirely new type of life became possible. On present showing this development took place in several stages, reaching its culmination around the opening of the third millennium B.C" (*The Rise of Civilization in India and Pakistan*, *op.cit*., pp.104-05).

It is clear from this description that the peculiar behaviour of rivers in this region helped agriculture to grow and take roots. The deposits of alluvial resulting from the seasonal flooding of the rivers were a fertile soil. It was not necessary then to clear any wooded or bushy areas for agriculture as a precondition. This area has yielded rich evidence of early agriculture through a fairly well excavated site known as Mehrgarh. We describe the evidence obtained from this site below.

Mehrgarh is locate don the banks of Bolan river at a distance of approximately 150 kms from the Quetta valley. The excavated site shows three different stages of settlement all of which may be termed as Neolithic settlements. From the beginning itself the habitation comprised of houses made of sun-dried mud-bricks having several smaller rooms and a hearth. "The presence of agriculture", as stated by Irfan Habib, "is attested by finds of seeds: the bulk are of naked six-row barley; the other sub-species of barley like hulled six-row and two-row, and of wheat like einkorn, emmer and hard [species of wheat] are present in small amounts". He suggests "Such cereal cultivation had probably spread from West Asia. Agriculture seems to have given an impetus to animal domestication. Goats were already domesticated and the humped ox (the characteristic Indian or *zebu*bull and cow) and sheep began to be tamed and bred from captured wild stock" (*Prehistory*, *op.cit*, p.51). The other evidence pertaining to agriculture and therefore of significance to us is the appearance of mud-brick structures of growing sizes, as we move from the earlier stage, to a later stage supposedly used as granaries. Moreover another specific find of great relevance is sickle blades of stone set in bitumen. This is perhaps the earliest indication of the use of tools specifically for agricultural purposes. Clearly otherwise arid zone harboured agriculture due to environmental conditions made available by alluvial carrying rivers.

7.3.3 Northern Valleys

Evidence of early agriculture in this region is best reported from the Kashmir area. There are two principal sites in Kashmir that give us useful material evidence on early agriculture. From Burzahom, close to Srinagar, we get information about pit-dwelling inhabitants. The walls of these dwellings as also their floors were sometimes plastered with mud. There are also some deeper pits which were probably reached through steps. It is, however, significant that direct evidence for agriculture in Burzahom has not been available. The other site, from where such evidence has been unearthed, is at Gufkral. From the early stages we find evidence that suggests that wheat, barley and lentils were grown by them. Domestication of sheep and goats is also reported. As suggested by Bridget and Allchin, the Kashmir valley culture "appears as a local adaptation to the special environment of the mountains, its people having rich sources of food from hunting and from agriculture" (*The Rise of Civilization in India and Pakistan*, *op.cit*., p.116).

7.3.4 East

The region East of the Indus area is different from the Indus area environmentally as it has been a region of high monsoon rainfall. The Mesolithic settlements have been present in this region from a very early time and the beginning of agriculture has in many cases been in continuation of this culture. There are two main sites, at Koldihwa and Mahagara, which yield interesting evidence on early agriculture. The habitation at these sites was in circular huts which were raised on wooden posts. The marks of holes left behind by these posts give us a fair idea of the shape and size of the huts which were generally circular in disposition. The most significant find is husks of rice indicating that this probably was the earliest rice growing culture. The wet environmental conditions resulting from monsoon were probably a prime reason for rice cultivation. The view that Koldihwa and Mahagara were the earliest rice growing places has been contested by Irfan Habib. He is of the opinion that the dates of Koldihwa-Mahagara sites has been misread; and the earliest evidence of rice cultivation in fact comes from Chopani Mando in Belan valley to the South of Allahabad between Tons and Son rivers.

[The] grains of domesticated rice were found by G.R. Sharma and his colleagues at Koldihwa in the valley of the small Vindhyan river of Belan, South of Allahabad, and carbon tests of material thought to belong to the same strata as the rice, yielded dates ranging from 6719 to 5010 BC. As such, the site would have contained the earliest occurrences of rice in the world. This statement has actually found a place in many textbooks. But it is now certain that the early dates from Koldihwa are due to a misreading of the charcoal-bearing strata; and the true cultural sequence seems to be as follows.

First of all, in the same small valley of the Belan river, at Chopani Mando, there was a Late Mesolithic or 'proto-Neolithic' phase, which is carbon dated 3385-3135 BC. The people lived in huts, whose floors have yielded large numbers of microliths. They were hunters and gatherers; and so the males were nearly as robust and tall as those of Sarai Nahar Rai and Mahadaha five thousand years earlier, though the women were already becoming smaller (mean adult height: 162 cm) and gracile. This is what the skeletons found at Lekhahia in the Mirzapur district of Uttar Pradesh, c.3035-2780 BC, tell us. Life was still short: out of nineteen skeletons whose age at death could be roughly determined, eleven died before reaching the age of 25. To return to Chopani Mando, we find here some ground-stone tools like hammer stones, querns and mullers; but there is no trace yet of domestication of plants and animals, though wild rice was gathered. Hand-made pottery had appeared, sometimes bearing cord-impressed decorations. This pottery links this culture to the 'Vindhyan Neolithic' represented by the sites of Kunjhun river, Koldihwa and Mahagara, the last situated in close proximity to Chopani Mando. The Vindhyan Neolithic must have succeeded the Mesolithic culture of Chopani Mando some time around 3000 BC; its carbon dates from Kunjhun river range from 3530-1265BC, while at Mahagra the dates are confined to the second millennium BC or 1770-1375 BC. The Vindhyan Neolithic is certainly important because, as has been mentioned, it has yielded very good evidence of the cultivation of rice, which is now India's major food crop. The otherwise primitive nature of this culture is evidenced by its cord-impressed pottery, which was still hand-made.

(Prehistory, op.cit., pp.62-63).

Another site of significance is Chirand located in Bihar on the plains of the river Ganga. This site has been assessed for its closing period as “contemporary with the Late Harappan” by Bridget and Alchin (p.119). The occupants lived in huts made of bamboo and strengthened with mud-plaster. Evidence for rice cultivation in the form of rice husks has become available from this site. Since fish bones have also been found along with rice husks it may be assumed that rice and fish formed a main food item the inhabitants.

7.3.5 Peninsular India

The evidence for early agriculture in this part of the country comes mainly from sites excavated in the Karnataka region. These sites are commonly known as ‘Ash-mounds’ and are located at Utnur, Kupgal, Kodekal and Pallavoy. It is suggested that no outside influence worked in the development of these sites and they had an impulse of their own in developing a Neolithic culture. The geographical peculiarities of the region where these sites are located have been described by Bridget and Allchin: “In that part of the Deccan plateau where this new pattern first developed, the predominant physical features are residual granite hills rising from a rolling ‘sea’ of black cotton soil. The hills were favoured for settlement, and wherever they contained suitable caves or rock shelters, these were used for habitation, and often enlarged by the construction of a levelled stone terrace in front. Small plateau on the summits of hills or level areas on hillsides were likewise exploited and artificially levelled or extended. In some cases there seem to have been single large terraces, while in others there were many small ones, rising one behind the other up the slope of a hill. At this early period, sites are only rarely found on the banks of rivers away from hills. There is as yet no evidence for structures associated with the earliest settlements in this area” (*The Rise of Civilization in India and Pakistan*, *op.cit*., p.122).

Interestingly the ‘Ash-mound’ sites have been found to be contemporary with the early phase of Harappan culture. The most notable feature here is the existence of cattle-pens where domesticated cattle like sheep and goats were kept penned together. “These pens were surrounded by two heavy stockades of palm-trunks. The inner of the two provided the area in which the cattle were penned, while the outer provided a space within which the herdsmen lived” (Bridget and Allchin, *op.cit*, p.123). We have not found any direct evidence of agriculture in the form of grains from these places. But the availability of tools such as rubbing stones, querns and ground axes suggests that cultivation was practiced.

7.4 SUMMARY

The evidence discussed by us so far leads us to form a certain view about early agriculture in India. The environmental conditions had become favourable at a time about 10,000 years in the parts from now. Agriculture originated in West Asia and from there travelled a route that passed through North Afghanistan, the Indus system, northern valleys to the central and eastern parts of India. Sedentary settlements came into being as mud-brick houses began to be built. Domestication of cattle was practiced and early agriculture had begun. Sheep & goats became the early domestic animals and wheat and barley were cultivated as cereal crops. As we move to eastern India we find the beginning of rice culture. The local environmental conditions had made their impact as the variety of evidence from the sites spread from Baluchistan to Chirand in Bihar verily testify this feature.

South India was, however, an exception as Neolithic Revolution there seemed to occur due to an impulse that was not part of the development in Northern India.

7.5 EXERCISES

1) Examine the significance of Neolithic Revolution.

2) Describe the evidence for early agriculture from Baluchistan and the Indus System.

3) Discuss the origin of rice cultivation in India.

7.6 SUGGESTED READING

Bridget and Raymond Allchin, *The Rise of Civilization in India and Pakistan*, Great Britain, 1982.

Irfan Habib, *Prehistory* in *People's History of India, 1*, New Delhi, 2001.

UNIT 8 RIVER VALLEY CIVILISATION

Structure

8.0 INTRODUCTION

The river valley civilisation that developed in India in the third millennium BC is generally known as Indus civilisation or the Harappa civilisation. As has been noted in the preceding unit (7), the environmental condition in the West and South Asian region had become conducive to the growth of agriculture at the end of the Pleistocene period, about 10,000 years ago. Originating in West Asia the agriculture soon spread in India in different regions. One of the regions, identified as the Indus region, provided peculiar environmental conditions that supported agriculture in the flood plains of Indus and other rivers of the region. Several sedimentary settlements have been unearthed by the archaeologists in this region yielding evidence of early agriculture and permanent habitation. Such settlements were in fact the precursor of a fully developed urban civilisation. It sustained on the same agricultural practice that had mediated the emergence of sedimentary settlements in the region in the past and that was essentially based on the flood plains of the river as the principal area of agricultural activity. Since seasonal inundation of the river valleys and subsequent deposit of rich alluvial soil was a principal feature supporting agriculture we also call Indus civilisation as the River Valley Civilisation. In this unit we propose to study the agriculture pattern of Indus civilisation based on archaeological data uncovered so far. Since archaeological records, generally, are not even in their details, there is a possibility that some aspects relating to agriculture would appear as dense in details and therefore descriptive while others would appear as providing bare details only.

8.1 THE ANTECEDANTS

The flood-plains of rivers supporting agriculture has been a typical environmental activity in the Indus region. It gave rise to habitations that sustained on a mix of agricultural and nomadic practices. Some major sites of this type excavated in the region are Kili Ghul Muhammad, Rana Ghundai and Mehrgarh. The result of excavation at Mehrgarh have been particularly rewarding. Mehrgarh was an early food-producing village located on the banks of the Bolan river that flowed through the Kachi plain which is an extension of the Indus valley. Possehl highlights the strategic importance of the site thus: "The Bolan River provides a major route of communication between the Indus Valley and Baluchistan. It is the principal hydrological feature of the Kachi Plain today where it runs along the eastern edge of Mehrgarh. The Bolan Pass is a relatively easy route to the Quetta Valley and central Baluchistan. Mehrgarh sits at a strategic place, at the base of this route, just off the central plain of the Indus River. This is a very important, special location; a hub of communication, a place where peoples met and mixed." (*The Indus Civilisation, A Contemporary Perspective*, *op*.cit., p.25). It is clear that the richness of material evidence from Mehrgarh is perfectly in tune with its situational importance. We shall examine the evidence from this site to understand the background of Indus valley agriculture.

Mehrgarh is a unique site as it provides evidence from nearly 'every phase of the Neolithic Revolution' extending roughly from 7000 BC to 3800 BC (cf. *Prehistory*, *op.cit*, p.51). Settlements at Mehrgarh have been found spread almost in a line. The overlap is absent as the settlers moved from one place to another along the Bolan River. This movement was from North to South with three distinct periods -I, II and III - of settlement noticeable. As stated by Possehl "A great deal of information on the paleobotany of Mehrgarh is available. The collection from Period I is especially rich. The dominant plant of Period I is domesticated, naked six-row barley. There are two other varieties of domesticated barley as well. Domesticated wheat is present in the form of einkorn, emmer and a free-threshing hard durum [all are different varieties of wheat], but in amounts much smaller than the barley sample. The noncereals so far identified for the period include the Indian jujube [*ber*] and dates, represented by stones in Period 1 and II" (*The Indus Civilisation, A Contemporary Perspective*, *op.cit*, p.27). It is thus evident that the beginning of the Indus civilisation was marked by an already existing system of agriculture at permanent settlements in the river valleys of the region. This system, as we have noted subsequently, in Block 4, Unit 12, was sustaining on the seasonal alluvial deposits brought by the floods in the rivers. The take-off stage for Indus civilisation was thus available and the results of further developments were astonishing as has been shown by the growth, expanse, and prosperity of Indus civilisation.

8.2 THE ENVIRONMENTAL CONDITIONS

An understanding of the environmental conditions in the Indus area is of importance because the region today falls in a semi-arid zone and may perhaps not sustain agriculture in the same measure in which archaeological evidence provides a testimony. The study of environmental conditions in the Indus area has evoked some debate as to different climatic conditions obtaining at the time of the flourish of Indus culture. We find it worthwhile to at least outline the contours of this debate to help us understand more clearly the environmental setting in which the agricultural developments in Indus civilisation took place.

"Based on the work pioneered by Sir Aural Stein (1931) [famous archaeologist whose area of focus was the North-West] and the writings of V. Gordon Childe [*Man Makes Himself* and *What Happened in History*?]", says Possehl, "it was once thought that all of the Near East and the Western parts of South Asia had been subjected to severe post-Pleistocene desiccation. The presence of stone dams called *gabarbands* and large numbers of prehistoric archaeological sites in areas now almost devoid of settled peoples seemed to fit such an hypothesis"

(*Ancient Cities of the Indus*, New Delhi, 1979, p.221). This view gave rise to the belief that arid environmental condition in this region was the consequence of an exploitative human activity that denuded the region of its natural resources contrary to the view that severe climatic fluctuations caused the degradation. Subsequently three studies focusing on climatic conditions of Indus culture appeared between 1961 and 1971 which extended the discussion further. The first, in time sequence, was a study undertaken jointly by Robert L. Raikes and Robert H. Dyson, Jr. ('The Prehistoric Climate of Baluchistan and the Indus Valley' in *American Anthropologist*, Vol.63, No.2, 1961, pp.265-81 reprinted in G.L. Possehl, ed. *Ancient Cities of the Indus* pp.223-33). They reexamined "the arguments and evidence presented in support of the hypothesis of desiccation in Baluchistan" and came to the conclusion that aridity in the region was not a consequence of any severe climatic variation but was the result of human activity of degrading nature over a long period of time. (cf. Robert L. Raikes and Robert H. Dyson, *op.cit*., p.223-33). The two other studies are by Gurdip Singh ('The Indus Valley Culture' in *Archaeology and Physical Anthropology in Oceania*, Vol. 6, No.2, 1971, pp.177-89 reprinted in G.L. Possehl ed., *Ancient Cities of the Indus* pp.234-42) and by C. Ramaswamy ('Monsoon over the Indus Valley During the Harappan Period' in *Nature*, Vol. 217, No. 5129, 1968, pp.628-29 reprinted in G.L. Possehl ed. *Ancient Cities of the Indus*, pp.243-44). Gurdip Singh's study is based on the pollen data gathered from Sambhar, Didwana and Lunkaransar Lakes in Rajasthan which are all salt lakes. He is of the opinion that a climatic change occurring at about 2000 BC increased the salinity of these lakes; by implication therefore the same aridity affected the Indus region. Ramaswamy puts forward the case for climatic variation rather directly. He says that there is adequate archaeological evidence to suggest that the Harappans, who flourished in the Indus Valley between 2500 and 1700 ± 100 BC, lived in climatic conditions that were much more moist than the conditions that exist in the region today. "These conclusions" he asserts "are further supported by the recent discovery of considerable reserves of ground water [vide K.L. Rao, *Indian Geohydrology*, Vol. 1, 1965, p.2] in the arid region of extreme West Rajasthan close to the Indus Valley. Carbon - 14 tests carried out by staff of the Tata Institute of Fundamental Research in Bombay, at a place called Palana, 14 miles South of Bikaner (28^{O}00' N., 73^{O}18' E.) indicate that the ground water there is about 5,000 - year old, this being the upper limit of the true age of the water" (Reprint, *op.cit*., p.243).

The issue was subjected to a scrutiny in later years. It has now been found that the three studies discussed above do not give clinching evidence in support of the view that there indeed has been a marked climatic shift in the region since the days of Indus civilisation. Irfan Habib asserts that the climatic - shift view is "inconsistent with the drainage system at Mohenjo Daro and Kalibangan which could not have withstood any heavier rainfall than what the area now receives. If an 'arid' phase really followed a 'wet' phase in the present geological age (Holocene), then the change must have long preceded the Indus civilisation" (*The Indus Civilisation, A People's History of India*, 2, New Delhi, 2002, p.24). Similarly, for Gurdip Singh's study Possehl writes: "The changing salinity of these lakes, which appears to be well documented, need not be attributed to changes in rainfall. The geology of Rajashan is complex. The three lakes investigated are hypersaline today, but there are also fresh water lakes in this same region (Lakes Pushkar and Ganger). This observation leads to the conclusion that under one climatic regime in Rajasthan, there can be both fresh water and hypersaline lakes, calling into question the Singh hypothesis" (*The Indus Civilisation, A Contemporary Perspective*, *op.cit*., p.9).

It can now be safely contended that on the whole there has been no significant shift in climate in the Indus area. The region has remained semi-arid since the beginning of the Indus Civilisation with inadequate rainfall so as not to support agriculture without the assistance of supplementary irrigation. The flood-plain agriculture of the Indus civilisation was characteristic of the climatic conditions and the peculiar behaviour of seasonal floods in the rivers.

8.3 INDUS AGRICULTURE

Indus agriculture was the outcome of the agriculturally productive potentialities of the region about which we have given you details in Section 8.1 above. The fact that it sustained the development of such an important civilisation is in itself adequate proof of these potentialities. Irfan Habib has attempted an estimation of the population of the Indus civilisation to show the number that lived on Indus agriculture we reproduce his interesting account below: "The number of inhabitants that this large area (nearly 700,000 square kilometers) contained has been variously estimated, the estimates ranging from one to five million. Perhaps, it is more reasonable to set it at a point somewhere midway. Given a total of about 150,000 persons assignable to Mohenjo Daro and Harappa together, the total urban population could not have been less than 250,000, bearing in mind the fact that large urban sites like Ganweriwala in Bahawalpur and Lakhmirwala in the Indian Punjab still remain unexcavated. At the height of de-urbanisation in India during the nineteenth century, the rural population was nearly nine times the urban. With a much lower level of agricultural productivity than in the nineteenth century, it will be difficult to assume that sufficient food for the urban population was grown in the Indus civilisation by a rural population less than fifteen times its number. Such a ratio would give a total population of four million for the entire territory of the Indus civilisation, or nearly six persons per square kilometer. This would compare with nearly 50 persons per square kilometer in the same area in 1901. (In 1991 the corresponding figure was about 180 persons!) The comparison helps us to see how sparsely populated the Indus basin must still have been at the time of the Indus civilisation" (*The Indus Civilisation*, *op.cit*. pp.22-24).

How such an increase in agricultural production was achieved does no more remain a puzzle if we carefully examine the method of agriculture and the tools etc. used for the purpose. We have already ruled out the tentative suggestions that climate was more favourable then than it has been now. Advanced agricultural tools and a more organised method seem to be more likely factors influencing agricultural production. We shall discuss this in detail in the ensuing sub-sections.

8.3.1 Method and Tools

In a region which did not have sufficient rainfall for supporting agriculture recourse was taken, as has been noted above, to the flood-plains of the rivers which had the tendency of depositing every year soft and fertile alluvial soil along their banks during the summer months. The agricultural pattern of Indus civilisation was thus geared accordingly and it is useful to understand the river behaviour at some length to truly appreciate this feature. The Indus has a very large and wide flood plain and the alluvium deposit too is fairly deep. In fact the behavioru of Indus is comparable with the two other river systems that were also the cradle of important ancient civilisation - the Nile and the Euphrates - Tigris river systems. A comparison of this type may help us place the Indus system in proper perspective.

A comparison of Indus with Nile and Euphrates - Tigris has been done by Shereen Ratnagar. She writes: "The Nile is, in contrast [to Indus], predictable and tame. It floods its extremely narrow valley between late June and September with a fair degree of regularity, the water standing in the fields for several weeks and then subsiding, thoroughly wetting and fertilizing the soil before it is time to sow. Wheat and barley require no further irrigation, even though Egypt is a hyper-arid land with less than ten centimeters of rainfall per year.

"The Indus too floods in the summer months, well before the wheat and barley sowing. It is at its highest level in August. But its annual water discharge is 207 billion cubic metres as against the 63 billion cubic metres of the Nile. Its catchment in the Himalaya is several times the magnitude of the Nile or Euphrates catchment, and it carries a huge amount of water at great speed" (*Understanding Harappa: Civilisation in the Greater Indus Valley*, New Delhi, 2001, pp.20-21). The flood plains of Indus, as is evident, were quite expansive and the alluvial deposit sufficiently deep for supporting agriculture, mainly the *rabi* crop, for the vast habitational settlements as that of the Indus civilisation. Shereen Ratnagar is quite perceptive when she says, "The locations of Harappan sites are not totally explained by climatic conditions. In fact rainfall, as in all arid regions of the world, is erratic - variability in Sind, for example, is 65 per cent. In ancient economics the aim was to minimize risk rather than to calculate the relative costs of input and output, for land and labour were not commodities that were bought and sold - much less so seed, fodder or natural fertilizer. Hence people chose to settle in areas with reliable resources - i.e. those annually inundated or, more important, with perennial springs or lakes or sweet-water wells close to the surface - rather than in areas with high but unreliable rainfall….It is truly a paradox that the plains of the mighty Indus did not offer potential for unlimited agricultural growth" (*Understanding Harappa, op.cit.* p.40).

The important evidence on agricultural tools comes from Kalibangan, Banwali, Jawaiwala and Shortughai. Two ploughed fields have been discovered by archaeologists from Kalibangan and from the Indus settlement at Shortughai. The sites at Banwali and Jawaiwala (in Bahawalpur, Western Panjab) have provided evidence relating to plough as an agricultural tool. The discovery of plough furrowed field at Kalibangan is of seminal significance as it proves the use of plough and the use of ox for drawing the plough - as a draught animal. The use of plough and ox as a draught animal for drawing the plough was a fundamental advance in agriculture. Irfan Habib notes its significance by asserting that the "plough greatly lessened the labour of peasants previously performing the same task manually with the hoe, and also enabled the same family to till a much larger area of land (probably double, to judge from studies of such change in contemporary sub-Saharan Africa). It accordingly brought about a substantial increase in yield per head of population" (*The Indus Civilisation, op.cit.*, p.10).

8.3.2 Crops

We have noted that Indus agriculture was mainly based on *rabi* crops which were actually the winter crops sown after the recession of floods by September or so. Wheat and barley were two main crops for which evidence was already there in Mehrgarh - they continued in the Indus civilisation. The other *rabi* crops, for which evidence has come from Indus period sites, were mustard, linseed, peas, lentil, gram. If not everywhere, at least in some localized place millets - grown in summers, and also rice have also been reported. Shereen Ratnagar writes:

"Available evidence indicates that rice (identified at Rangpur and Lothal in eastern Saurashtra) became an actual crop only in the second millennium BC in South Asia. Of the millets, coarse-grained and hardy plants suited to tracts with low rainfall and poor soils, foxtail or Italian millet is known in Harappan Kutch either as a weed or a wild plant. The more nutritious jowar and bajra were to be crops of a slightly later period but ragi was perhaps being grown around this time in Saurashtra and Kutch" (*Understanding Harappa*, *op.cit*., p.18, n.1). The other evidence for crops is for date-seeds and grape-seeds and *ber* from Rohira and a species of vetches from Balakot. Though no direct evidence for cotton has been found it can be presumed that the crop that appeared around 4000 BC continued to be grown during the Indus civilisation.

There is some more related information that adds to our understanding of Indus agriculture. Irfan Habib refers to an interesting evidence as he says, "Ovens, including tandoors, have been found at Kalibangan (Early Indus phase), taking the history of bread-making in India back to nearly 5,000 years ago" (*The Indus Civilisation*, *op.cit*., p.11). Similarly the use of fibre and oil extracted from cotton and sesame has been deduced by Shereen Ratnagar. She also suggests that "oil from linseed (which may have been western Asiatic in origin) would have been used for lamps rather than for food" (*Understanding Harappa*, *op.cit*., p.19).

8.4 AN OVERVIEW

We have discussed the main evidence pertaining to the environmental conditions and the agriculture of the Indus civilisation and have also attempted to establish a correlation between them. We know give an overview of the agricultural system and the subsistence pattern of the Indus region.

Possehl suggests that the 1000 or more settlements of Indus civilisation (1052 recorded so far) known today can be "hierarchically arranged" into large to medium to small sites. The small or in some cases medium sites were settlements of the village farming communities and pastoral camps with thin scatters of pottery and so signs of permanent architecture". Further, "The Indus peoples were mostly farmer and herders. Barley seems to have been the principal food grain, except in the Sorath domain [Saurashtra region] where the people were cattle keepers par excellence who also raised goats, sheep, water buffalo and a variety of crops". The main agricultural season in the Indus region was the *rabi* or winter cropping season. The flood plains were ready for agricultural activity from September onwards and were intensely used for raising *rabi* crops. "Whether rice was a cultivator of significance during the Mature Harappan", doubts Possehl, "has yet to be determined". (*The Indus Civilisation*, *op.cit*., pp.63-4)

The crops of the Indus civilisation were wheat, barley, gram, peas, sesame, rape and cotton. In addition the people of the Indus region grew dates and grapes. They also collected *ber* or Indian jujube. Possehl says "They were also great fish eater, exploiting the rivers and lakes, especially in Sindh". We also have information relating to *kharif* or summer crops from some Indus sites, as we have noted in earlier sections. The main *kharif* crops grown by them were *jowar* or African millet, *bajra* or pearl millet and *ragi* or finger millet. As noted by Possehl "The importance of these plants is that they are summer grasses that prosper during the Southwest monsoon, unlike wheat and barley, which are winter grasses that do not thrive as monsoon crops. The millets thus led to double or year-round cropping and were important, if not critical, additions to the prehistoric food supply.

"The appearance of these plants coincides with the beginnings, or at least the expansion, of significant maritime activity in the Arabian Gulf and Indian Ocean. It is proposed that an extension of his maritime activity took Indus sailors at least so far as the southern end of the Red Sea and possibly farther South along the East coast of Africa. It is in this environment that they came in contact with the millets, integrated them into their food supply, and eventually carried them back home to the subcontinent". (*The Indus Civilisation*, *op.cit*., pp.64-5).

In the end we can say that the livelihood pattern of the Indus peoples was, as suggested by Possehl, a "complementarity of settled agriculture and pastoralism. While there must have been a variety of occupations for the peoples of the Indus Civilisation, most of them would have been farmers and/or pastoralists. They produced the food that sustained the nonagricultural people in the great cities and towns of this civilisation"(*ibid*).

8.5 EXERCISES

1) Discuss the relationship between the behaviour of rivers in the Indus region and the growth of agriculture.

2) Examine the pattern of agriculture in the Indus Civilisation.

3) Why was *rabi* season the principle agricultural activity in the Indus region? Examine.

8.6 SUGGESTED READING

Gregory L. Possehl, *The Indus Civilisation, A Contemporary Perspective*, Vistaar Edition, New Delhi, 2003.

Irfan Habib, *The Indus Civilisation* in *A People's History of India,* 2, New Delhi, 2002.

Shereen Ratnagar, *Understanding Harappa: Civilization in the Greater Indus Valley*, New Delhi, 2001.

Bridget and Raymond Allchin, *The Birth of Indian Civilization, India and Pakistan before 500 B.C.*, Great Britain, 1968.

M.S. Randhwa, *A History of Agriculture in India, Volume I,* New Delhi, 1980.

UNIT 9 AGRICULTURAL DIFFUSION AND REGIONAL SPECIFICITIES-I

Structure

9.0 INTRODUCTION

The diffusion of agriculture in North India was marked by elements of continuity and change. The antiquities of irrigation, list of basic crops including rice and use of primitive plough can be dated to Harappan and post-Harappan period. However, the changes occurred in the nature of agricultural practices. These changes were to a large extent influenced by several of variables including ecology. While high yield variety of wet-rice cultivation was the hallmark of Gangetic plains the emerging variations in agriculture mechanism ushered in a new phase of irrigation outside this region. The transition from a plough-ard and wooden ploughshare to an iron one signalled the beginning of complex state societies. Extension of cultivation continued in the medieval period too. Some areas were colonised as late as 19th century AD. However, the real changes came in the form of introduction of several new vegetables and fruits by various agencies in the 16th and 17th centuries AD.

This unit discusses the nature of agrarian expansion in the aftermath of Harappan civilisation through the pre-colonial period in North India. The technological advancement and the adaptation to existing and borrowed knowledge marked the shift to the Gangetic plains and further diffusion of agriculture in to different ecologies in the post-Harappa period. Environment, no doubt, played its part in this process but the role of the state and communities also began to assume gradual importance. We have focused in this unit on the:

- possibilities of agriculture outside Harappa; crop-pattern and linkages, if any, with the Harappan civilisation;
- agro-pastoralism and shifting subsistence patterns;
- iron and wet-rice cultivation; their role in second urbanisation and early state formation;
- shift of the agricultural epicentre to different ecologies and significance of irrigation;
- phased formation of agricultural regions in early India; and
- extension of cultivation areas and new crops, state interests and intervention in medieval period.

You will appreciate that the temporal and spatial expanse of the subject covered in this Unit is quite vast. We have, in fact, made at attempt here to encapsulate major developments in agriculture-environment interface. In this process it is likely that a few developments of significance may not have been selected by us in order of precedence.

9.1 GEOGRAPHY AND SUBSISTENCE STRATEGIES

The possibilities of agriculture, it spread and regional variations in early India were dependent on geography to a considerable extent. The status of cultivation in early India ranged from shifting cultivation to slash and burn to swidden (or *jhoom*) to hoe to plough cultivation. The passes and valleys facilitated the transhumance of pastoralists to and from Afghanistan or central Asia in the North and Tibet in the East. While some of the rivers, spreading a cover of the fertile silt attracted agriculturists, the fluvial uncertainties of some like Sutlej, Kosi, Tista and Brahmaputra brought disaster. The process of urbanisation supported by a flourishing hinterland was also uneven. While the first urbanisation in the Indus system is dated to the second half of third millennium BC and the second urbanisation in the Ganges system to the first millennium BC, the plains of Brahmaputra witnessed such developments at a later stage. Pre-conditions of agricultural development like land clearance was constrained by ecology and technology. The Gangetic plains were heavily forested and it was not before the effective use of iron began that the fertility of the soil could be tapped for agriculture on a wide scale.

Not all the regions within Northern plains were as fertile as the Gangetic area. Therefore complex societies could be sustained in the middle Gangetic plains and Eastern India. Here wet-rice cultivation yielded higher surplus. The rain-fed agriculture in the northwest was utilised to produce wheat and barley. The drier areas normally practiced cattle breeding. Western Rajasthan, the region of Thar Desert, hardly permitted conditions of cultivation. Caravan traders frequented the desert and subsequently the trading centres grew in the region. However, with the development of irrigation facilities some of the sub-regions in Rajasthan began to be cultivated. In contrast, the areas in the Northeast, Bengal and Orissa benefited from the blowing of the Northeast monsoon from December to February. These areas received plenty of rain and were hence blessed with dense vegetation. Though it is difficult to map climatic changes and its consequences for agriculture but such changes have been indicated for the middle of the first millennium AD. Analyses of plant remains and soil belonging to the post-Harappan period in the Northwest point to growing aridity.

The variations in the settlement patterns and forests were often guided by climatic conditions. In the drier areas villages were generally nucleated. Fields bounded the settlements and pastures were located far away. In the wetter, rice-growing eastern India linear homesteads were the norm. As far as forests are concerned, the range included extensive rain forests of the wetter areas to tropical deciduous to pine and fir. Vegetation in these forests ranged from Savanna, bushes and coarse grasses to teak, ebony and sandalwood. The river systems of the Indus, the Ganges and the Mahanadi had estuaries where mangrove swamps could be found. (See, for more details, Unit 2, Block 1 on **Indian Landscape).**

Soil types have been the other important factor, which has decided the agricultural viability of different regions. From the fertile alluvial and cotton soil to not so fertile red soil and laterite, the differentiated availability of natural nutrients, water retention and pliability have all determined the nature and rate of agricultural growth. Riverine regions, which silt the flood plain, are preferred even when the location is hazardous. In relatively elevated areas deep ploughing is required. The use of ploughshare, iron in the north and wood in the peninsular region and its consequences for the agriculture have been debated among historians rather animatedly.

Uncertainties and vagaries of climate made cultivators dependant on agricultural calendars prepared by the local brahmanas. The agricultural operations of sowing and harvesting came to be associated with lunar and solar calculations. These calculations were based on the study of the phases of the moon, equinoxes and solstices.

9.1.1 *Vana/Aranya* and *Ksetra/Janapada* Dichotomy: The Theoretical Divide

Early Indian literature describes *Pulindas*, *Nishadas* and *Sabaras* as demonic figures relegated to the unknown, unpredictable wilderness. As described in the *Mahabharata*, the process of burning of *Khandava vana* for the settlement of Indraprastha destroyed many such demonic creatures along with animals and human beings. These forests and their inhabitants were juxtaposed to the predictable world of plough agriculturists. However, the vana/aranya and ksetra/janapada were neither homogenous nor immutable spaces. The perceived opposition between these two systems was maintained only in the theory as there could be overlaps in practice. *Harshacharita*, written in 7th century AD, refers to the acculturation of such forest dwellers says that and their subsistence activities were similar to those of their neighbouring peasants. Even the tribal settlements could transform into peasant villages. So the forest dwellers were not essentially hunter-gatherers. They practiced shifting cultivation or horticulture or even sedentary cultivation.

The images of forests, which were seen as home to demonic creatures earlier, came to be romanticised later. These were preferred by ascetics and seemed an ideal location for establishment of hermitages. Clearance of the forests to extend cultivable land did not cause enough damage to vegetation till the population was small but in the past few centuries it has continued unabated resulting in the depletion of forest cover. *Arthashastra* of Kautilya recommended strict state control over forest clearance, perhaps to check over-exploitation.

9.2 THE AFTERMATH OF HARAPPAN CIVILISATION

Some historians regard the Harappan decline as transformation in the nature of civilisation. It is argued that while the urban features disappeared, agriculture in some areas continued and flourished. To understand this transformation we shall undertake a brief survey of some archaeological cultures.

9.2.1 Post-urban Harappan Situation

The post-urban Indus region was marked by several cultures. In the North West Frontier Province (NWFP) is found Swat Culture IV dated to C.1800-1400 BC. Here, the cultivators grew wheat (bread and shot), barley, rice, oat, lentil (*masur*), linseed and grapes. Cattle, goats, sheep and pigs were domesticated as well as consumed. In the Kachhi plains of Northeastern Baluchistan, sites like Sibri and Pirak testify the cultivation of *rabi* and *kharif* crops. *Rabi* crops include wheat (bread and shot), barley (six-rowed varieties), oats, chickpea and linseed while rice, millets (*jowar* and *cheena*) were the principal *kharif* crops found along with grapes. Goat, sheep and humped bull were being domesticated. The Jhukar Culture, spread over Jhukar (north of Mohenjodaro), Chanhudaro, Amri and Mohenjodaro itself consisted of very few settlements and does not provide us with evidences pertaining to cultivation of crops. In the Cemetery-H Culture discovered at Harappa, rice and finger millet (*ragi*) were introduced in this period. At a site named Hullas, *rabi* crops including wheat (shot and bread), barley, gram, lentils, oats, grass pea and field pea and *kharif* crops like rice, *jowar*, *ragi*, cow-pea, green-gram, horse-gram and cotton have been found. The increased number of settlements in Punjab (on the Indian side), Haryana and Northwestern Uttar Pradesh might have resulted from migration of some communities from Hakra and Ghaggar to upper reaches of Sutlej –Yamuna divide and to the upper Doab. Here, the extensive flood lands and heavier rainfall suited rice cultivation. Rice cultivation in period II-A along with millet, bajra or bulrush millet (*Pennisetum typhoideum*) in period III is obtained at Rangpur. A dry forest and a different climate existed in the region. This is indicated by identification of the trees of acacias, tamarisk and albizzia. At Rojdi, a site belonging to Gujarat, *kharif* crops including millets (*ragi*, *bajra*, *jowar*) and *rabi* represented by the lentil and pea have been discovered. However, rice is not reported.

9.2.2 Agro-pastoralism in Chalcolithic Cultures

Outside the Indus (Harappan) region a large number of hunter-gatherers, pastoralists and farmers existed. It is difficult to ascertain the Harappan influence on their lives. Some changes in the pattern of crop combination and the agricultural practices in the Neolithic-Chalcolithic period are discernible. Rice has been reported from the valley of Swat. Here, the discovery of a small ploughed field with furrow marks dated to 1300/1200 calibrated BC has led archaeologists to infer that a plough-ard was used. The earth was automatically pushed to one side of the furrow. Some sites dated to 3rd and 2nd millennium BC at Burzahom and Gufkral (Kashmir) were using sickle shaped implements for harvesting grain. Such implements are also discovered from Central Asia. Rice also occurs at Ahar in

Rajasthan, upper Gangetic valley, Chirand in Bihar, Orissa and the further East, possibly in Northeast and at a later date at Malwa. Wheat and Barley have been reported from Balathal in Southeast Rajasthan and appear as dominant crops in Malwa. Millets, generally cultivated in the South are represented in Balathal too. It has been suggested that the social pattern of the wheat growing area was not as complex as of those cultivating rice.

In central India and Rajasthan several chalcolithic sites have been investigated. Of these, mention may be made of Kayatha culture in the Chambal Valley, Dangwada in Ujjain and Ahar in Rajasthan. The site of Kayatha (Sample TF 402) brings out the evidence of cultivation of Indian jujube, two kinds of wheat (*Triticum sphaerococcum* and *Triticum compactum*) and seeds of horse gram. Faunal remains of bovine species and tortoise are also reported. Though five-fold cultural sequences spanning from Chalcolithic to early medieval times are discovered at Dangwada, the site context of material remains of the early period have not been satisfactorily understood. However, lentil, rice, horse gram and Indian jujube dated to Sunga and Gupta period are found. Ahar or Banas culture is located east to the Udaipur town in Rajasthan. The study of the chalcolithic layers points out to a possibility of a mixed economy. Here, agriculture and animal herding co-existed with hunting and fishing. Several impressions on the pottery sherds indicate to the cultivation of rice and millet. Vishnu-Mittre suggested that the factual history of millet was attested for the first time in the Ahar material culture. Sorghum, possibly *bajra* or bulrush millet was also cultivated. The sites abound in faunal remains pertaining to turtles, fish, goat, sheep, deer, pig and cattle.

In the Gangetic plains, the peasant, unlike the Indus culture, was no longer confined to the narrow strips of flood lands enriched by fresh doses of moisture and silt. The generosity of monsoons allowed him to increase the yield by shifting to new reclaimed virgin lands from forests. Several chalcolithic cultures like OCP (Ochre Coloured Pottery), BRW(Black & Red Ware), PGW(Painted Grey Ware) help us to understand the relationship between environment and crop pattern. The sites of OCP culture were generally located on the riverbanks. Such sites are spread over eastern Punjab, western UP and eastern Rajasthan. Atranjikhera, one of the important excavated sites, remained flooded or water logged for a considerable period of time. The list of crops at Atranjikhera includes two cereals– rice (*oryza sativa L*, *lathyrus sativus L*) and barley (*hordeum vulgare L*), and two pulses – gram (hulled and six-row gram) and *khesri*. Rice was cultivated as a summer crop and required plenty of water. Barley, a winter crop could produce good yield with modest irrigation. K A Chowdhury has suggested that the cultivation of gram was possibly the oldest record of its cultivation in India. *Khesri* was grown as a weed on dried up paddy fields. Both these pulses shared certain similarities; required small amount of water, cultivated as winter crops and belonged to legume family. These factors enhanced the fertility of the soil.

BRW culture is found in the upper Ganga-Yamuna and middle Gangetic Doab. Some of the important sites include Atranjikhera, Noh, Jodhpura and Narhan. At Atranjikhera, the crop pattern is basically similar to the OCP levels. At Noh rice impressions along with *urad* and kidney shaped seed of horse gram have been reported. The *oryza sativa* variety of rice is found from impressions at Jodhpura. At Narhan, one finds a well-developed agricultural regime. Hulled and six-row barley, rice (*oryza sativa*), club and bread wheat, mustard seeds, linseed and pulses (pea, *moong*, chickpea and *khesri*) are the main crops discovered here.

The sites of PGW culture are located in Western UP, Punjab, Haryana and Northern Rajasthan. These sites were on riverbanks and the inhabitants utilised both the cultivable plains and pastures. A sickle and hoe has been reported from Jakhera. The breeding of cow, buffalo, pig, goat, sheep and horse is indicated from the faunal remains. Wheat, barley and rice have been discovered at Atranjikhera. The cultivation of wheat by PGW people (wheat requires water supply at regular intervals) has led K.A. Chowdhury to speculate on the possibility of irrigation in the period.

9.2.3 Subsistence in Transition: 'Pastoralism to Agriculture' in Vedic Corpus

Archaeological cultures provide enough evidence, as seen above, regarding agricultural practices and crop pattern. The Vedic corpus, however, map a transition from a pastoralist to an agriculturist society. The literary construct of 'eastward migration' of Indo-Aryan speakers from Punjab to western Ganges plain and further East is being increasingly challenged. However, it has provided insights into changing ecological frontiers, crop pattern and necessities of newer technologies. It is argued that the landscape of the plains was heavily forested and the climate was generally wetter. Some areas of the Punjab were semi-arid and hence more conducive to pastoral activities. The migration of the Vedic people to the Gangetic plain was through Himalayan foothills as it was difficult to cut paths across more dense forests in the plains. Communication was possible across rivers of the Ganges system.

Rigveda is replete with references indicating the presence of a predominantly pastoralist society. Several linguistic expressions denote the usefulness of cow in this period. In the absence of landed economy, cow was treated as a scarce resource and hence became an object of veneration. Also, the Rigvedic people engaged in cattle raids, fought over grazing grounds and control of river water. Herd owning clans could use common pastures. Another animal, horse rose to prominence in this period as cows could be herded from horse back to vast pastures. It also helped in cattle-plunder activities. Agriculture in the Sapta-Sindhu (land of the seven rivers) region was mainly used to produce fodder. The use of wooden ploughshare by the pre-existing societies is also not ruled out. In fact, the antiquity of plough is drawn to pre-Harappan times and Indo-Aryans borrowed words like *langala* from the non-Aryans. Agricultural products like *yava* or barley were offered in sacrificial rituals. The shift to the Ganga-Yamuna Doab or Kuru-Panchala area in the western UP was marked by the use of iron implements and 'six to twenty-four oxen' yoked to the plough. Though this seems to be an exaggeration, plough definitely became a symbol of power and fertility. The ploughing rituals are discussed in detail in *Shatpatha Brahmana.* Although the later Vedic texts speak of iron, agricultural implements have not been satisfactorily discovered. Rice and wheat began to be cultivated along with already cultivated barley. It is postulated that the dominant pastoral chiefs acted as administrator-protector of local agriculturists. Pastoralists and agriculturists shared a symbiotic relationship as the agriculturists made available post harvest stubble for the herds to feed on. The animal droppings could manure the fields. Also, pastoralists did not stick to one place for long and acted as periodic carriers of products of exchange.

The transition from chalcolithic to the NBPW (Norther Black Polished Ware)/ early historic period in the upper Gangetic plains was marked by growth in number of sites, enhanced settlement size and increase in geographical extent of inhabited area. Within the NBPW culture habitation spread from well-drained area away from lakes and rivers to the most inhospitable areas. Some of the areas like Mathura remained pastoral for centuries because the soil was not conducive for the growth of agriculture. In contrast, the middle Gangetic plains did not have settlement clusters or nucleated villages before 500 BC.

The NBPW (also known as deluxe pottery) culture marks the arrival of sedentary peasant farming. This is testified by evidence related to cultivation of varieties of rice (including the transplanted) and plough cultivation etc., resulting in high yield. The proliferation of settlements in this period is attributed to wet – rice cultivation and its increased yield.

9.3 SECOND URBANISATION AND COMPLEX STATE SOCIETIES

The process of urbanisation in early historic India presupposes the support of a prosperous hinterland. The environmental conditions like land, soil and moisture etc. not only conditioned the hinterland and their agricultural viability but also had a direct bearing on the specific crops being produced. Newer technologies and higher yield can be considered as the important bases of urbanisation. The forces unleashed by these socio-economic changes created favourable conditions for the arrival of complex state societies.

9.3.1 The Environmental Setting

The centres of second urbanisation, located in the different regions like Northwestern borderlands, central Ganges plains, Ganges-Brahmaputra delta, Western coastal plains, deltas of the Eastern coast and in central and peninsular India shared the common factors of soil fertility and higher agricultural potential. Tamra Nala and Lundi Nala watered Taxila. The Northeastern valley was home to Buddhist monasteries and is today famous for citrus orchards. Buddhist monasteries were also situated in Charsada through which flowed the Kabul and Swat rivers. Kandhar is known as the oasis city on the Eastern side of Dasht-i-Margo, the desert basin of Helmund River. The central Ganges plains are an area of monsoon climate and large forest trees can be found here. As one traverses eastwards, two features change: steady increase in rainfall and humidity and the replacement of the open grazing grassy lands by the paddy fields. Varieties of alluvium could be utilized at different times and in different climatic conditions. Settlements in the older alluvium were regularly established. This situation is also true of Ganges-Brahmaputra delta. Rice was grown as the principal crop. The agricultural potential and the environmental setting of central Gujarat plains are similar to those of Western Ganges plains. Interestingly, this region shows a spatial overlap from the first urbanisation to second urbanisation in the Indian sub-continent. On the basis of a study of settlement patterns of Kathiawad, it has been suggested that the region practiced flourishing cultivation in the early historic period.

9.3.2 Iron and Rice: The Causative Agents

The rise of second urbanisation and complex state societies in the first millennium has been linked to transformative potential of iron technology and wet-rice cultivation. It is suggested that these two elements facilitated the increase in carrying capacity of the land and helped in sustaining urban centres. Urbanism seen in its various dimensions viz., proliferation of settlements, arts and crafts was inextricably linked to the new methods of cultivation and the higher yield. Some historians have questioned this technological determinism. It is argued that in the chalcolithic cultures outside Harappa, the cultivated land not only included the alluvial strip of river valleys but also the heavier, extensive stretches of black cotton soil. However, the amenability of the black cotton soil to heavy iron-tipped plough is recognised. The factor of rice, as we shall see, is also a vexed issue. As far as the crop pattern is concerned, the basic list remains the same from the BRW to NBPW phase. Also, the Doab region was already being exploited in the PGW phase. The inhabited settlement area rose by 32% from the BRW to PGW and 38% from the PGW to NBPW.

In order to appreciate the causal agency of iron in the historical change, it would be worthwhile to undertake a brief survey of various stages of use of iron in early India. Up to 700-600 BC, the sites of Kausambi, Hastinapur and Atranjikhera show that the agricultural productivity remained low and the economy was marked by a combination of hunting, animal husbandry and agriculture. However, except for stray discoveries of cutting tools like sickle and axe no agricultural implements have been found. Land was either cultivated by wooden ploughshare or it may have been of marginal significance. It is remarked that the fields in the riverine regions develop cracks following a flood. The practice of filling seeds in these cracks with the help of brooms exits even today. The period between 700/600 BC- 1st Century AD is characterised as middle iron phase. Some of the sites in this period were located near raw-material rich areas. The agricultural situation undoubtedly improved from single to double crop arrangement as has already been cited in the case of Narhan excavation. Besides sickles and axes, ploughshare, spades and hoes have been reported. However, as represented at the site of Rajghat, animal husbandry, both the drought and milch animals was still in vogue. The emergence of historical period in the first millennium BC/AD definitely ushered in an era of agricultural implements.

It can be suggested that the farming implements were virtually absent in the early phase though the process of colonisation and exploitation of riverine regions had already begun. Also, the sites such as Pirak would show that mere presence of iron tools in the site sequences might not have evolved in to an iron age. Even if seen in the wider context of environment and patterns of land, the rise of urban centres and complex state societies in the 1st millennium should not be attributed to the single factor of iron.

Manifestations of wide varieties of rice cultivation in archaeology and literature and the significance it acquired in Indian rituals underline its antiquity. Archaeologists have argued in favour of an Indian centre of origin of cultivated rice. Chinese and South-East Asiatic centres may not have had a uniform, direct bearing of rice-cultivation in India. The evidence of rice-cultivation at Koldihawa, the calibrated ranges of which are 7505-7033 BC, 6190-5764 BC and 5432-5051 BC cannot be summarily dismissed. Although the ‘seed broadcast’ method was initially practiced, the transplanted variety began to be cultivated in the middle Gangetic valley only. It was a well-established practice by the beginning of the early historic period. The enhancement of yield under transplanted variety is an undeniable fact. Whether this variety along with other variables had a direct bearing on rise of complex state societies is still being debated.

MAP

9.4 EARLY INDIA: IRRIGATION, RECLAMATION AND PHASED FORMATIONS

The nature of presence of a pan-Indian polity or an empire in early India has aroused lot of interest among scholars. Attempts have been made to redefine the term 'empire' in this context. It is now widely held that Mauryan Empire consisted of many variegated peripheral regions and so there could not have been uniformity in subsistence strategies. The process of reclamation in early India necessitated the construction of viable irrigation mechanisms. Since the regions were uneven because of their environmental features and convergence of historical forces, the agricultural regions emerged in a phased manner.

9.4.1 Irrigation Patterns in Early India: The Construct of Hydraulic Despotism

The variations in the irrigation system in early India depended on particular environment, acreage of land under cultivation and the sponsoring agent- the state, communities or individual. In other words, natural conditions and the control mechanism determined the type of irrigation. It could range from simple channels diverted from river or natural streams, water-bailing machines, pot-fitted wheels attached to the wells to developed technologies like Persian wheels, hillside channels watering terraced fields, canals, large reservoirs, tanks and embankments. The availability of water resources does not follow a uniform pattern. Uneven rainfall, failure of the monsoons, and scarcity and excesses of water have always compelled people to restrain and regulate the natural sources. Kautilya's *Arthasatra* classifies the modes of water supply as: (1) *Hastaprayartima*- drawing water with hands and carrying it to the fields in the pitchers; (2) *Skanda*- carrying water on the shoulders or the neck of the bullocks; (3) *Srotyantra*- a mechanism for lifting water in channels flowing in to the fields; and (4) *Udghatam*- the water wheel for raising water from river, etc. There is no dearth of literary references pertaining to irrigation in the Mauryan period. Archaeological excavations attest the presence of several terracotta ring wells at Hastinapur, New Delhi, Ropar, Ujjain and Nasik. These have also been reported in Eastern UP and Bihar. Although not all of them were used for irrigation purposes, there is evidence that the water from brick well at Ujjain irrigated the fields. Many tanks (including the votive ones) have been discovered at Taxila, Hastinapur, Udaipur, Ahicchatra (in Bareilly), Kausambi and Bhita. A number of tanks found at Mathura were also being used for irrigation. What is noteworthy about these tanks and wells is that these were mostly located in areas where irrigation was necessary. In comparison, there was a relative paucity of wells, tanks and canals in the central Gangetic plains. There was general increase in the number of wells in the post-Mauryan period notwithstanding the decline in the number of ring wells. The significance attached to artificial irrigation underwent a change during state- formation. Here, the reasons more than cause of subsistence were economic and political. Greater attention was paid to agriculture for it was the primary source of revenue. In the Swat region a tank was developed in 29 AD under the instructions of Theodorus, the Datiaputra. The region of Saurashtra bears testimony to the history of Sudarshan Lake. Later the dam of the lake was badly damaged because of heavy flooding. In the second century AD this lake was renovated under Saka ruler Rudraman. Similarly, king Kharvela extended an old canal in Kalinga. At Besnagar in Madhya

Pradesh is found an old canal. The Bes River was located about two furlongs from this canal. It has been suggested that this canal was perhaps an inundation canal because rivers in this part of the country overflow in the rainy season and remain dried up in the summer. As far as the role of state is concerned, some of the irrigation sources necessitated state's initiatives. The initial outlay of the canal required huge expenses and hence was beyond the means of individuals and communities. They could build relatively less expensive tanks but these tanks could not irrigate large areas.

It was only with the publication of Karl A. Wittfogel's work on "Oriental Despotism" that the studies on water resources and it's relation with the state gained impetus. Wittfogel proposed that the requirement of large-scale irrigation in arid or semi-arid region led to an enormous hydraulic organisation, which in course of time became the source of agro-hydraulic despotism. Organisational forms developed inevitably because water's specific properties needed task management. Wittfogel's contention is that the hydraulic route was a deliberate choice for it provided productive benefits. In such a system the state became all powerful and acquired matchless military power with even the dominant religion fused within the structure. Wittfogel classified the Mauryan Empire as a grandiose hydraulic economy. No legal and social pluralism was allowed to exist in a hydraulic state and its absolutist nature remained undisturbed. To enhance the plausibility of his theory, Wittfogel applied to it all the central elements of 'totalitarianism'. He devised the theory of 'diffusion and generalisation' in order to explain variations from his ideal model. Variation, according to him occurred due to the coreness of the area and its relation to marginal and sub-marginal regions. Property rights, which were weak in a hydraulic state, also formed the basis of variation, viz. (a) simple, (b) semi-complex and (c) complex. Indian case was picked up as a semi-complex model. The relation with the state determined class position in such a society. The ruled did not participate in the state process.

Karl A. Wittfogel's hydraulic theory was basically an ecological and sociological explanation of 'Oriental Despotism'. Wittfogel's understanding of historical geography is seen as flawed. Only the northwestern part of Indian subcontinent was arid. Early agrarian societies developed in semi-arid regions because these could be irrigated by inundations, while humid areas covered with forests had to be cleared before these could be cultivated. In the other parts of Indian subcontinent, irrigation could be a communal, provincial and state responsibility. Kautilya's *Arthasatra* does not refer to any officer in charge of irrigation, when even the bureaucracy is shown as a large one. The repair of the embankment of the Sudarsana Lake by the governors under the Mauryans, Rudradaman and the Guptas indicates that irrigation was also a provincial responsibility. In the post-Mauryan period, the state generally ceased to bear the main responsibility for irrigation. The rulers undertook occasional levies from the peasants to accomplish the work. It has been suggested that hydro-agriculture was better suited to India. Kautilya preferred small-scale irrigation. Kautilya, while enumerating different types of irrigated lands perhaps makes mention of a channel from a tank or dam rather than a canal. Even the canals mentioned above were too small for large-scale irrigation. Wittfogel ignored the role of technology. He did not visualise the struggle of human beings against nature. It has been argued that both Kautilya's *Arthasatra* and Abu'l Fazl's *Ain-i-Akbari* focus on the extension of cultivation to wasteland rather than artificial irrigation.

9.4.2 Proliferation of Agrarian Knowledge: Formation of Sub-Regions and Regions

In the post-Mauryan period, the epicentre shifted from the Gangetic areas to the peripheries. New centres of power emerged. By the 3rd Century AD large parts of the Himalayan zone, Assam, West Bengal, Orissa, Eastern MP, Rajasthan and Gujarat did enter the historical phase. The bases of state formation in Gupta and post-Gupta period can be located in diffusion of iron technology, plough agriculture and the role played by the *Brahmana* migrants. State formation in the hills of Punjab took place only in this period. At least 48 kingdoms existed in the largely forested red soil areas of Maharashtra, Eastern MP, AP, Orissa and Bengal. It has been remarked that the spread into different areas was not without conflict. Agrarian expansion and reclamation pattern largely depended on the nature of land endowments in the early medieval period. The traditional wisdom of *Brahmanas* regarding rainy season, sowing season etc., and the knowledge of known practices of agriculture was diffused in different areas. The preservation of cattle wealth espoused by brahmanic ideals helped agrarian economy. Several texts dealing with agricultural knowledge began to be translated in the vernaculars. An important example of the diffusion can be seen in a 9th century inscription from the Ajmer area. The term *brhadhala* mentioned in the inscription means big plough, which could have helped in breaking difficult soil, and make it pliable. Pounders were used in Bengal under the Palas. As these developments indicate, sub-regional agrarian bases developed in the post-Gupta period. The process of agrarian expansion continued unabated and the 6th-9th centuries AD were marked by emergence of agricultural regions. Bengal under Palas and Senas, Orissa under Somavamsis and later Gangas are cases in point.

By the early medieval period different modes of water supply came to be associated with different regions. Western India was characterised by construction of wells (*vapis*) in Rajasthan and Gujarat. The use of *arahattas* became popular in 6th-9th century Rajasthan. *Harshacharita* refers to *Udghatagati* and *Ghatiyantras*, which were in vogue in western UP Ponds, came to be associated with rural Bengal. The access to and utilisation of these water bodies necessitated the organisation of supra-village organisation and in course of time could create nodal points in the rural space.

However, not all the areas witnessed uniform pattern of reclamation. In Bengal deltaic regions were also colonised. In the regions like Rajasthan, Gujarat and Maharashtra land endowments were made in the waste areas. The transfer of privileges and certain rights to the beneficiaries of these endowments posited them in an advantageous position vis-à-vis the ranks of peasantry. However, in the Brahmaputra valley the land endowments were located in already reclaimed areas. In fact, core of the valley was reclaimed before the onset of early medieval period. Limited practice of wet –rice cultivation by the Kachari people is evident from the epigraphic terms and ethnographic literature on pre-modern irrigation in the valley. Reclamation in the hilly fringes of the valley continued till the 19th century AD.

9.5 SITUATION IN MEDIEVAL PERIOD

Extension of cultivation continued in the medieval period too. Sultanate rulers are credited with the extension of cultivation, reclamation and construction of canals. The trend continued under Mughals too. Integration of some regions in Assam started only in the medieval period and continued even in the colonial period till 19th century AD.

9.5.1 Crop-patterns: Continuity and Change

In the medieval period, the Sultanate rulers may not have directly promoted agrarian expansion unlike early India. However, their interest in the land-revenue system is undeniable and it had an indirect bearing on agricultural production. The imperial dominion consisted of large areas of alluvium soil. There were though certain exceptions like Siwalik Hills due northwards or the broken Aravalli ranges in the South–West of Delhi. As demonstrated in *Baburnama,* the dry stretch of Agra-Gwalior necessitated the creation of artificial water storage facilities. The region of Mewat received inadequate rainfall and hence could not be cultivated without artificial means of irrigation. Exceptions, however small, had a definite bearing on crops harvested. While generally two crops, *kharif* (monsoon) and *rabi* (winter) were harvested, there was a possibility of a third *zayad* or additional crop of short duration in Doab.

As far as crop patterns are concerned, the situation in the medieval period continued to be the same from preceding times except for a few changes. Rice and sugarcane were produced in the East and wheat, oil seeds etc in the North. Sugarcane was probably introduced in the 17th century AD. Cotton was extensively cultivated along with inferior crops like *bajra* (‘diet of the poor’) barley and sesame. Some of the crops came to be cultivated on a much wider scale. Wide scale cultivation of poppy might not have taken place before 16th century AD. Maize (*makka*) began to be cultivated in Maharashtra and Rajasthan only in the second half of 17th century A.D. The cultivation of fruits also received attention of the medieval rulers. Pomegranates are specially referred to. Jodhpur specialized in its cultivation and even the Persian varieties were no match to these. Rulers like Muhammad Tughlaq and Firuz Tughlaq are credited for developing a large number of gardens in and around Delhi and Chittor. Grapes received special attention in these gardens. These orchards however produced mainly for the towns and the elites. Portuguese are credited with introducing tobacco and also some fruits in India. These include papaya, cashew nuts and pineapple. Coffee was also introduced in this period.

9.5.2 State Intervention and Regional Variations

The area under cultivation substantially increased under the Sultanate and the Mughal rulers. During the Sultanate period the route to Delhi was largely afforested and Mewat posed hazards to trading groups. Balban ordered the cutting of forests and subsequently constructed Gopalgiri fort, which was put under Afghans. In course of time the area began to be cultivated. Areas of Multan district, an arid waste region were colonized under Ainul-Mulk Mahru. Several canals and water channels were constructed here. Subsequently, the production of the area doubled. Firuz Tughlaq contributed substantially to construction of an extensive system of canals. The canals from Yamuna, Sutlej and Ghaggar watered the areas of Hissar in Haryana. In Sind and Punjab, the canals were relatively smaller but contributed to growth of agriculture. According to estimates worked out by historians, extension of cultivation almost doubled from 16th to the beginning of 20th century AD. The clearance of forests and agrarian expansion continued in Bihar, Bengal and Awadh. The practice of constructing canals continued under Mughals also but it is suggested that owing to their low level of flowing their potential for irrigation remained limited.

The agricultural situation in the medieval Northeast began to change from 13th century AD. onwards. Brahmaputra valley under the Kacharis was acquainted with plough and wet rice cultivation. However, cultivation was predominantly shifting in nature besides gathering (of fruits, roots and herbs) and hunting-fishing activities. The subsistence economy of the region was not able to defend itself from the invading agriculturists. Ahoms were basically an agricultural tribe and if the legend is believed they came to the valley in search of cultivable land. They subjugated the local tribes and established themselves in the extreme southeastern part of the valley. Ahoms originally belonged to Mongolia, China and are credited to have introduced wet-rice cultivation on a wider scale in the Brahmaputra valley.

Contemporary chroniclers noted sub-regional variations within Assam. Mughal chronicler Shihabuddin Talish remarked that even the foreigners were attracted by the flourishing wet-rice cultivation in Brahmaputra valley. On the other hand, Ralph Fitch in 1585 noted only the cultivation of silk, bamboo, cotton, cane etc., in the lower Assam. Compared to the valley, the hills practiced primitive methods of rice cultivation besides hunting and gathering activities. With little modifications the variations still exist.

9.6 SUMMARY

The study of agricultural diffusion in the North India shows that the basic list of crops did not change much with the eastward movement in the aftermath of Harappan civilisation. However, the Gangetic plains once made cultivable created favourable situation for further expansion. The shift of the epicentre from the Gangetic plains to peripheries was accompanied with the tapping of iron and other resources. Red soil forest terrain was colonised in a big way in the early medieval period. The practice of making land endowments to *brahmanas* facilitated the diffusion of agricultural knowledge. The role of the state is undeniable. What is debated is its degree of control. The rulers from the early medieval times not only granted land but also ordered the clearance of forests and construction of irrigation facilities. They also encouraged cultivation of new crops and development of orchards.

9.7 EXERCISES

1) Why did plough become a symbol of power in later Vedic period? Discuss.

2) Do you think the settlement patterns changed in the NBPW/early historic period? Comment.

3) How were the seeds sown in the riverine region? Describe.

4) Which of the following is true or false?

    a) As discussed in *Baburnama* the Gurgaon-Jaipur stretch was a dry one.

    b) Poppy cultivation on wide scale only began in medieval India.

    c) Persian variety of pomegranate was better than the Jodhpur one.

    d) *Zayad* is an additional crop of short duration.

5) What was the basic objective of land classification in medieval period?

6) Medieval India was marked by a relative surge in irrigation devices. Explain.

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UNIT 10 AGRICULTURAL DIFFUSION AND REGIONAL SPECIFICITIES -II

Structure

10.0 INTRODUCTION

Agricultural diffusion in the peninsular India is a vexed issue. The antiquities of crops and cereals and the technology of agriculture and related practices is difficult to ascertain. The scholars have, debated the sources of stimuli. North Indian influences are either discarded or seem to have been adopted in a modified way. Environment and cultural response seems to have played a significant role in the choices made by early communities. Throughout proto-historic and early historic India such choices remained limited and agriculture could not attain an edge over other resource-use practices. The creation of agricultural infrastructure and the consequent spurt in agrarian expansion came with royal initiatives. The entire process was institutionalised and even the driest parts in peninsular India were agriculturally colonised.

This unit surveys several issues related to expansion of agriculture in various regions of peninsular India from the proto-historic times to the medieval period. This process of agricultural expansion was conditioned to a large extent by the opportunities that environment offered. We discuss here the agro-pastoral nature of pre-iron Age settlements and the uneven nature of agrarian growth in the Chalcolithic period. We also examine the heterogeneous character of megalithic subsistence patterns, the concept of ecological zones and co-existence and inter-relationship between them and the various facets of agrarian growth in wetland and mixed and dry zones in different regions of peninsular India.

10.1 PRE-IRON AGE SITUATION

The earliest pre-Iron Age agricultural settlements in the peninsular India were located in the semi-arid regions where agricultural cultivation had limited possibilities. Owing to sandy loamy soil and low rainfall the region was more conducive for development of pastoralism. In the states of Andhra Pradesh, Tamil Nadu and Karnataka the lower Godavari, Krishna, Tungabhadra, Pennar and Kaveri basin opened to agriculture in the third millennium BC. As the economy was marked by a variety of sustenance factors like millet farming, cattle and sheep pastoralism and hunting of wild animals, it can be called as an agro-pastoral economy. Ecology had important bearing on proto-historic developments, which were marked either by agrarian growth or lack of it. The first Chalcolithic cultures were found in the western and southern Deccan. In the region of Andhra a few well-documented sites like Nagarjunakonda and Kesarapalli are located in the coastal plains while the rare site of Chagtur is situated in the Mahbubnagar district of Telengana plateau.

10.1.1 Three-fold Classification

Bridget and Raymond Allchin, on the basis of the excavated sites provide us with a three-fold classification for the emergence of the settlements in the peninsular India. In the earliest settlements at Utnuru, Kupgal, Kodekal, Palvoy, Piklihal I, Maski I and Brahmagiri Ia, that are dated around 2500-1800 B.C., cattle husbandry played an important role. Here, ash mounds or cattle pens have been discovered. However, the presence of rubbing stones and querns at earliest levels indicate the processing of grain for food. These settlements were located on the top of granite hills or on levelled terraces or in the valleys between hills. The location of the settlements in the intermediate period continued to be more or less the same. The important sites for this period include Piklihal, Brahmagiri (parts Ia and Ib), Sanganakallu I, Tekkalakota I, Hallur IIa and T.Narsipur. The third phase includes the sites of Tekkalakota II, Hallur (layers 8-9), Piklihal, Sanganakallu 1.2, Brahmagiri and Paiyampalli. While metals like copper or bronze were not found at some of these sites in the earliest phase, the later phases showed enhanced use of metal and interaction with Chalcolithic cultures of central India and northern Deccan. These settlements were in proximity to streams and away from major watersheds. The soil types in the settlements included tropical black clays, tropical red and black sandy loam, ferruginous tropical soil and deltaic alluvium. Apart from the above-classified sites there were many other sites in the three physiographic regions of Andhra viz., coastal Andhra, Rayalaseema and Telengana besides Northern maidan of Karnataka and Sahyadris of Tamil Nadu.

10.1.2 Agro-pastoral Economy

The landscape ecology (topographical conditions, flora, soil variations and rainfall) along with archaeo-botanical and archaeo-zoological evidences of pre-Iron age settlements indicate the agro-pastoral nature of economy. Generally, areas with the potential of rain fed gravity flow irrigation were colonised. This colonisation was geared to the cultivation of millets and pulses. Of animal husbandry, cattle occupied prominence over sheep/goat. Ethno-historical studies have suggested that sheep/goat pastoralism branched off from millet farming-cum- pastoral stock. The early farming cultures moved in to the habitation of surviving late Mesolithic cultures and interacted with them. At some sites Neolithic-Chalcolithic cultural horizon is found to have overlapped with the Iron Age culture.

10.2 CHALCOLITHIC CULTURES OF DECCAN

The region of Deccan is not uniform. The various sub-regions are:

- Western Deccan with high altitude and strategic passes;
- Upland plateau of the central part;
- The fertile plains of eastern Deccan; and
- Mysore plateau and the upper reaches of Krishna-Tungabhadra plains in the Southern Deccan.

In this region, the archaeologists have extensively explored Chalcolithic cultures of Maharashtra. Here, the various chalcolithic cultures like Svalda, Daimabad, Malwa and Jorwe are dated between ca. 2300 B.C. and 900 B.C.

10.2.1 Environmental Variations and Agrarian Specificities

As far as environment is concerned, the region of Deccan is marked by features such as plateau like morphology, shallow stream valleys, basaltic rocks and chalcedony, agate, chert and jasper (varieties of quartz stone). As the rainfall variability is high, droughts occur frequently. The region abounds in black soil which has moisture retentive minerals. This moisture retentive quality of soil is seen as a boon for rain fed farming in the semi-arid regions. Except in the Tapi valley most streams have narrow flood plains. High flooding, migrating stream courses and the breaching of natural levees (a natural embankment built up by a river) do not affect the settlements in the Deccan plateau as much as they do in the Gangetic plains. It has delimiting impact on agriculture, as there is no fresh addition of alluvial soil and the dependence on monsoons becomes inevitable.

The Svalda sites are mostly found in the Tapi basin. Kaothe is an important excavated site of this culture, where dwelling pits have been found. In the courtyard of these dwelling pits, deeper pits are found which were probably used for storing grains. These dwellings also had make-shift kitchens. In the Tapi valley farmsteads have been identified at many sites. Located within a distance of three kilometers of major sites they lay in proximity to fields. It is postulated that semi-nomadic Chalcolithic people may have lived and practiced agriculture only during a certain season. Here, the evidence of crop production reveals cultivation of *bajra* - pearl millet (Pennisetum typhoids). Generally, the early farming cultures in central India and Deccan produced barley (Hordeum vulgare) whereas the Kaothe people were cultivating *bajra*. The succeeding Chalcolithic people did not cultivate it. Besides agriculture, the Kaothe society also practiced hunting and fishing. The Malwa culture spread in northern and central parts of Maharashtra in around

1700 B.C., primarily in search of fresh pastures. Inamgaon is an important excavated site of Malwa culture. The subsistence pattern of Malwa people indicates cultivation of barley besides domestication of animals and hunting of wild games. Jorwe culture can be considered as a representative Chalcolithic culture of Maharashtra and is spread over the entire state except the coastal strip on the west and Vidarbha region in the Northeast. Prakash in the Tapi valley, Daimabad in the Pravara – Godavari valley and Inamgaon in the Bhima valley constitute the major centres of this culture. However, the concentration of sites in these regions is not uniform. Here, the absence or presence of black cotton soil has been seen as an important determinant. As Tapi valley has the most fertile topography, highest density of sites is found here. Godavari basin, because of undaunting surface records a lesser density while the Bhima valley, more or less a rocky terrain with thin soil cover, has sporadic distribution and the minimum density.

Many early farming settlements have been found in the Khandesh region of the Tapi drainage. However, these are located mainly on the tributaries than on the main river. Because of erosion and bad land topography, irrigation and intensive cultivation is not possible here and so population concentration is not found on the banks of river Tapi. Pravara–Godavari valley in itself is also not uniform. While the upper reaches can support few farming settlements, the lower reaches have larger tracts of black soil. However, the settlement density in the lower reaches is not as high as in Tapi valley. In Bhima valley except for certain small patches at Chandoli, Songaon, Walki and Inamgaon, the whole of the basin is dry and does not contain large stretches of cultivable soil. According to Leshnik, the black cotton soil zone clearly represents an ecological adaptation dictated by available technology, knowledge and means. Except for the site of Walki evidence of plough cultivation is not found anywhere. It has been suggested that the large fissures that develop in summer in the fields help in circulation of air and serve the purposes of a plough and so is the old adage ‘the black cotton soil ploughs itself’. Antlers (each of the branched horns of a stag or deer) found at Inamgaon could also have been used as plough. Perforated stone disc used as weights for digging sticks have been found. The digging sticks were useful in burn and slash cultivation or jhum cultivation. After the forest was burnt, sowing and planting was done directly in to the ashes.

Crop production and plant economy is better attested in Malwa and Jorwe cultures at Inamgaon and Daimabad in comparison to other sites. Jorwe farmers practiced rotation of *kharif* and *rabi* crops. At Inamgaon, though the principal cereal was barley, cereals like wheat, rice, *jowar*, *kulith* (Dolichos lablab), and *ragi* (Eleusine coracana), green pea, lentil, green and black grams were also cultivated. The traces of an irrigation channel (extant length 118 m; 3.50 m deep in the middle, 4 m wide) and an embankment parallel to it, belonging to Jorwe culture suggests that it could be used as a narrow water tank and water could be diverted to adjoining fields by gravity flow. This irrigation channel is supposed to have helped in the cultivation of wheat and hyacinth bean. The channel probably fell into disuse after BC 1200 or so. Late Jorwe levels show decline of agriculture and rise in the weaning age. At Inamgaon is reported a rapid decrease of the quantity of charred grains with a simultaneous increase in animal bones.

10.2.2 Subsistence Pattern

Subsistence pattern of Chalcolithic cultures in Maharashtra shows some important features: farming; hunting-fishing; rearing of cattle, sheep/goat, buffalo and pigs;

except for the coastal strip, the semi-aridity of the whole region with an annual rainfall between 400-1000 mm; possibilities of artificial irrigation at Inamgaon; fertility and moisture retentive nature of black cotton soil and its self ploughing character. Though the Chalcolithic farming villages present evidence of early agrarian development, their scope was limited and they could never have an edge-technological or economic – over the pastoralists. The Jorwe farmers had to quit agriculture and opt for pastoralism instead.

10.3 ARCHAEOLOGY AND LITERATURE: IRON/MEGALITHIC AGE AND TAMIL ANTHOLOGIES

In peninsular India, several sites including those in the Northern Deccan show an overlapping of Neolithic-Chalcolithic cultural horizons with Iron Age levels. In this section we study the evidence surviving in literature and place it side-by-side with archaeological details.

10.3.1 Megalithic Distribution and Typology

Megalithic burials, strewn in almost the entire peninsula are generally associated with the Iron Age. However, these are not reported from western Deccan. In Andhra, Karimnagar has a large number of such burials. Some of the Megalithic sites in Maharashtra, Karnataka and Andhra Pradesh including the region of Deccan are T. Narasipur, Jadigenatalli, Ramapuram, Hallur (South Dharwar district), Chandrawalli, Brahmagiri, Maski, Nagarjunakonda (coastal Andhra), Yelleswaram (coastal Andhra), Hashampet, Khapa (Vidarbha region), Tekklaghat (Vidarbha region), Mahurjhari (Vidarbha region) and Ranjala. Megalithic burials reported from the Tamilakam region include Panparripu, Adichanallur (Tinnevelly district), Thirthu, Paravi Perumal Malai (Madura district), Pollachi, Porkalam (Trichur district), Kothapalayam, Pazhayannur, Singanallur, Kodumanal, Tirukkumbuliyur (Trichinapalli district), Alagarai (Trichinapalli district), Ariamedu, Muttarapalayam (near Pondicherry), Suttukkeni (near Pondicherry), Kadamaliaputtur, Perumbayur, Sanur (Chingleput district) and Amirthamangalam. Megalithic people used variety of methods for the burial of the dead. These can be classified as sepulchral (pits, chambers, legged, unlegged) and non-sepulchral (commemorative or memorial) types. The choice of a particular type depended on geological suitability and cultural response. Urn burials though widely distributed are quite common in eastern coastal plains. In Malabar Coast laterite small rock cut chambers have been found. Resources like water, minerals and arable land influenced such choices and had important bearing on megalithic settlements.

10.3.2 Agro-pastoral Economy

The megalithic burial sites were situated away from the habitation. Also owing to non-sedentary behaviour of the pastoral, semi-settled megalithic farmers, evidence for large identifiable habitation places has not been found. The resource constraint or conflicts with the neighbours seemed to have resulted in short periods of occupation and sporadic distribution of such sites. McIntosh has attributed the higher frequency of the grave sites in the early period to environmental deterioration and cultural response. Presence of some agricultural implements like iron axes (flat iron with crossed iron bands for hafting, pick axes), flanged spade, hoe, sickles etc., indicate the practice of agriculture. Some of the systematic archaeo-botanical investigations of megalithic sites have shown evidence of remains of rice, barley, wheat, millet, common pea, lentil, grass pea, horse gram, red gram, Indian jujube, etc.

The nature of subsistence economy of megalithic people has attracted the attention of a large number of scholars. Megalithic culture, which formed the agrarian background to emergence of historical places in deltaic Krishna-Godavari region, reveals only occasional occurrences of iron objects. The rise of urban centers in the lower Krishna is attributed to this agrarian background. In Telengana plateau the excavations generally attest prolific presence of iron implements that were related to increasing craft production. However, few sites in the plateau like Pochampadu and Peddabankur have also exposed agricultural implements. Because of non-availability of clear-cut patterns, the megalithic economy has been variously characterised as settled agrarian, pastoral nomadic, pastoral and agricultural or semi-sedentary agriculture. It has been suggested by some that this economy was a mixed one with predominance of pastoralism. In fact, one can visualise different subsistence strategies at work. It was possible that in the early phase pastoralism was dominant and in the later phase irrigated agriculture became more common in the riverine regions and new areas were colonised. Some Scholars have suggested that the megalithic black and red ware tradition witnessed population pressure, which coincided with the shift from highland, pastoral cultivation to deltaic paddy producing plough cultivation in Andhra and South India in the post-5th century BC.

10.3.3 *Tamilakkam*, *Sangam* Literature and the Ecological Concept of *Tinai*

Early Tamil anthologies or what is commonly known as *Sangam* literature contain several strata of Tamil compositions. The earliest and most archaic stratum is believed to belong to Iron Age. The region of *Tamilakkam*, i.e., the area broadly corresponding to modern day Tamil Nadu and Kerala, offers possibilities for studying various ecological zones and the natural determinants of modes of subsistence in the early historical period. The nature of agriculture in the *tinai* ranges from slash and burn cultivation of hills and forests *(kurinji*) to shifting cultivation and pastoralism of lower hills and lesser forests *(mullai)* to plough agriculture of riverine regions *(marutam)* to extremely limited possibilities of arid zones *(palai)* resulting in plundering and hunting activities. Several communities like hunters and food gatherers (*kadar*/*vetar*), cattle rearers (*ayars/idayars*), practitioners of shifting agriculture (*kuravar*), plunderers and cattle lifters (*maravars/kallars*), plough agriculturists (*ulavars/toluvars*), fishermen (*partavars*/ *valayars*) and salt manufacturers (*umanars*) existed in different and often overlapping ecological segments.

Instead of identifying and literally borrowing the contents of Tamil anthologies, social scientists are increasingly making attempts at realistic application of the concept of *tinai*. It is difficult to arrange a hierarchy or even segregate these physiographic divisions neatly and fix their chronological development. Both *kurinji* and *mullai* had cultivable slopes. The *tinais* represent micro-eco-zones which overlapped and provided opportunities for interaction. Consequently, macro-zones could be produced. In terms of human communities and material production overlapping segments were centres of their existence. According to Rajan Gurukkal, distribution of four forms of material production namely animal husbandry, shifting cultivation, petty commodity production and plough agriculture are archaeologically attested but their beginnings cannot be dated.

10.3.4 Plunder and Agriculture

Specifically, from agricultural point of view, the region of *Tamilakkam* could be further divided into *Vanpulam* (non-agricultural stretches) and *Manpulam* (riverine agricultural wetland). *Pura Nanru*, a Tamil anthology contains songs on slash and burn cultivation. As opposed to this, the agriculturists in the wetland area were aware of agrarian technologies like harnessing of bullocks at necks with a cross bar and Tamil anthologies make references to irrigation devices like tanks, minor dams and use of sluices. Animal power was also used for threshing and pounding. In the redistributive economy, cattle and grains were the common gift items though some expensive material gifts could also have been offered to the bards. In some studies, the meanings that cattle raids and plunder acquire in redistribution process of megalithic economy and their relationship with agriculture has been highlighted. Several concepts and terms like *vetci* (cattle raid), *karanti* (cattle rearing), *vanchi* (chieftain's attack), *kanchi* (defending the attack) and *tumpai* (preparing for a raid) attest to the plunder activities. In order to augment their resources, the chieftains of *Vanpulam* indulged in plunder activities. As compared to resource deprived *Vanpulam* chieftains, the chieftains of *Manpulam* owned large paddy fields and were prosperous. As is clear from songs and institutions described in *Pura Nanru,* the society idealised war and martial ethos. An inevitable and invariable consequence of such plunders was incessant trampling or putting of the paddy fields on fire. Cultivable fields were destroyed and the peasants always remained vulnerable to such attacks. Thus, in the redistributive economy plunders played a significant role. Though the society understood the significance of agricultural surplus for gaining prosperity and strength but the organisation of attack or the raising of the raiding army was not done on a permanent basis. In such a scenario advanced plough agriculture could not spread beyond riverine regions of Kaveri, Vaigai, Tamraparni and Periyar before the early medieval period. Though the technical know-how existed in *Tamilakkam* but because of plunder and redistribution and also lack of management and use of ideology or force to harness labour, the scope of agricultural practice remained limited.

The *Manpulam* sub-regions existed as islands in the larger landscapes of *Vanpulam*. It would be erroneous to assume that these sub-regions remained isolated and stagnant over time. The interaction between hilly tracts and riverine regions had transforming impact on semi-developed or un-developed eco-zones though the contradiction within economic infrastructure could not be totally done away with. The process of human adaptation was governed by social and environmental limitations. *Vanpulams* consisted of inhospitable arid and hilly areas besides pastures. Known as *enal* or *punam* these abounded in cultivation of millets and grams. As *Vanpulams* constituted of diverse ecological niches, subsistence economy could not have been uniform. Pastoralists–agriculturists who were engaged in animal husbandry and dry farming also practiced craft production. Similarly in the riverine areas artisanal categories could be supported by surplus generated from plough agriculture. People in *Vanpulam* depended on *Manpulam* for a variety of reasons viz., work for artisans, exchanging hill products with wetland agrarian products and marginal sections of *Vanpulam* society drawing sustenance in one form or other. Some exchange centres, *ankaati or avanam* are referred to in Tamil anthologies. Poems in *Pura Nanru* describe the exchange roots passing through inhospitable *Vanpulam* tracts. The common medium of exchange

MAP

was paddy and the required commodity was salt. This exchange was necessitated by differential access to resources. Though the degree and volume of foreign trade can be debated, the Tamil region was definitely a part of long distance exchange also. Items obtained from nature including agrarian products were exported from the Tamil land. These included pepper, ginger, cardamom, cloves, aromatics, and wood species like teak and sandal, cotton fabrics and precious and semi–precious stones.

10.4 EARLY STATE FORMATIONS AND AGRICULTURE

The process of state formation offers insights into development, interaction and integration of eco-zones in early peninsular India. Three major phases in the process of state formation have been identified in the Tamil region. In the proto-historic period developed micro-eco-zones ruled by clan-based chieftainships. These micro-zones were basically habitats of proto-historic communities. In the Tamil anthologies one finds, references to macro eco-zones, which were produced out of interaction among micro eco- zones. In the early historic period, these macro-eco-zones were integrated under the secondary state of Satavahanas. The Pallava period ushered a marked change in the organisation of agrarian production. While the warring chieftains were unable to use force on peasants for production in the earlier period, the *brahmanas* exhibited better management as a corporate body. The *brahmana* landowners efficiently managed the labour, both for agriculture and arts and craft. These *brahmanas* in the Pallava-Chola period, wielded power and status and as recipients of land endowments enjoyed several privileges over it. The warring strength of Pallava-Cholas is attributed to a developing peasant economy under the *brahmanas*.

Attempts to redefine nature of the Mauryan State have highlighted the unevenness of the constitutive elements of the empire. It is believed that the core metropolitan area initiated the process of conquest and control of diverse regions with differential access to the resources: an agricultural rich tract, mineral rich stretches and trade routes etc. Forest dwelling communities were either forcibly subdued or placated and tamed, depending upon possibilities of the relevant strategy. The state was faced with the need of agrarian surplus as well as forest produce. Agrarian surplus required forest clearance and colonisation of new areas. On the other hand, the forests were also to be protected for their material value. Thus, equilibrium had to be created between forest clearance and agrarian expansion. Whether or not the Mauryan State facilitated the diffusion of North Indian elements and ideology and provided the external impetus for secondary or pristine state formation under Satavahanas can be debated. The rule of the Satavahanas extended to Maharashtra, Karnataka and Andhra Pradesh, roughly corresponding to the commonly understood region of the Deccan. The region certainly had the potential and the productive capacity, which might have caught the attention of the metropolitan state of the Mauryas. The tribe of Andhras is mentioned along with many other tribes in the Ashokan Rock Edit XIII. The shift of iron epicentres outside the Gangetic belt and search for newer resource areas brought Ashoka to the peninsula. Consequently iron ores in the Deccan were tapped. The presence of Ashokan inscriptions in the gold mining areas of Karnataka further substantiates this point. Kautilya's *Arthasatra*, a text of political economy highlights the profitable nature of the southern trade route as it passed through gold mining areas and abounded in precious items like rubies, pearl and diamonds. The Mauryans established their provincial capital at Suvarnagiri (meaning gold mountains) in Karnataka. They issued their rock edicts in this area. Fertile alluvial plains of the Krishna-Godavari delta and the mineral rich Eastern Ghats facilitated the pre-state developments in Andhra. Similarly, the Southern Deccan had dispersed fertile pockets. However, not all the pockets of Deccan attest evidence pertaining to Mauryan contact. Though the iron was present in Deccan, it could not be used effectively for the agrarian expansion owing to certain ecological factors.

10.5 EARLY MEDIEVAL AGRARIAN DEVELOPMENTS

In the early medieval period, agrarian developments can be seen in Deccan plateau, Andhra plains, Tamil region and the coastal strip from Maharashtra down to Kerala. The peasant economy, which was confined in early peninsula only to *marutam,* did spread in to other eco-zones also. It has been suggested that the peasant society was getting organised. *Brahmadeyas* and the temples emerged as instruments of agrarian expansion. Creation of such institutions was accompanied with clearance of forests, construction of irrigation devices and management of cultivating labour in the areas, hitherto unknown for growth of agriculture. Agricultural infrastructure was increasingly being created. Whether the sponsorship of such infrastructure rested with the state, intermediary groups or the local autonomous bodies cannot be uniformly true for the whole of peninsula. What is certain is that agrarian expansion was a continuous process and the emergence of newer institutions facilitated the integration of the existing agrarian regions. Pallavas and Pandyas did adopt and modify North Indian elements to the specific agrarian situation of their regions. As implementers of stone sluice technology, they made major contribution to artificial irrigation.

10.5.1 *Nadus* and the Newer Instruments of Agrarian Integration

Nadus, which evolved out of peasant settlements, can be considered as basic agrarian units in early medieval Tamil land. Seen as peasant micro-regions, the antiquity of some of these can be dated back to the period of earliest Tamil anthologies. These agrarian entities owed their dynamism to interactions with the newer evolving institutions of agrarian expansion. In the early medieval centuries, their numbers rose in all the Tamil macro-regions. Different ecological zones differed in their access to utilisation of water resources. While the riverine regions like Kaveri delta necessitated the adoption of flood control mechanisms viz. embankments and canals, in the drier and upland areas, tank and reservoirs were constructed. The process of expansion was at times accompanied with conflict between different subsistence strategies, pastoralists and shifting cultivators clashing with plough cultivators. Depending upon the available technology, human initiatives and convergence of historical factors, the plains opened to agriculture in a phased manner. The process of such an expansion can be seen in Pallava region of Palar-Cheyyar valley and Pandya region of Vaigai-Tamraparni valley. By eleventh century, most of *Nadus* had emerged, the highest number being in the Kaveri valley. Although the term *Nadu* literally means cultivable land, it was generally applied to settlements irrespective of the degree and level of agrarian development. *Periya-nadu*, a supra-local organisation of agriculturists emerged in eleventh century A.D. in the drier areas North of Kaveri and continued to operate till the fourteenth century A.D. This organisation was more active in peripheral areas. Another division created by re-aligning *nadus* into larger units primarily for revenue purposes was *valanadu*. *Valanadus* were delineated on the basis of natural boundary markers like watercourses.

Brahmadeyas or land endowments to *brahmanas* were institutionalised in Andhra and Deccan at an early date i.e., fourth century A.D. while the Tamil region witnessed such developments only by the seventh century A.D. These endowments were located in virgin land or already cultivated land. In the Pallava-Pandya regions, the reservoirs with stone sluices were developed by the ruling class and maintained by local bodies known as *sabha* and the *ur*. These endowments were made in the vicinity of water bodies in all the *nadus*. The *nadus* under Pallavas evolved within *kottams*, pastoral-cum- agricultural regions. Studies on the temple distribution have revealed that during the Chola period there existed a relationship between agrarian expansion and temple ecology. Along with the *brahmadeyas*, temples emerged as important instrument for agrarian integration of various pockets like *nadus* and *kottams*.

10.5.2 Reclamation, Irrigation and Crop-production

Agrarian expansion in the early medieval period had three important dimensions:

- Horizontal expansion of cultivation through reclamation of diverse pocket, clearance of forests and clearance of forest and establishment of rural settlements;
- Creation of irrigation facilities; and
- Qualitative and quantitative increase in crop production.

Burton Stein identified three episodes of relatively stable agrarian integration in South India from the ninth to the nineteenth century. He writes, “In only one significant respect was there an important change – the relationship of cleared, cultivated land to forest. The reduction of forest and the expansion of regularly cultivated land was a continuous process… As in any developing tropical, agrarian system, the clearing of forest was one of the standard methods for expansion; this kind of change in environment may therefore be considered a regularised process in which the tempo of expansion is a factor of vital importance”. However, no uniform pattern is discernible in the whole of peninsula, although it is possible to speak of general developments. Not all the areas could be deforested for developing agrarian settlements. In the Eastern Ghats, the settlements in the dense forests with shrub-savannah and thorny thickets remained non-agricultural in nature. However, those on the foothills had natural catchments where tanks could be constructed with lesser efforts and agricultural activities could be carried out. It has been suggested that peasants themselves could do reclamation of virgin or wasteland within settled villages while forest clearance and creation of irrigational infrastructure was possible only through the above mentioned institutions like the *brahmadeya*s and the temples. The dynasty of Kadambas in Goa reclaimed forest and coastal land. The cleared coastal land was used for cultivation of rice. Skandasisya of the late Pallava period ordered the clearance of forests by burning and establishment of new village in the Salem district. Kakatiya rulers and their intermediaries in Andhra were credited with the forest clearance and reclamation in the Telangana plateau. There is a rich corpus of epigraphic data from the peninsular India substantiating the process of extension of cultivable tracts. The land endowment records mention several boundary markers like water bodies, plants and trees and forests, villages communities besides referring to land size productive capacity and the nature of soil.

Irrigation received special attention in the early medieval period. Development of sluice-weir in channels to draw water from tanks and rivers did not develop before the Pallava period. The sluice-weir of tanks, which began to develop from eighth century onwards, increased the agricultural productivity. In pre-Pallava times, surface irrigation or its modified techniques of *picottah* was a dominant practice. Another important development was the creation of channels from the rivers to feed the tanks. Inscriptions from various talukas of Karnataka attest the presence of such channels. While the technological changes were being introduced in the drainage system, the management of tanks for the purposes of de-silting, repair of broken sluices, or raising the capacity of storage necessitated the organisation of irrigation.

Developments in the drainage system were directly related to wet cultivable produce. Other crops, production of which increased in the early medieval period included extension of cultivation to wildly grown products, garden products, vine crops and several new crops. The surplus produce of wet rice could be used for short or long distance exchange or temple related rituals and services. Because of demographic pressure, varieties of millet like finger millet (*ragi*) and fox tail millet (*kanuga*) and certain inferior grains like *jowar* came to be cultivated on a large scale. Finger millet either came from Africa or could have been a native of Karnataka, from where it spread to Andhra Pradesh, Tamil Nadu and Maharashtra. The epigraphic charters instructed the peasants for mandatory cultivation of *ragi*. If the Tamil anthologies are believed, the production of sugarcane can be dated to early Christian centuries. A logical development was production of jaggery. The production of jaggery was a long drawn process and it assumed commercial proposition by the tenth AD. The increased cultivation of betel leaves (*tambula*) and areca nuts (*guvaka /puga*) in the eleventh century AD. has been linked to their ritual consumption in the temples. Regional studies on the western coast of Konkan have amply demonstrated the production of areca nuts on a commercial scale from the middle of the ninth century A.D. The western coast was also popular for production and trade of spices in general and black pepper in particular. Coconuts, widely known for their ritual status were introduced in the peninsula in the early Christian centuries. Orange was probably a native of Kashmir and was diffused in the peninsular India around tenth century AD. It was being cultivated in Karnataka before tenth century AD from where it was diffused to the Arab world.

10.5.3 Geo-polity and Agrarian Expansion

Geo-political context of important dynasties in the early medieval centuries provides useful insight in to agrarian specificities in the peninsular India. The core region of the Hoysala and the Kakatiya dynasty, located in the modern districts of Hassan and Mandya and Warangal respectively, recorded low rainfall- 30 inches per year upon which depended the generation of royal revenue. The proportion of high agriculture based on irrigation was about $1/5^{th}$ of sown acres in Hoysala Kingdom and $1/8^{th}$ in the Kakatiya dominion. The ratio of cultivated to non-cultivated land was less than half in both these regions. Pandyas and the Cholas, on the other hand, were located in the rich riverine plains providing extended zones of cultivation and were thus more densely populated. Tirunnelvely district under Pandyas exported grains, cotton, cotton clothes and bullocks to Malabar Coast. Vaigai basin in the fourteenth century imported money, coconuts and fish. Cholas used grain surplus to establish exchange relations extending up to Malaysia.

10.5.4 Eco-zones: Phased Opening of Agrarian Frontiers

Studies on settlement histories while taking cognizance of agrarian specificities in terms of environmental factors, crop and irrigation factors also highlight phased opening of agrarian frontiers at a regional or even a micro regional level. The process of the making of an agrarian region in early medieval Andhra brings out various facets of agrarian expansion. The proliferation of rural settlements in Andhra shows a phased agrarian expansion. Though the agricultural activities continued in various pockets since early time, the qualitative and quantitative expansion did not take place before early medieval period. Coastal Andhra formed a paddy monoculture. In the pre-10th century A.D. dynasties like Eastern Chalukyas did not venture into Rayalaseema and Telengana as they were governed by the 'high revenue yielding area' factor. Environmental setting of Telengana and Rayalaseema was not conducive for the growth of agriculture. In Telengana the rainfall was uncertain and the soil could not retain moisture. In this region Kakatiyas promoted agriculture through construction of large tanks and reclamation of land in the districts of Khammam, Mahbubnagar, Nalgonda and Warangal. Though the process of reclamation also continued in the Rayalaseema districts like Cuddapah, Kurnool and Chitoor, the region as a whole lagged behind and did not open to agriculture on a considerable scale before the Vijayanagara period. Production of dry crops in Rayalaseema is attested by the epigraphic references to *nela*, *chenu*, *polam* and *varipolamu*. The hero stones found in Cudappah, Chitoor and Anantpur districts belonged to the heroes who sacrificed their lives in cattle raids. However, in the medieval period we have instances of women sacrificing their lives in their attempt to close breaches in the tank bunds. Anantasagaram tank in Anantpur district reveals one such story. Within Andhra, the coastal area has been characterized as a wet ecological zone, Telengana a mixed ecological zone and Rayalaseema as the region of dry farming. However, exceptions existed in all these ecological zones. In the coastal region, Eastern lowland border stood in contrast to the elevated Western position. In Telengana, the central and the eastern part witnessed steady rise in tank construction. Red soil could become productive only with the wet cultivation. In the Rayalaseema region, Cuddapah despite being the hilliest area opened early to agriculture because of its basins at the confluence of Krishna and Tungabhadra rivers. Anantpur and Kurnool developed last. The epics of *Palnativirula Katha* and *Katamaraju Katha* point out to limitations of fragile ecology and the conflict between different subsistence methods over resource-use. Palnadu country, identified within the modern state of Guntur, acted as a buffer zone and had a geographical identity of its own. Here, the staple crops were sorghum and millet. The epic of *Katamaraju Katha* describes the conflict between migrant pastoralists and agriculturists in the fourteenth century.

In Salem district (Tamil Nadu), an arid region in the Northwestern part, two phases of agrarian expansion in the river valley have been identified between 10th and mid 14th century AD. However, in the mid 16th century even the driest portion of Salem was also opened to agriculture. In a study of Tirunnelvely, specifically from agricultural point of view, three ecological zones viz., the wet, the mixed and the dry, have been identified. The wet zones were established by 1000 A.D. The dry zone depended on the mercy of rains, was favourable only to cultivation of millet. This zone, rich in black and sandy soil was colonised in the fourteenth century A.D with migrants from other places including Andhra hinterland. The mixed zone abounding in elevation and red soil had moderate rainfall. Here, the slopes facilitated the construction of reservoir type tanks. As mentioned above, such terrains also facilitated the construction of large tanks elsewhere. Ramappa lake in Mulug taluk of Warangal district was similarly surrounded by hills on three sides and its bund on one side had a height of 56 feet and a length of 2000 feet. In the Narsampet taluk of the same district, Pakala lake had a dam made up of laterite pebble and earth, about one and a half kms. long from which 40 channels were created. The process of proliferation of rural settlements and emergence of agrarian regions, which began on a considerable scale under the dynasties of Hoysalas, the Kakatiyas, and Pandya-Cholas, was really accelerated in the 16th century Vijayanagra period. New agricultural frontiers were opened in the drier upland stretches and market oriented production of cash crops like cotton and indigo began. Settlement studies, which classify phased developments in various eco-zones, do not exhaust the possibilities of variations. Also, environmental determinism may relegate the human factor to a status of passive recipient of agrarian changes. Traditions in the region of the Deccan contain the motif of construction of settlements and resettlements. It is recorded that the Karahada region in Southern Maharashtra in 14th –15th century AD suffered a famine for twelve years after which it was ruled by pastoralists till its re-colonisation by Adil Patsah of Bidar.

10.6 SUMMARY

As the earliest pre-iron Age agricultural economy was marked by a variety of sustenance factors like millet farming, cattle and sheep pastoralism and hunting of wild animals, it can be called as an agro-pastoral economy. The agro-pastoral nature of economy continued throughout the chalcolithic cultures. Studies have demonstrated the importance of black cotton soil to the uneven agricultural growth in the Chalcolithic Deccan. Because of non-availability of clear-cut patterns, the megalithic/iron economy has been variously characterized as settled agrarian, pastoral nomadic, pastoral and agricultural or semi-sedentary agriculture. In the early phase pastoralism was dominant and in the later phase irrigated agriculture became more common in the riverine regions and new areas were colonized. Sangam literature contains various references to ecological segments, their interaction and possibilities of agricultural development. However, agriculture in proto-historic period did not acquire prominence over other subsistence strategies. With the process of state formation and increased interest in generation of agricultural surplus, agrarian expansion received new impetus. Early and later medieval was marked by newly emerging instruments of agrarian expansion, creation of agricultural infrastructure and opening of even dry areas to agriculture.

10.7 EXERCISES

1) What do you understand by the adage ‘the black cotton soil ploughs itself’? Describe briefly.

2) Irrigated agriculture followed the pastoral economy in the megalithic age. Comment.

3) Why did agriculture remain confined to *Manpulams* in the *Tamilakkam* region? Disucss.

4) Mark the statements given below as right or wrong:

   a) *Nadus* evolved out of trading settlements.

b) Production of jaggery assumed commercial propositions by 10th century A.D.

c) Arabs introduced Orange in the peninsular India.

d) The physiographic region of Rayalaseema was last to open to agriculture in medieval Andhra.

5) What are the three dimensions of agrarian expansion in the peninsula in the early medieval period? Describe

6) How have the eco-zones been classified? Substantiate your answer with example of Salem district of Tamil Nadu.

10.8 SUGGESTED READING

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UNIT 11 ENERGY RESOURCES

Structure

11.0 INTRODUCTION

As we have explained in the introductory passages given at the beginning of this Block several fresh possibilities of appropriating environmental resources emerged as sedentary societies based on agriculture began to settle. The foremost among these related to energy resources. New forms of energy resources were discovered by the societies and energy consumption on an ever increasing scale became a uniform practice. The appropriation of energy resources depended on the availability of different forms of energy as also on the accessibility of the sources of these forms. It was also directly related with the pattern of consumption of energy by different societies which obviously showed a diversity adapted to the stratified social structure.

The historical information on energy resources for pre-industrial societies is thin and so is the case with the patterns of energy consumption. Yet we have attempted to weave a narrative based on this evidence that describes the forms of energy resources and the pattern of energy consumption as it evolved historically. In addition, details on the imperative of conservation have also been included. You will find the Unit interesting since it opens before you a relatively less explored and discussed subject. We recommend that you pay attention to the relationship that specific environmental conditions obtaining in India had with the appropriation of energy resources. It will help you understand better the next Block (5), on **Indian Philosophy and Environment** and help you place colonial policy with regard to environmental resources (discussed in **Block 6**) in the correct perspective.

11.1 FORMS OF ENERGY

Energy is generally understood to carry the meaning of the source of strength that is necessary for performing various kinds of activities. Most of the forms of energy are shapeless and not easy to be subjected to physical verification. They can be verified mostly in terms of the work performed with their support. The word energy is derived from the Greek *energeia* which is made up of *en*, "in" and *ergon* meaning "work". Evidently its meaning centres around the work done by using energy. The idea of energy in the above sense goes back to Galileo in the seventeenth century. He recognised that in lifting weight the force that was applied was in fact a form of energy. The idea was further developed by Newton who suggested that the quantum of force applied on an object was associated with the acceleration gained by that object.

The forms of energy broadly range between inanimate natural forms and animate forms of energy; and when we step on the industrial societies electrical and nuclear forms add up. Humans and animals perform work with the help of their physical energy. This is the simplest form of animate energy. Similarly natural or inanimate forms of energy are located in most of the physical matters. They are available at the primary level in the form of solar energy and wind and water energy and at the secondary level in the form of thermal, mechanical and chemical energy.

It is, however, difficult to enumerate all the various kinds of energy. The sources of energy are visible, but the energy itself is transitory, recognisable through the process of activity generated by it. Therefore in our attempt to identify the forms of energy we are greatly helped if we focus our attention on the sources of energy. The forms, as we have said above, are closely connected with the sources; it is easier to recognise the sources which are more tangible in character. The sources of energy can be broadly divided into two categories more or less compatible with the two main forms of energy: first being animate sources of energy and the second, inanimate sources of energy.

For a very long span of time in history, barring the energy emitted by sun, humans have depended upon the animate sources of energy. In the initial stages of development human physical power was considered as the primary source of energy. For all those long centuries of human existence when agriculture had not developed and hunting-gathering activities were the principal mode of living the physical prowess of the humans was the principal source of energy. This prowess was augmented with the help of stone tools and implements that were manufactured under an organised method. We have read in Block 2 how stone tools and implements were continuously upgraded and diversified. The effort obviously was to sharpen the human physical energy and carefully segregate most of the work done for a differential use of energy to be applied to them. The detailed classification of stone tools into core and flake tools and into microlithic tools of various kinds bears ample testimony to this effort.

Mention may be made here of a mechanical device called spring which accumulates energy and releases it suddenly when required. Its first known use, and of continuing importance was in the bow used to shoot arrows in hunting and in battle. The first unequivocal representation of it, dating back from later Paleolithic times, is from North Africa. However, the effectiveness of the simple bow was limited by the strength of the arms of humans who would use the device.

Next to be utilised by the humans was perhaps the animal energy. The domestication of wild animals was a major advance in the field of the use of energy resource. The details on the emergence of pastoral practices have been given in Block 2. Animals as the source of energy were utilised in numerous spheres of life. They were also an important source of food for the humans. Animal power was harnessed for use as draught power to be utilised in agriculture. You have already read in Block 2 about the symbiotic relationship that had developed between the nomadic pastoralists and the settled agriculturists. The utility of animal power had become so evident to agriculturists that in peninsular India the Neolithic sites (mid-third millennium BC) from their inception exhibited a high imperative of large number of livestock maintaining (Cf. *Archaeology and Interactive Disciplines, op.cit,* p.166). Animals provided the energy for the transportation purposes right upto the beginning of the mechanised modes of haulage. One of the earliest references of this kind of energy harness is available in the rock paintings at Morhana Pahar near Mirzapur in Uttar Pradesh. There two chariots have been shown drawn by two and six horses respectively. You must have read about this pictorial evidence in Block 2 where it has been described at length. Another important area where animals supplied energy was in the field of irrigation/water lifting devices. Similarly cow also provided cow-dung, extensively used to fire the hearth. Human as well as animal excretion has been extensively used in the fields as fertiliser to increase the agricultural production.

Early humans first made controlled use of an external inanimate energy source when they discovered the use of fire. Burning dried plant matter and animal waste, they employed the energy from this biomass for heating and cooking. For the heating purposes humans were greatly dependent upon the forest resources. The forest resources were also extensively used as raw material for various other purposes such as housing, and the making of furniture, carts, agricultural tools, musical instruments and numerous other handicrafts. Wood has been an integral component of human housing since ancient times. Even in the mud houses roofs were usually made of wood. The necessity for wood was greater in the absence of technological support. The demand for forest resources for this kind of activity kept on growing with the increase in the population and material development of human societies.

In humanity's early attempt to harness inanimate, natural forms of energy, water occupies a central position. Besides being a key life sustaining resource for most of the living beings including humans, the irrigation potential of water for sustaining agriculture had also been discovered fairly early. The first civilization in India as also elsewhere in the world was riparian in character. But we shall discuss this and the other aspects of the appropriation of water as an environmental resource in the next unit. Here we are concerned with the use of water as an important energy resource. Not much early evidence on this matter has been garnered. We may however speculate that the flow of water in major streams and rivers would have been used for transporting the large tree trunks and logs from one place to the other. This practice has been in use even today. A greater use of water energy however become possible after the development of a few mechanical devices that were energy saving by themselves. Perhaps the earliest use of water in this fashion was in driving waterwheels. In the hilly regions of India and in similar terrain elsewhere too, the flour mills are even today driven with the help of waterwheels.

It was with an increased use of contrivances and mechanical devices that the era of uncontrolled exploitation of inanimate sources of energy began. Most of the natural inanimate resources were now harnessed. The pressure on them gradually increased and the stage of exploitation began endangering the existence of most of the natural resources. All this, however, relates with the onset of modern age. We shall discuss these developments in Block 6 and Block 7.

11.2 ENERGY CONSUMPTION: HISTORICAL PATTERNS

It can be conveniently argued that the social evolution of humans has been closely tracked by developments in similar manner in the levels and patterns of energy consumption. In the early stages of human society the nature of energy consumption was more or less equal in terms of its horizontal and vertical expanse. The levels of energy consumption had remained confined to bare necessities and the possibilities of surplus retention were very limited. Most of the demands for energy by these societies were available in the form of food procurable locally. It was with the growth of agriculture on the one hand and the domestication of animals on the other hand that the need for newer sources of energy arose and the consumption of energy multiplied. The most important change was in the basic source of energy: manpower was gradually replaced, first by the power of draught animals. Donkey-driven mills were employed as early as the fifth century BC to crush ore from the silver mines at Laurion, and their use had extended to the grinding of corn in Greece by about 300 BC.

The next major development was the use of the water and wind energy. One of the most important uses of water energy was in agriculture for irrigation purposes. The distribution of water to cultivated fields through channels has been an old practice. An early evidence pertaining to irrigation of this type relates to Mesopotamia and dates back to about eighth century BC. This irrigation was helped by the proximity of the Tigris and the Euphrates, which assured a constant supply of water. As described by Seton Lloyd, "Almost the whole of the alluvial plain is capable of being prodigiously fertile agricultural land; and a great part of it has clearly at one time or another been under cultivation. Evidence of this is the profuse network of ancient irrigation canals, now abandoned, whose spoil-banks, like parallel ranges of small hills, run far out into the plain beyond the scanty farmlands of the present day" (*Foundations in the Dust, The Story of Mesopotamian Exploration,* Thames and Hudson, London, Revised 1980, p. 23).

The evidnece from Harappan settlement suggests that small **bunds** were erected across the rivers to use the flow energy of water for spreading fresh alluvial soil along the banks. This soil was then used as agricultural field. The knowledge of the Harappans about water energy is further supported by the discovery of the famous dock-yard at Lothal. It points to the fact that knowledge relating to the tidal currents was tactfully used in creating the dock so that ships could come in with flow-tides and could go out into the sea with ebb-tides (Cf. S.R. Rao, *Lothal, A Harappan Port Town*, Vol. I, A.S.I., New Delhi, 1979, pp. 123-132).

A very early use of water energy was in driving wheels. The evidence relates to about second or first century BC in Egypt. The wheel was submerged in running water which made it turn. This rotary movement was transferred via a fixed axle to a flat millstone. This type of mill was used for grinding cereals or oil-producing plants. In fact this was the stage when natural energy and mechanical contrivances were combined. This gave a remarkable boost to the use of energy as it enhanced its driving power substantially.

The early waterwheels, first used to drive mills for grinding grain, were subsequently adopted to drive sawmills and pumps, to provide the bellow action for furnaces and forces, to drive tilt hammers or trip-hammers for forging iron, and to provide direct mechanical power for industrial mills. Until the development of steam power during the industrial revolution waterwheels were the primary means of mechanical power production, rivalled only occasionally by wind mills. Thus, many industrial towns sprang up at locations where water flow was perennial. In an old reference to a watermill dating back to about 85 BC, appearing in a poem by an early Greek writer, the liberation from toil of the young women who operated the querns (primitive hand-mills) for grinding corn was celebrated. According to Greek geographer Strabo, King Mitheradates VI of Pontus in Asia used a hydraulic machine, presumably a watermill, by about 65 BC. Early vertical-shaft water mills that drove querns were known in China by first century AD, and were used throughout Europe by the end of the third century. A horizontal-shaft water mill was first described by the Roman architect and engineer Vitruvius about 27 BC. The Roman mills were adopted throughout much of medieval Europe and waterwheels of increasing size were made almost entirely of wood. In addition to flowing stream water, ocean tides were also used though rarely to drive waterwheels.

Like watermills, windmills were among the original prime movers that replaced animal muscle as a source of energy. They were used for centuries in various parts of the world, converting the energy of the wind into mechanical energy for grinding grain, pumping water, and draining lowland areas. The first known wind device was described by Hero of Alexendria (c. first century AD). The earliest known references to wind-driven grain mills, found in Arabic writings of the ninth century AD, refer to a Persian millwright of AD 644, although windmills may actually have been used earlier.

One of the limitations of both the waterwheel and the windmills was that it was usually necessary for the power they generated to be utilised on the spot. There were, nevertheless, systems for transmitting power over land, often for considerable distance, but the power-loss must have been much.

As with waterwheel, it is difficult to estimate the power output of windmills. A large Dutch windmill of the eighteenth century, with a 100 feet (approx. 30 metres) sail-span, probably generated about 10 horse power (h.p.) in a 20 miles per hour wind speed. Smaller mills, with a 24 ft (approximately 7 m.) span, probably yielded about 5 h.p. Theoretical considerations show that the windmill in its traditional form could not, at best, yield more than 30 h.p. It was not, therefore, a powerful prime-mover by modern standards, and a substantial proportion of such power as it did develop must have been dissipated in the clumsy transmission system, even after iron gearing had been introduced.

The foundations for the use of steam power are often traced to the experimental work of the French physicist Denis Papin. In 1679 Papin invented a type of pressure cooker, a closed vessel with a tightly fitting lid that confined steam until high pressure was generated. It was given more efficient and workable form by a Scottish instrument maker James Watt in 1765 who developed a steam engine. Although far more difficult to build, Watt's rotative engine opened up an entirely new field of applications; it enabled the steam engine to be used to operate rotary machines in factories and cotton mills.

Other important development with regard to energy utilisation had been the discovery of a device by Michael Faraday who converted mechanical energy into electric energy. This led to the development of electric generators whereby thermal energy was used to power the mechanical energy and in turn generate electric energy. The greatest advantage with the electric energy has been the possibility of transmission of energy to distant places from the source of its generation. Similarly another major energy resource has been the nuclear energy which has a great potential.

11.3 CONSERVATION

The concept of energy conservation is related with the theory that the energy remains constant and it only changes its form. The conservation of energy is not a description of any process going on in nature, but rather it is a statement that the quantity called energy remains constant regardless of when it is evaluated. The law of conservation of energy can be applied not only with regard to nature, but to any isolated system as well. Energy exists in various forms and is convertible to one-another within the constraints of conservation law. These different forms of energy include thermal, kinetic, gravitational, chemical, nuclear, radiant, electric, mass energy, etc. It is the universal applicability of the concept of energy, as well as the completeness of the law of its conservation within different forms, that makes it so attractive and useful. However, one must remember that all the forms of energy are still not in control of the humans. Most of the energy we consume has led to increase in the other unwarranted forms of energy. The most visible example can be the uncontrolled consumption of combustion energy which has led to increase in the chemical energy causing Ozone depletion. Therefore it is necessary to realise the spirit of the law of conservation of energy and either control over-consumption of energy or develop other non-conventional sources of energy.

Most of the energy resources consumed by humanity are exhaustible and non-renewable therefore it is necessary to be prudent in one's consumption of finite sources of energy. At the same time, we must realise that there are several renewable sources of energy and it is suggested to develop the technology to harness the potential that is going waste.

11.4 SUMMARY

The analysis of energy resources attempted here suggests a possible relationship between social stratification and the pattern of consumption. Along with the changes in the patterns of consumption of energy we can also trace the changes in the source of energy. In the beginning, the primary source of energy had been the plants, animals and humans themselves. Subsequently the inert potential of the land energy was harnessed by the humans and soon the potential of various minerals as sources of energy was also harnessed. The trend of greater energy consumption continued with the growth of urbanisation witnessed during the emergence of civilisations across the world. This phase onwards, crystallisation of social stratification led to a variation in the energy consumption across the different sections of the society. Hereafter and until the advent of industrial revolution the consumption of energy varied vertically, whereas it remained more or less similar horizontally. The pattern of energy consumption witnessed, radical changes with the emergence and growth of industrial revolution. Industrial revolution provides a paradigm shift in the nature of energy sources, and the process of appropriation and distribution of energy resources. The changes introduced during and after the industrial revolution have been very rapid and have resulted into a serious deterioration of our environment. The loss of forests, pollution of water and air are some of the manifestations of the change in the sources of energy.

11.5 EXERCISES

1) How do you distinguish between animate and inanimate forms of energy? Discuss briefly their historical evolution.

2) Write a note on the historical patterns of energy consumption.

11.6 SUGGESTED READING

T.K. Derry & Trevor I Williams, *A Short History of Technology*, Oxford, 1960.

Maurice Daumas, ed. (tr. Eilean B. Hennessy), *A History of Technology & Invention*, Vol I: 'The Origins of Technological Civilization', Bombay, Eng. Tr. 1969.

S.R. Rao, *Lothal, A Harappan Port Town*, Vol. I, A.S.I., New Delhi, 1979.

UNIT 12 WATER RESOURCES

Structure

12.1 INTRODUCTION

The earth is sometimes called the watery planet as this is the only member in our solar system which has an abundant supply of water. Water is used as a raw material for various metabolic processes. It is an important ecological factor. It is also a very good solvent medium and has sustained life on earth ever since the biological origins of the living organisms. Water as a resource has been known to humans since the remotest past and has been used by them as an essential life-supporting ingredient. We propose to study resource-use practices pertaining to water. The Unit also proposes to analyse the various traditional methods of water conservation as practiced by human societies.Utilisation patterns adopted by various civilisations of the world which kept on changing with the developments in the technology for better appropriation of water and with the growing demand of water for various developmental activities is also our concern. Finally, we also examine the issue of water rights in the historical perspective along with the theoretical propositions connected with water rights in the Unit.

12.1 WATER AS A RESOURCE

Water is one of the important substances necessary for life. Water covers about 75% of the earth's surface, occurring in lakes, rivers, and oceans. The oceans alone contain 97% of all the water on earth. Much of the remainder is frozen in glaciers and frozen ice. Hardly 1% water constitutes ice-free fresh water in rivers, lakes, ponds, etc. It is this negligible amount of total available water that sustains all forms of terrestrial and aquatic life. There are subterranean reserves of water at very deep levels and also at shallow depths trapped in the soils. This trapped water is very useful for agricultural production and even for direct human use. The use of water as a resource has focused on this small amount. It has also been guided by some of the properties of water which we discuss below.

12.1.1 Properties & Distribution

Water in its' fluid form does not exist on any other planet in our solar system and is thus an exclusive privilege available to the inhabitants of planet earth. Only at a certain distance from the sun do we find the right temperatures that permit water to exist in liquid form. The other unique property connected with water is that it becomes most dense as temperature falls to plus 4° centigrade. If it were at its heaviest at freezing point then our lakes and waterways would freeze from the bottom up, jeopardising fish and other aquatic life. Water has surface tension and great capillarity, that is, the ability to rise in narrow tubes. This makes it possible for water to defy the laws of gravity and remain at the surface of the earth where plants can absorb it through the roots. Water is also one of the world's most important sources of energy. Inexpensive, non-polluting, hydroelectric power is a boon to all. Water dissolves salts of various kinds; it can also emulsify indissoluble substances. Blood and lymph are both water solutions which supply body tissues with nutrients and obligingly remove waste from cells. Plants also get the nutrients they need via water based salt solutions.

These properties also have some disadvantages. The same water also dissolves pollutants, acidifying our lakes and waterways and poisoning living organisms. It also spreads disease in flora and fauna. Though water is considered a renewable resource it is finite and governed by a natural water cycle.

The stable water supply of earth is used again and again in this cycle. About one third of all solar energy is dissipated in driving the water cycle. Sun makes water evaporate from the oceans, lakes and streams. This evaporation forms clouds which fall back on earth in the form of water or snow. Some of this water percolates through the soil until it reaches saturation point. Rest of the water returns to its origin point. This whole process of evaporation, condensation and rains is known as water cycle. This cycle keeps replenishing the water requirements of the world.

The global distribution of water shows that only 35% of the total quantity is fresh water, which is available in various forms. The following chart will explain this:

Form	% of fresh water
Frozen	80
Ground	19.7
Lakes	0.2
Rivers	0.02
Soil	0.04
Atmosphere	0.02
Biological	0.001

Water resources can be classified in two groups: a) surface water resources, b) ground water resources. India has a total of 1122 cubic km of water of which 690 cubic km is surface water and 432 cubic km is ground water, and it is unequally distributed.

India is a country of rivers. There are 12 major rivers with the total catchment area of 252.8 million hectare (m.ha.). Tanks and ponds have around 2.9 m. ha. area, reservoirs have around 2.1 m. ha. area, where as smaller rivers and canals occupy 7 m. ha. area. Most of the area under tanks and ponds are located in southern states of Andhara Pradesh, Karnataka, Tamil Nadu, followed by West Bengal, Rajasthan and Uttar Pradesh accounting for almost 62% of the total. In the case of reservoirs, Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttar Pradesh dominate. Orissa ranks first as far as brackish water is concerned and followed by Gujarat, Kerala and West Bengal. The annual precipitation including snowfall which is the main source of the water in country is estimated to be around 4000 cubic km. The resource potential of rainfall for the country is estimated to be around 1869 cubic km. Clearly, the water resources are thus unequally distributed over the country. Further if we consider the average availability it is 2208 cubic meter per capita annually. Average availability in Brahmaputra is as high as 16589 cubic meter while it is as low as 360 cubic meter in Sabarmati basin. Any situation of availability of less than 1000 cubic meter is considered as scarcity situation.

The ground water situation in different parts of the country is as varied as the surface water situation. In the high relief areas of the northern and north-eastern regions occupied by the Himalayan ranges, the various hill ranges of Rajasthan, the central and southern Indian regions, the presence of very steep slope conditions and geologic structures offer extremely high run-off and thus very little scope for rain water to find favourable conditions of storage and circulation as ground water. The large alluvial tract extending over 2000 km, known as Sindhu-Ganga-Brahmaputra plains is the most potential region as far as ground water resources are concerned. Almost the entire central and southern India is occupied by a variety of hard rocks with hard sediments in the inter-tectonic and major river basins. Rugged topography, hard and compact nature of rock formations, the geological structures and metrological conditions have yielded an environment which allows ground water to store itself in the weathered residuum. It is a potential region for ground water development. The coastal and deltaic tracts, particularly of the East Coast, are caused by vast and extensive alluvial sediments and are very productive in terms of water availability but in the vicinity of coasts suffer from salinity.

12.1.2 Resource Use

As water is an essential condition of life on this planet, water resources have been a decisive factor in the growth and sustenance of human civilisation since ancient past. All the early civilisations were distinctively and predominantly riparian. Prime examples of ancient river valley civilisation of the world are Egyptian civilisation in the Nile valley, the Mesopotamian civilisation in the valleys of the rivers Tigris and Euphrates, the Harrapan civilisation in the Indus valley and the Chinese civilisation in the Hwang-

Ho valley. Harness of water from natural resources and its careful use in agriculture and other activities is a hallmark of these civilizations. Archaeological evidence shows that certain engineering measures were also adopted to enhance as well as sustain water resources.

As we step on a period of history for which written records become available we get regularly occurring information on the use of water as a resource and methods employed to use this resource in the most beneficial manner. Reservoirs are made, embankments are raised, wells are dug up, channels created for transporting water to desired destinations and devices invented for utilising the various properties of water. The written records are replete with such information and a sizeable number of structures have survived the ravages of time to surprise us by their ingenuity even today. The evidence is rich and dense and any efforts at listing all of them are likely to use a huge space. We shall attempt a random recall which is also likely to be a rewarding exercise.

We can begin by recalling some of the characteristic features, related with the use of water as a resource, of the first civilization on the Indian sub-continent. The environmental settings were arid or semi-arid. The importance of water as a resource was clearly understood. The habitation sites were selected with a lot of care so that deposit of good alluvium soil for agriculture resulting from seasonal floods was regularly available. Canals were excavated in the river basin to take water to agricultural fields. A canal of this type has been traced near Shortughai drawing water from Kokcha river (Irfan Habib. *The Indus Civilization*, p. 25). The wells were made for use by individual households that seldom changed their location – the earliest evidence of the exploitation of ground water. Drainage was carefully planned so that the waste did not pollute the fresh sources of water. Towns like Dholavira, surrounded by brackish water, paid great attention to water storage. “In its heyday, the entire city might have looked like a lake city or a *jala durga* (waterfort). The area reserved for the tanks was immense, approximately 750 m. in length and the southern and northern margins, while the width varied from 70 to 80 m. In the west, the tank area was about 590 m. In the south-eastern area, for example, the reservoir covered about 5 ha (hectare), the largest within the walled area. The walls acted as effective bunds. Both faces of the wall were plastered with fairly water-repelling sticky clay. Special and vulnerable areas, mostly on the exterior face, were vencesed with hammer-dressed stones.

Keeping in mind the general slope of the city, several bunds were constructed across the width of the tanks to reduce the pressure of the stored water body on the city walls. The bunds also served as conseways for easier movement. In times of scanty rainfall, they enabled the water to get stored in selected tanks instead of being spread out over a large area and reduced quickly by evaporation and seepage. In the area designated as the citadel, an interesting networks of drains, both small and large, was discovered. Most of the drains intersect each other and ultimately link up with an arterial drain.

The entire drainage system could have been set up to assiduously conserve every drop of rainwater that fell in the city. The water must have been a treasured commodity in an area lacking in perennial source of surface water and where the ground-water, largely brackish and saline, tends to dry up during droughts" (J.P. Joshi, R.S. Bisht, *India and the Indus Civilisation*, New Delhi, 1994, p. 31).

The importance of water for agricultural societies during the Vedic period must have increased. Flow of water in channels for irrigation purpose was practiced. There are references to artificial waterways — *kulya* and *khanitrima apah* — in Rig Veda. These perhaps refer to irrigation channels. The other expressions used for the same device are *Sushira* and *Soormi*. Wells – *avat* – were dug up. Lifting devices to draw water from the wells were also in use, called *ansatrakosh* and *ashmchakra*. These were probably composed of a leather bucket drawn over a pulley for lifting water from the wells (Cf. G.C. Pandey, *Vaidic Sanskriti*, Allahabad, 2001, p. 263; R.C. Majumdar, ed. *The Vedic Age*, Bombay, 1951, p. 403).

Mauryans, as the founder of one of the earliest empires, gave special importance to water resources. On the authority of Kautilya we know that the building of reservoirs by damming streams was an important public work the king was encouraged to construct. Similarly Ashoka refers in his edicts to the construction of wells and watering-places along the major routes. The epigraphic evidence testifies to the construction of a big reservoir of water by damming a stream in the Junagarh district of Gujarat by Pushyagupta, the governor of the region during Chandragupta Maurya's reign. The reservoir was named as Sudarshan. Under Asoka his Greek governor Tushasf maintained the dam and the reservoir. In AD 150 there occurred a breach in the dam which was repaired by Rudradaman. The dam seems to have been maintained till the fifth century AD when the last known repairs were carried out by Parndatt during the reign of Skandagupta, in AD 457-8. (Cf. P.K. Majumdar, *Bharat ke Prachin Abhilekh*, Delhi, undated, pp. 109-115 & 149-158).

Since medieval India was also a largely agricultural society, the resource-use practice with regard to water was basically geared at providing irrigation to the fields. Besides using most of the prevalent methods, a few new techniques were introduced during this period. The prominent among them were *arghatta* and *arhat* (Persian wheel), which improved irrigation significantly.

In the 14th century a very elaborate network of canals was constructed by Firuz Tughlaq. The rivers from which the canals were cut were Yamuna, Sutlej and Ghagghar. An additional water tax was levied on the farmers of the irrigated areas. Due to greater and more secure availability of water, production of cash crops had increased. The same concern for the use of water resources was shown by the Mughals. They also promoted irrigation facilities by providing loans to farmers to install irrigational devices. There was a general concern for better use and regulation of water resources.

In South India, too, great emphasis was laid on a careful use of water resources. The system of tanks, small and large both and the mechanism of their regular upkeep from a very early time is too well known. The streams and rivers were also channellised by raising empanlements and dams. The famous *anaikattu* (anicut) on Kaveri river was built by Chola rulers for the irrigation of the lands in Tanjore. Large dams were also built in this region for creating big reservoirs of water. Ka Katiya rulers are known to have built three big dams in Warangal. Another dam located at Kamthana, near Bidar built by the Kakatiyas, supplied water for irrigating the neighbouring region. The epigraphic evidence and archaeological remains support this picture. This picture changed drastically after the colonial power established control over India. The apathy and neglect shown by the new dispensation towards these age old resource-use practices resulted in the ruin of most of these devices. Francis Buchanan noted this pitiable state during his travel along the eastern coast in eighteenth century. A major consequence of this was a series of famines and consequent loss of life. Thereafter new policy was initiated to redeem the situation, though considerable damage had already been done.

A comprehensive survey of traditional water harvesting systems in India has been undertaken by Centre for Science and Environment and their compilation of the results of survey published under the title *Dying Wisdom* (*State of India's Environment: A Citizen's Report*, Vol. 4, ed. Anil Aggarwal & Sunita Narain, New Delhi, 1997). We strongly suggest to you to use this book to get larger information on the subject.

The optimal management of available water resources today has become a major issue world over. The spatial and temporal variability of rainfall along with high evaporation and runoff is posing a major challenge to the scientific community. Added to these is the increasing demand resulting from an exponential population growth. It has created more and more pressure on dwindling supplies and per-capita access to fresh water is falling. We shall discuss these issues in Block 6.

12.2 WATER CONSERVATION

Water is a renewable resource, but it is also finite. We have no more than what we had in the days of Harappan culture but the demand has multiplied. Water has become at least as important a resource as oil. Water shortage and deteriorating water quality are the two major concerns today. It is thus evident that there is an urgent need to initiate measures for water conservation. We have to join hands in day-to-day battle to protect the lands, rivers, lakes, aquifers and seas against pollution. In this regard past practices of water conservation need to be examined in some detail.

Water conservation has a long history going back to earliest times. The need of conservation at that time was perhaps to save water for the lean period of the year. It was conservation directed at quantity as quality conservation did not seem to be their concern. The evidence for water conservation is available from ancient literature, epigraphy, archaeological remains and local oral traditions. Conservation was a special feature in habitats that were located a little away from source of water or were naturally deficient in water. Digging well was a regular old practice. It provided avenues to harness the ground water. Wells have been as old as a Harrapan tradition. Almost every dwelling unit of Harrapan culture had a well. Mohenjodaro records over 700 wells. Unlike other running sources like rivers or streams wells provided an option to fetch only the required amount of water – an early evidence on judicious use of water.

Another source of water, that is the running water, but particularly the flood water was very nicely utilised by past cultures. We have the evidence from Srinagaverupura situated near Allahabad on the banks of river Ganga. During the monsoons, the river swells up by about 7-8 meters and spills into the nearby artificial canals. This canal was dug by settlers of the region to carry superfluous floodwater. This diversified water was stored in tanks, to be used during lean periods of the year. The water from the canal first entered a silting chamber where the dirt settled down. Relatively clear water entered the first tank which was made of bricks. Thus next tanks received cleaner water.

The mechanisms of rainwater conservation however differed according to the physiographic features of the respective regions. In Rajasthan it was basically rooftop method whereas in the case of south India it was tank based method. In Rajasthan these mechanisms were known as *Kund/ Kundi*. Individually rooftops were used as catchment area which collected rainwater and stored it in an underground tank. This water was even potable. In other words *Kund/Kundi* were artificial wells conserving rain which would have otherwise run-off. The mechanism was also used in open field for general public where similar *Kund/Kundi* were built and the neighbouring area used as the catchment.

A very indigenous method to secure drinking water was practiced in the Runn of Kutch by Maldharis. They knew that the density of sweet water was less than the saline water. On this theoretical premise they were able to store rainwater afloat on underground saline water. It is known as *Virdu* method of water conservation.

In the North-East Himalayan region people developed methods of carrying natural spring water for drinking purposes. As the region is mountainous, the rainwater runs off very fast. However, the upper range natural springs survive throughout the year. The people there used intricate network of bamboo pipelines to carry water to convenient points where it was stored and subsequently used.

A very interesting method of water harvesting is practiced by Jarwas in Andaman. Although Andaman Islands have an annual rainfall of 3000 mm it runs-off rapidly due to ragged physiography of the place. The Jarwas use full length split bamboos. An entire length of bamboo is cut longitudinally and placed along a gentle slope with the lower end leading into a shallow pit. These serve as conduits for rainwater which is painstakingly collected in pits called Jack wells. These split bamboos are also placed under trees to collect the fall of rains through the leaves. A series of increasingly bigger Jack wells is built, connected by split bamboos so that overflows from one lead to the other, the bigger one. This stored water is basically used for domestic purposes.

We have already read about Sudarshan lake near Junagarh which was constructed to store water for domestic and irrigational purposes. Similar evidence for tank and canal construction from ancient past from different regions is also available Hanthigumpha inscription of 2nd century BC. describes that a canal was dug in Tosali division near capital city of Kalinga. According to the Kuntagiri plates, the Kadamba king Ravivarmann ordered construction of a tank bund for irrigational purposes. Most of these were developed to channelise water for optimal use which otherwise would have gone to waste. Such an awareness of water conservation emerged due to unequal seasonal distribution of rains. The plateau region-Deccan is full of artificial tanks which stored rainwater for irrigation. These are known by various names like *arakes, volakere, derikere, katte, kunte, kola,* etc. depending upon the difference in structure and nature of use.

Similar structures are called *zing* in Ladakh and *ahar* in south Bihar where water from seasonal streams or rainwater is stored to be used in ensuing period for domestic and agricultural purposes. *Ahars* are rectangular catchments receiving water flowing through hilly rivers. On similar lines we have indigenous methods employed in Bengal. They created broad and shallow canals to carry floodwater of rivers. These canals ran parallel to each other at a reasonable distance. By creating cuts in the canals floodwater was released to fields.

A very useful method of water conservation for irrigation was developed by Paliwal Brahmins in the arid region of Rajasthan. They created rain-fed water storage structures, which allowed runoff to stand over and moisten the soil bed of the storage structure itself. This piece of land was later used for growing crops. These structures were known as *khareen*.

Another unique method of rainwater harvesting is known as *haveli* as practiced in Madhya Pradesh. The area has heavy black clay which can hold a large amount of water but when it dries it becomes hard and develops wide cracks. Bunds are created to tap rainwater and released few days before sowing by an opening into embankment. This release makes soil soft and allows the sowing of wheat and gram to rarely need second helping.

The above description make it amply clear that various methods of water conservation were practiced traditionally depending upon the local needs. These methods utilised every kind of water supply – rains, floods, ground water, etc.

12.3 WATER RIGHTS

The details of resource-use practice given above make it clear that water has been considered a useful essential resource. Therefore rights to it have also been zealously safeguarded. In early times, however, population was limited and it was often possible for individuals or communities to settle differences in many cases by simply moving on and exploiting a new source. The scale of water available in most situations and consumptive uses, even for irrigation, seldom threatened others with deprivation. Customary rights/uses regulated most transactions.

Gradually greater rights began to be exercised and in many cases the state initiated the practice of levying cesses on the use of water especially on the water drawn from state built reservoirs or such similar devices. No codified procedure though had come into practice. It was, however, from the nineteenth century onwards that water laws for various uses began to be invoked. This trend was further strengthened with the multiple uses and increasing diversions for consumptive/commercial use which were often conflicting in practice. The problem has since then become more acute because of increasing population. The increasing demand over the availability has been creating scarcity and resultant disputes. Over the world a serious and intensive thinking on availability of earth's fresh water resources and possibilities of exploitation has begun

With rapid population growth placing more and more pressure on dwindling supplies, per-capita access to water is falling. Ancient usage pattern is being challenged by new claims. More than 200 countries in the world have to share their common resources of surface and ground water transcending their political boundaries. The competition for the world's water resources is becoming a major contentious political issue of our time. Shortage of water, quality of water, and management of water are the three issues being discussed in contemporary world. Hence, there is a need to define the rights over water and their historical evolution.

It was believed for a very long time that water in a natural stream was not the subject of property but a wandering thing without an owner. However, this understanding underwent a significant change in the industrial world and the issue of water rights came into existence. The genesis of water rights is generally traced to the rights of navigation in rivers that often formed the boundary between two states. Rivers that formed natural boundaries or flowed through successive domains or territories and came to be used as a common highway were supposedly open to all for communication and commerce. However some states began to exercise greater control over them thereby denying others, or reducing their, usage of the resources. This necessitated framing of some kind of laws as the dispute over ownership rights of water increased. Conventions pertaining to the Danube between Austria and Turkey in 1619 and the Rhine between Germany and France in 1697 were among the early landmarks in the making of modern International law on navigation. Inland navigation was an item on the agenda of the Congress of Vienna in 1815.

These disputes were basically on consumptive uses. The scenario changed as world saw rapid pace of industrialisation. Political issues of boundary alignment along wayward rivers tended to be settled on the principle of the median line - a line purporting to demarcate the deep water course of a river. However, braided rivers and those prone to make large erosive invasions of territory on either bank have continued to pose problem of jurisdiction.

Historically there have been following principles defining the water rights:

- *Riparian Doctrine*: The private property right in water only to those whose land abutted the river was a viable theory so long as people living away from the river satisfied their needs from other sources. However, with the change in nature of utilisation/needs it is no more viable.
- *The Prior Appropriation Theory*: According to this theory water in the natural course is the property of the public. It is in fact a suitable version of the riparian theory which puts the earlier appropriation right holders on advantage over all subsequent users.
- *The Territorial Sovereignty Theory*: According to this theory the owner has an absolute user right. This notion of private property when extrapolated for the entire domain of natural resources generates territorial sovereignty principles.
- *The Equitable Apportionment Theory*: Equity is a legal or a judicial notion therefore it provides basis for legal interpretation. It says: treat all claimants as equal right holders and through fair legal means apportion the resources in accordance with their individual needs.
- *The Equitable Utilisation Theory*: It says distribute the resources equitably such that optimum utilization occurs for all concerned when all relevant factors are taken in to account. It is based on the guidelines laid down by (Article 5 of) the Helsinki rules for equitable utilization of water resources.
- *The Community Interest Theory*: In 1851 the English common law made a distinction between *bonus vacans* and *public–juris* that is between no one's property and every one's property. The notion of every one's property is appropriate for water resources , which are to be used by numerous communities all along their flow. As a principle of distribution this theory allows the groups, participatory in the distribution, to be defined as communities in various ways, as culture specific groups or domicile specific groups. Otherwise it is based on the equitable utilisation theory.
- *The Public Trust Theory*: It emphasises that the principles of distributive justice need not be based only on the notion of private property, rather one should consider natural resources a common property and the sovereign or the state as its only trustee. This theory says that the state, which holds the natural water as a trustee, is duty bound to distribute or utilise the water in such a way that it does not violate the natural rights of any individual or group and safeguards the interests of the public and of ecology.

12.4 SUMMARY

In this unit we attempted to highlight the significance of water as a resource for human survival. It also dealt with the question of availability of water in various forms on earth and the amount of water available for human use. It was followed by an examination of the various resource-use practices of the past societies. Further the mechanism developed by these societies for the conservation of water were also discussed. The unit also gave a brief survey of various theories of water rights and its applications.

12.5 EXERCISES

1) Examine the historical practices of use of water as a resource.
2) What mechanisms did pre-modern societies in India adopt for water conservation? Elaborate.
3) Write a note on water rights and their environmental significance.

12.6 SUGGESTED READING

Chhatrapati Singh, *Water Rights and Principles of Water Resources Management*, New Delhi, 2001.

Anil Agarwal and Sunita Narain, ed., *Dying Wisdom: Rise, fall and potential of India's traditional water harvesting systems*, Centre for Science and Environment, New Delhi, 1997.

Madhav Gadgil & Ramchandra Guha. *This Fissured Land, An Ecological History of India*, Delhi, 1992.

UNIT 13 FOREST RESOURCES

Structure

13.0 INTRODUCTION

Meaning of the term forest has been highly debated among the social scientists. Social interaction with the forest has been part of human existence since beginning as hunter-gatherers, agricultural societies and even the industrial society has been having contact with the forest in some form. It has been a dilemma for the social scientists to define the meaning of forest as the uses of forest have been culture specific and therefore the perception of forest has been different in different cultures. The general historical understanding of forest has been that of an area that is wooded, is the habitat of wild animals and many species of birds and reptiles and is not subjected to the laws of civility. This understanding extends further to also include the notion that many articles of use to man are grown in the forest naturally and have to be obtained from there. It is with regard to these articles and their extraction that some variance gets induced which is culture specific. Notwithstanding this variance, forest is imagined in history as a repository of many natural resources that have to be subjected to varying resource-use practices.

This unit attempts to make you aware of the changing notion of forest as a resource. Forests have been examined here with respect to various raw materials they supplied and at another plain have also been seen as providing an alternative to the agrarian landscape. Eversince the emergence of agriculture based monarchical political structures from sixth century BC, there is evidence for the coexistence of forest dwellers as another distinct socio-political entity. The monarchical political formations and forest dwellers shared a dichotic relationship where both were dependent on each-other not simply in terms of economic gains but also for the identity formations. Forests were visualised as places of safe refuge by the recalcitrant peasantry and other social elements raising a voice of dissent. With the expansion of agriculture there have also been disputes over the proprietary claims, though these disputes assume noticeable features only with the advent of colonial state in the 18th-19th centuries.

We take forest as an entity and discuss issues like an understanding of the forest, its treatment in history, the present day coverage of the forest and different levels at which humans have interacted with the forest. The underlying consideration in this discussion shall be the resource-potential of forest and the practices adopted for its use.

13.1 UNDERSTANDING THE FOREST

Evidently there is a complexity related with the historical understanding of the forest as a concept. In the same time span forests were understood differently by people belonging to different cultures. It is very difficult to provide universally applicable set of characteristics of forest. The term *jungle* used to denote forest in contemporary India is problematic. Michal R. Dove has argued that, "in contemporary Urdu, *jungle* is defined as 'a wood; a forest; a jungle'. In classic Sanskrit, the cognate term, *jangala* is defined as arid, sparingly grown with trees and plants. There is major difference in meaning between the two terms: the latter denotes an open, arid savanna stage of vegetation, while the former denotes a closed, tree dominated cover (with unspecified aridity)." Francis Zimmermann in the preface of his book *Jungle and the Aroma of Meats*, writes, "An extraordinary misunderstanding has overtaken the history of this word (jungle). *Jangala* in Sanskrit meant the 'dry lands', what geographers would call 'open' vegetation cover, but in the eighteenth century the Hindi *jangal* and Anglo-Indian *jungle* came to denote the exact opposite, 'tangled thickets', a luxuriant growth of grasses and lianas. Let us agree to abandon that misunderstanding for the time being'' (p. vii). We must emphasise that in this unit we deal with the traditional meaning of the term forest in English language as described above. Forest has been attributed a rawness where rules of civil society do not apply. The term *jungle-raj* seems to refer to this law-lessness. This attribute of the forest perhaps originated in the context of relatively stable production of food in the early-agricultural societies. The agricultural societies were glorified and non-agricultural social formations devided.

The characteristics of the forest are best understood in terms of man-forest relationship in history. Recent past has shown increasing incongruity in the man-forest relationship. We shall have to see if in a more remote past the situation was any different. However, in order to give a simple coherent picture, intricate and micro-regional variations shall be given relatively less attention. We would possibly benefit if we decide a few major indicators guiding the relationship between man and forest. The foremost indicator is the user-resource arrangement put in place by humans vis-à-vis forest resources. The next significant pointer is the level of technology available for operationalising this user-resource arrangement. The final pointer is the availability of alternative resources, say agricultural resources as alternative to forest resources.

13.2 FOREST COVERAGE

Complex physiographic, climatic and pedagogical conditions have given rise to as many as 30,000 species of plants in the country ranging from thorny bushes (Rajasthan etc.) to evergreen forests (Assam, etc.). Forests are dominant natural vegetal cover in India. The present day distribution of forest is very uneven ranging almost from nothing in some regions (Delhi 1.5%, Rajasthan 2.5%, Punjab 3%) to nearly one-third in other regions (Himachal Pradesh 33%, Madhya Pradesh 31%, Kerala 28%). Exception-ally high shares are exhibited by Tripura (63%) and the Andaman-Nicobar Islands. This distribution can hardly reflect the true nature of the original cover in the past; much of the forest cover, especially in the Great Plains, has been removed as a consequence of Human occupance.

The climate, land, and species singly or in combinations, define the forest types. These have been described in Unit 2 of Block 1 at length. Indian forests species, do well in certain environments. There are however some species such as bamboo, cane, reeds, neem, pipal, banyan, tamarind, palm etc., which grow all over the country.

Grasslands, on a sizeable scale, no longer exist in India. Much of the surface area (about 59%) is either under cultivation or under forest cover. The pastures with scrubs and grasses are found in patches usually in the arid to sub-humid areas of the country. Like forests, grasslands also have a variation in accordance with the natural environment and soil. In the western margin of Uttar Pradesh, the sub-humid Madhya Pradesh, and Andhra Ghats, etc., are found patches of coarse grasses, much more sensitive to over-grazing. Sandier and humid soils are covered with poor quality grasses and scrubs. Sub-tropical Himalaya, above 1400 m has considerable stretches of mostly induced grasslands from western Himalaya to the Burma border. (R.L. Singh, ed., *India: A Regional Geography*, National Geographic Society of India, Varanasi, 1971, reprint 2001).

13.3 FOREST IN HISTORY

The earliest references of human settlement in India can be traced back to the culture of 2-million years old (approximately) stone choppers. Two technological traditions are known from this stage: the Sohanian and Acheulian. Sohanian culture was confined to Siwaliks and Acheulian spread from Siwalik Hills in the north to near Madras in the south. Acheulian sites are particularly densely populated and richer in Central India and the South Eastern Ghats. Both these regions received adequate rainfall, had a thick vegetation cover, and were rich in wild plants and animal food resources. The only areas devoid of early human settlement were tropical forests. Acheulian tool assemblage comprises chopping tools, polyhedrons, discoids, hand-axes, cleavers, scrappers, denticulates, notches, flakes and blades. Though our knowledge of the exact functions of most of these tools at this stage is very imperfect, it is fair to assume that they served a variety of functions like hunting, butchering, digging of roots and tubers, processing of plants and making of wooden tools and weapons. In this arrangement human dependence on forest resources is clearly visible. Moreover this dependence lasted for a considerably long time. The subsequent periods of cultural development do not match with this early stage in terms of the time span occupied by them. The man-forest relationship based on a heavy sustenance of man on forest resources was the hallmark of this early phase. There were several sub-stages in this relationship which were all located in an evolutionary framework and about which detailed information has been read by you in Units 5 and 6 of Block 2.

The next important phase of human settlement in India is termed as Harappan civilisation. This civilisation emerged basically in the semi-arid regions of North-Western India and in the absence of written records we have to depend solely on the archaeological information for this phase. In fairness to the efforts made by a galaxy of eminent archaeologists though, it must be said that material evidence unearthed for Harappa civilization provides significant clues to man-forest relationship for this phase. It is suggested that the size of Harappan urban settlements would have required wood that could only be supplied by a forested region not far from the sites. The requirement of wood as fuel to support the firing of bricks, a conspicuous building material of Harappa culture, is another supporting argument for the existence of forest and the dependence of the inhabitants of Harappan settlements on the forest resources. A quick inventory of the objects in which wood was used would read as below:

- Toys made of wood;
- Wood handles for copper-tools such as sickles, axes and adzes;
- Wooden carts, their assembly components and their wheels;
- Wooden boats and their sails and oars;
- Potter's wheel;
- Wooden beams in roofs and wooden beams in door openings and in windows. (Cf. Irfan Habib, *The Indus Civilization*, *People's History of India 2*, New Delhi, 2002, pp. 30-33).

Moreover the animals depicted on Harappan stamp seals such as elephants, tigers and rhinoceroses require forest as their habitat. Borrowing comparisons from other contemporary bronze are civilizations, it seems certain that forest resources must have been in good demand. A significant point for us to note in this regard is that the borders of the Indus zone towards the east were covered with dense forests which the copper wielding cultures such as the Harappans were in no position to cut and clear. Perhaps these eastern regions were heavy rainfall areas and had no significant human habitation. The forests on the fringes would therefore be available for exploitation of forests resources (Cf. Irfan Habib & Faiz Habib, 'The Geography and Economy of the Indus Civilization' in *Proceedings of Indian History Congress*, 1987, p. 61).

The next significant period is the one occupied by the Vedic civilization. Vedic sources portray a close relationship between man and forest. Malamoud suggests: "The forest lies on the village's horizon and is, in a certain sense, integrated into village life. … Yet, this fusion of village and forest is so beautiful in the eyes of the Indian authors, and fundamentally so unrealistic, that they exclude it, at times, from the realm of the possible in our present age of iron, declaring that it can only be found in a distant past, in the wonderful age of the *rishis*, of those inspired seers who received the Vedic revelations" (Charles Malamoud, *Cooking the World: Ritual & Thought in Ancient India*, New Delhi, 1996.). However, there has been a problem with the presentation of this kind of harmonious relationship between man and forest. Indologists, working on a general conceptual level, have shown that the dichotomy of *grama* (village) and *aranya* (forest) is omnipresent in the Vedic literature. It is discussed as a duality between wilderness and civilization and has the basic, fundamental opposition. According to this concept, forest always remains *outside*, distanced and more or less detatched from the sphere of human praxis. Malamoud and Sprockhoff argue that there is evidence that the interpretation of *vana* and *aranya* as synonyms can be found only in the late Vedic and post-Vedic literature. Both draw attention to the etymological origins of *vana* and *aranya* and their usage in the earlier Vedic literature. They come to the conclusion that both terms have different connotations. *Aranya*, translated as wilderness, desert, sometimes also as forest, is linked etymologically with alien, distant; it is the dangerous, the frightening space, inhabited by demons, wild animals, but also by brigands, it is the space which one tries to avoid, it is linked with death. *Aranya* and *grama* appear as reciprocally exclusive categories. Malamoud and Sprockhoff take up another conceptual pair, namely that of *vana* (forest) and *ksetra* (fields, inhabited space), often *vana* and *grama. Vana* and *ksetra interact* with each other and this interaction is seen as positive. *Vana* is the forest which supplies villagers with timber for house construction and tools; here herbs and wild plants are found, single trees may get special ritual significance as *vanaspati*. But the boundaries between *vana* and *aranya* are fluid; the same space, which was seen as *aranya*, as wilderness in previous times may become *vana*, utilizable forest, or land for cultivation (Antje Linkenbach, 'Forests in Garhwal etc.'in *Social Construction of Indian forests*, ed. Roger Jeffery p.86-87)

The period from 500 BC to 300 AD saw large scale colonization of fertile forest lands both in the northern India and the river valley areas (for example Krishna, Godavari, Cauvery, Vaigai) in the peninsular India.

Greater colonization meant greater availability of surplus. Thus tribal chiefdoms started giving way to large states; Mauryas and Kushanas in northern India, the Chalukyas and Sangam Cholas in south India. The ground for further exploitation of forest resources was made ready in the logic of the empire building exercise. Of course trade was also coming up in a big way and the ships and boats had to be built out of the forest wood. Elephants assumed significance, and elephant forests started coming up. The number of towns increased and the houses in towns began to use wood on a greater scale. Moreover, superior timber had to be used for construction of furniture, carts, chariots, wooden bridges etc. During the Mauryan period, the concept of 'hunting reserves' also came up, as hunting became a recreational activity. Chanakya says that Brahmanas should be provided forests for plantations, for religious learning and for performance of penance. As we shall see in Block 5, many philosophical treatises were written in the forests. Upanishads and Aranyakas were the major ones. The importance of forests is further borne out by the treatment it receives in Kautilya's *Arthashastra*. Two important forest produce noted in the text are sandal-wood and the aloe-wood, obtained from the forested regions of Kamarupa, in Assam (Cf. Irfan Habib & Faiz Habib, 'The Economic Map of India, AD 1-300' in *Proceedings of Indian History Congress*, 1986, Vol 2, p. 149). Though Kautilya's treatise mainly pertains to the Mauryan period the principles enunciated in it were accepted as the bed-rock of further writings on the subject. A well-known scholar (of ninth century AD) Kamandaka who wrote *Nitisara* acknowledges the importance of *Arthashastra*. After the Mauryas, the other important empire builders were the Guptas. But during the Gupta times and more particularly later Gupta times economy began to decline. There was a manifest slump in trade and towns and in the use of monetary system. Inscriptions belonging to the period indicate a trend towards naturalization of the economy and thus greater pressure on land and consequently on the forest. Amidst all these developments, the forest question lost its prominence and in the later sources lesser attention was given to the forests. It is however pointed out by some scholars that during Harshavardhan's time (seventh century AD) agriculture and forestry had been in a prosperous condition. For this period we have an important account, by Hsuan Tsang, the Chinese pilgrim who travelled in India and the border lands between 629-45 AD. He records the following regions as forested areas:

- Kosambi, infested with wild elephants;
- Monghyr, a forest between Magadha and this region;
- Kalinga, forest between it and Kongeda having wild elephants;
- Andhra, forest between it and South Kosala;
- Chole, wild jungle;

- Malaya Mountains, giving Sandalwood and Camphor. (Cf. Irfan Habib & Faiz Habib, 'Economic Map of India, AD 500-800'' in *Proceedings of Indian History Congress*, 2001, pp. 105-110).

The Delhi Sultanate phase saw a change in the situation. The total population (both human and livestock) increased, as did the number of cities and towns. Consequently urban population also increased. All this led to a proportionate quantitative increase in the demand for fuel wood, fruits, food, fodder etc. Demand for quality timber for construction of boats, bridges, houses, carts etc. also went up considerably. In addition to all this, the concept of 'hunting reserves' for the nobility came into vogue. There are also instances of large scale clearing of the forests in the Doab region such as under Balban. This was done to destroy brigandages in the region inhabited mostly by the Mewatis.

As we come to Mughal India the information increases, in terms of quantity as well as quality. Most of this information has been plotted by Irfan Habib in his *Atlas of the Mughal Empire* (New Delhi, 1982). It is thus convenient to get details about forest resources at an all-India scale and at regional scale. The main forested areas in Mughal India were:

- The Northern Mountains or the Himalaya;
- Foot-hills/*terai* region of the Himalaya;
- The Central Indian Forests (between Narmada-Son rivers towards north to the eastern coastline between Narsapur and Balasore);
- The Ghat Range (along West coast);
- The Aloe-Wood Forest (in north-east);
- Brahmaputra Forest; and
- Lac Forests (in the Ganga delta).

Among the forest resources there was a big demand for timber particularly the superior variety. Timber was required for construction of buildings, furniture, bridges, boats as well as ships used in internal and external trade. There are ample references to fleet of boats/ships owned by merchants and some members of the nobility and royalty. Forests served another utilitarian purpose; the forest produce formed an important component of the non-agrarian production during the Mughal period. The production and use of many forest products like timber, fruits, roots, fibres, barks, resins, herbs, lac, babul tree for leather tanning, gumlac (red dye, sealing wax), and mulberry silk has been recorded in the sources.

Forest Produce (as recorded in *Atlas of the Mughal Empire)*

1. *Punjab*:	**Sal** timber, Spikenard (aromatic plant used in an ointment). Gum lac, Turpentine, Indian Jalap (tuberous roots used in a purogative drug), Chebulic Myrobalns (astringent fruit), Costus root.
2. *Gujarat*:	Teak timber, Gum lac, Aloe-wood, Honey, Chebulic Myrobalans.
3. *Uttar Pradesh*:	Sal timber, Ebony, Bamboo.
4. *Central India*:	Sandal-wood.
5. *Bihar*:	Bamboo, Long-pepper, Sun lac, Musk.
6. *Bengal*:	Timber for masts and boats, Aloe-wood, China-root (*Simlax gabra*, not *Smilax china*), Gum lac, Beeswax.
7. *Orissa*:	Timber, Gum lac, Beeswax.
8. *Assam*:	Aloe-wood, Gum lac, Musk.
9. *Deccan (West)*:	Teak timber, Sandal-wood, Gum lac.
10. *Deccan (East)*:	Timber for ship-building, Gum lac, Bezoar Stone, Beeswax.
11. *South India*:	Teak timber, Timber (Anjeli wood), Sandal-wood, Bamboo, Cinnamon, Cassia Fistula (Senna leaves), Nux Vomia (herb), Myoobalams, Lac, Bees wax.

It is evident that on the whole, the forest cover did not suffer any major problem of depletion. It is true that royal patronage as under the Mauryas, was absent but there were other factors, which kept things under control. Though the demand for forest produce increased but the land- man ratio was still very favorable. Land was abundantly available and as such the problem of converting forest land into agricultural land was not so strong which was the main reason for loss of forest. Added to this was the factor of natural regeneration of the forests, which kept the larger forest cover under more or less 'normal conditions'.

13.4 LEVELS OF INTERACTION

Forest-man interaction should be visualised in the context of the social relevance of the forest. The process of evolution from the simple social formations of 'hunting-gathering' to the complex social formations of 'industrial society' has influenced the level of interaction between man and forest. It is difficult to define this kind of interaction because there are tremendous regional variations in the physical nature of forests. However, we will attempt a broad generalisation to elucidate the intricacies of the social interaction with forests.

13.4.1 Sole Provider

The earliest stage of social formation has been termed as 'hunting-gathering' where to a great extent the physical needs of the humans were catered to by the forest resources. During this phase the forests were the sole provider of sustenance to humans. 'Hunter-Gatherers' survived by exploiting resources of the forest but in the process exerted little control over their natural environment. They were omnivorous; the proportion of meat, plant food, etc varying from region to region. In the absence of tools human dependence on animal meat was limited, initially to scavenging and only gradually to hunting. All along this phase human dependence on fruit and other plant food remained quite high.

Human dependence on forest witnessed a change with the introduction of tools, initially of stones (generally known as Palaeolithic tools) but soon also made of wood, one of the most versatile raw materials known to humanity. Unfortunately, timber rarely survives in the archaeological records and we are left mostly with stone tools as evidence. Introduction of flakes, choppers, and later on axes influenced the human-forest interaction. They were multipurpose artifacts, used for grubbing up roots, working wood, scraping skins, and especially skinning and butchering large and small game. By analysing the geographical location of the sites of tool-industry scholars have suggested that the hand axe was in fact a form of primitive discus used primarily for hunting purposes.

Forest also provided shelter to the humans. Traditionally it were trees that provided shelter though with the growth of terrestrial adaptation rock shelters became an alternative. Even today we have evidences for this kind of existence. Varied ecological niches in these ecosystems are exploited today by traditional ethnic groups (tribes/adivasis) whose economies are geared to hunting and gathering, riverine fishing, marine fishing and shifting cultivation. Typical examples are those known as Van Vagri (Thar), Birhor (Chota Nagpur), Chenchu, Yanadi, Konda, Reddi, Koya, Voda Baliji (Eastern Ghats), Kadars (Kerala), Baiga, Gond, Muria, (Madhya Pradesh), Kandh, Savara, Gadaba, Juang (Orissa), and Walri and Koli (Maharashtra). All these ethnic groups, pursue their traditional modes of food procurement notwithstanding the fact that they are now integrated into village economies. Since big game is now both scarce and its hunting is prohibited, they hunt small game and birds, and collect insects and honey and wild plant foods. The fact that Stone Age occupations occur within the tribal habitats indicates that the game and other forest foods now exploited must have formed the subsistence base on a much larger scale. [V.N. Misra, ‘Stone Age India: An Ecological Perspective’, in *Man and Environment* XIV (I)-1989].

13.4.2 Ancillary Product

With the development of agriculture as source for food, the relationship between man and forest underwent a drastic change. For the agricultural societies, forest assumed secondary position. However, one should be careful to realise that the shift to agriculture was not a quick process neither a smooth one. Initially agriculture was a risky proposition and forest resources provided sustenance in case of crop failure. At the same time the possibilities of surplus generation and accumulation led to fresh demand on forest resources. Earlier forest resources were required basically for consumption purposes and possibilities of storage were limited. The growing shift towards agriculture necessitated sedentary life style, that too usually away from the rock-shelters and other natural sheds. It forced humans to develop dwellings for themselves, for which the easiest procurable raw material had been wood, i.e., forest resource. Another important feature of settled agriculture was the emergence of stratified society. Trade had been another marked feature of the agriculture society. All these factors supported greater demand for the forest resources.

Growth of agriculture, sedentary life-style, and greater possibilities of surplus generation increased the demand for energy. At one level the demand for energy was met by utilising the draught power of animals and on the other hand it increased the demand for fuel-wood. Both the situations demanded greater utilisation of forest resources, as fuel-wood and as fodder. The dry leaves from the forest were used as manure for agriculture. As far as food was concerned, with the growth of agriculture, forest products were ascribed secondary position as discussed above. However, forests remained sole supplier of numerous ancillary products. Another essential requirement was that of wax for candles which could be procured only from the forests. Similarly forest gave gum, resin, lac, honey, rubber and querns which were used by humans in many day to day activities.

Wood was one forest product that was extensively used as raw material for housing, furniture, agricultural tools, musical instruments, and numerous other handicrafts. The necessity of wood was greater in the absence of technological support otherwise heavy materials like stone or brick could be used for raising the roofs of the building/ house in a cost effective manner. Similarly, wood was extensively used to provide beam for the construction of windows, doors and other openings. Wood was also required for construction of bridges, carts, and chariots. Most of the tools used in the agriculture sector were made of wood. Good quality wood was required for the preparation of plough and other materials.

13.5 CONSERVATION PRACTICES

The importance of timber, as discussed above, had grown enormously. Wood had multiple usages ranging from use as the basic source of energy, to a key ingredient of furniture and tools, particularly agricultural tools. As the civilization progressed the need to conserve such an important and critical forest resource became more and more evident. Moreover the forest was also giving many other products which too needed to be conserved and judiciously used. The policies adopted by different states often reveal their anxiety as also the measures initiated in this regard. We shall deal with the issue of conservation at length in Block 5. Here we are giving some interesting conservation episodes from the region of Rajasthan which have mantled the robe of cultural practice in the region. Some of the well recorded episodes of this practice are recounted below.

The attitude towards tree conservation is reiterated in the following anecdote written by Nainsi, in the Seventeenth century. King Maldevji got *babool* trees of Merta cut. In response to this, and by way of revenge, Viram Deo said that he would cut the mango trees of Jodhpur. However, people advised him not to do so as trees were to be protected. Hence he chipped a small branch of Mango tree symbolising that he had settled the account. In this anecdote, the chief is restrained from cutting trees by his advisors. The latter probably realised that denudation of trees would cause irreparable damage.

Another important example in this regard was the representation of *khejari* tree in the official flag of Bikaner kingdom in the Seventeenth century. Flags in medieval India generally depicted animals- lion in the case of the Mughals. The representation of the *khejri* was unusual. What is striking is that even to this day it plays a critical role in sustaining agriculture and animal husbandry. Similarly, concern for vegetation was visible in the construction of *bund* Jaitsar, near Jaisalmer. Maha-Rawal Jaitsingh sponsored the construction, in 1570 VS. (AD 1513) to capture the runoff water from the adjoining northern hills. The construction of the *bund*/embankment created a reservoir. This in turn was used to supply water to the other side where a garden was planted. A small canal with sluices was also provided to carry and control the water from the *bund* to the garden. This reservoir could contain water for four to five months only. However, the moisture retained by the ground was sufficient to sustain the garden round the year. Moreover, the dry bed of reservoir was utilised to cultivate *unali/rabi* crop (winter season crop).

The practice of punishments for cutting of trees was also prevalent there. It should be seen in the context of regional environment and socio-religious practices. The social concern for environment in medieval Rajasthan manifested itself in various forms. The attitude towards nature is apparent in the teachings of sects like Bishnois. The founder of Bishnoi sect, Jhambhoji (AD 1451-1536) had prescribed twenty-nine rules for his followers. Most of these were related to keeping harmony with the environment like prohibition on cutting green trees and animal slaughter. It is said that the followers of Jambhoji were known as Bishnoi (*bish* is twenty and *noi* means nine) because it means twenty-nine in vernacular dialects of Rajasthani language. One plausible explanation is that the economy primarily sustained on animal husbandry. Hence any slaughter, even during droughts, would reduce the means of livelihood. Similarly, the cutting of green trees was prohibited, as it would reduce the availability of green fodder for the animals. It became more important in this region where natural vegetation was very thin and sparse. Jambhoji's teachings, congruent with the interests of the common man, became immensely popular. The number of followers increased manifold but primarily in the arid regions of Bikaner and Jodhpur. His sect became so influential that the rulers of these states were forced to respect his sermons. Maharaja Ajit Singh issued a *parwana*- official order, restraining cutting of green trees in 1754 VS (AD 1698). Anup Singh, King of Bikaner prohibited cutting of green trees in the villages dominated by Bishnois in 1752 VS (AD 1696). Similarly, in 1878 VS (AD 1821), Man Singh the king of Jodhpur issued a similar order with respect to *khejari* tree.

The founder of the Bishnoi sect was not alone in attempting to influence conduct towards living beings via religious and ethical transformation. Another popular saint, Jasnathji (AD 1482-1506) who was a contemporary of Jhambhoji also endorsed such a viewpoint. His followers were known as Jasnathi. Like his contemporary saint, Jasnath ji was also aware of the importance of preservation of environment. In his teachings tree of *jal* had been accorded special protection, which was natural vegetation of the region. These teachings became popular in the region, which had traditionally sustained goat and sheep rearing. Conservation of green vegetation and prohibition of slaughter of animals seemed to be attempts towards conservation of their livelihood.

In Rajasthan, especially in the central and western parts, the vegetation was very sparse; there were very few forests. In such a situation it was necessary to protect the already existing ones with care. Lalchand complained to Amber ruler on *Jeth Vadi* 1, 1756 VS (AD 1699) about tree felling in his *pargana* (Sawai Jaipur) and expected punishment for the culprit. In village Saithal, *pargana* Bahatri, in 1745 VS (AD 1689) a person was punished for cutting a *neem* tree. Similar cases were reported from numerous villages and *Qasbas*. *Patel* (headman) of village Kharkhura was punished in 1780 VS. (AD 1724) for the same crime. It appears that trees could be cut only with the permission of state authorities. The *Patel* of village Kundala, Pargana Mariana was punished in 1789 VS. (AD 1733) for the unauthorised cutting of tree in his area. The term unauthorised (*bin hokum neem ka dala kate*) cutting of tree has been used in a context that implies permissions were granted for the purpose. This also suggests control enjoyed by the state with respect to vegetation.

Neem having tremendous medicinal properties, needed protection. Being a medicinal plant, it was considered inauspicious to cut *neem*, thus, punishment. Similarly, cutting the tree of *peepal* has been reported from village Chandpur *pargana* Bhartri in 1775 VS. (AD 1719). Ritually, the tree of *Bad* was considered auspicious, hence attempts to axe the tree were punished by rulers as reported from village Chauroti, *pargana* Hindaun in 1785 VS (AD 1729). Moreover the trees of *peepal* and *Bad* were worshipped by women of the royal household. Thus, perhaps religious considerations were an added justification for the enactment of punishment.

Alongside, we have evidence of punishments for cutting *Jamun* (*Syzygium cumini*) tree from village Nadu pargana Bahatri in 1774 VS. (AD 1718). *Babool* was a tree adapted to the specific conditions of Rajasthan and it needed little or no care in its rearing. In the arid part, *babool* was the dominant tree and provided food for the camels. Considering the economic and ecological value of *babool*, it was considered necessary to punish those who tried to cut it.

Furthermore, it is to be noted that even unauthorised cutting of grass was punished. Our documents clearly point out that there were reserved grazing lands. The cutting of grass grown even on the hills and forests was punished. Meadows were important for the military as cattle and horses used in warfare needed fodder. The primary source of draught and transportation was cattle and their need for pasture played an important role in state policies. State used to actively procure the grass and maintain a reserve stock. for the cavalry- horse, camels and elephants- the mainstay of their army.

13.6 SUMMARY

The unit stresses the fact that the forest is natural growth of vegetation not requiring human intervention. The variety of vegetation is: to strength and testimony of its originality. Literature has been important source for the reconstruction of forest in early as well as medieval times in India. The unit has documented the extent of the forest chronologically to map the forest coverage and at the same time it also dwells upon the popular renditions of forest. The unit also examines various social practices which encouraged the conservation of the forests. The role of social customs, practices and taboos are important areas of exploration to situate and comprehend the forest. The unit also looks at the various issues related with the claims over the forest produce. The notion of forests as common property resource and claims laid by state portrays a complex picture.

Forest as a resource has been used by humans eversince the origins of humans. Man-forest relationship has for a large part of human history been one where human dependence on forest resources for sustenance has been near total. The situation changed only with the emergence of agriculture. Hereafter the food resources were mostly obtained from cultivation that was not dependent on the forest. A complete independence from the forest was however not yet feasible. Several products used by humans in daily life were even now produced and obtained from the forest. The growth of civilizations however increased the demand of wood and forest again became one of the most important resources for human societies.

13.7 EXERCISES

1) Write an essay on the changing perception of forest in history.

2) Discuss the various levels of interaction between man and forest.

3) Write a note on the reasons for tree conservation in Rajasthan.

13.8 SUGGESTED READING

Irfan Habib, *The Indus Civilization*, *People's History of India 2,* New Delhi, 2002.

Irfan Habib, *An Atlas of the Mughal Empire*, New Delhi, 1987.

Briget & Raymond Allchin, *The Birth of Indian Civilization*, Penguin, 1968.

Romila Thapar, *Early India,* Allen Lane, 2002.

Francis Zimmerman, *The Jungle and the Aroma of Meats*, London, 1987.

UNIT 14 METAL & MINERAL RESOURCES

Structure

14.0 INTRODUCTION

Metal is a solid material which is hard, shiny, malleable, fusible, and ductile, with good electrical and thermal conductivity. Similarly mineral is defined as an inorganic substance of natural occurrence that is usually obtained by mining. The term mineral itself is derived from the term mine, i.e. excavation. Minerals are important inorganic substance needed by the human body for good health. There are very few metals and minerals available independently in the nature. The significance of metals and minerals is that they have a variety of applications for the humans. The social significance, since the ancient past, has been clearly brought out by Gordon Childe in the book, *Man Makes Himself* . He argues that the implications and consequences of developments in metallurgy meant four major discoveries: the *malleability;* the *fusibility*; the *reduction* from ores; and *alloy* making. Metal 'seemed a superior sort of stone that can not only be sharpened to cut like flint, but can also be bent, shaped by hammering, and even beaten out into sheets which can be cut up'. Secondly, 'when heated metal, especially copper, becomes as plastic as potter's clay; nay it will become liquid and will assume the shape of any container or *mould* into which it is poured. Yet on cooling it not only retains this shape, but becomes as hard as stone and can be given as good a cutting edge as flint. For tools copper possesses all the virtues of the older materials –stone, bone, wood– with other superadded. The possibilities of shape became unlimited as sole limit to shape was the mould.

The utilisation of these advantages required in practice a complex of ingenious inventions– a furnace with a draught fusion to produce the relatively high temperature requisite for fusion, crucible to contain the molten metal, thong to lift them with, and above all moulds to confer upon the casting the desired shape'.

The sciences applied in metallurgy are more abstruse than those employed in agriculture or even pot-making. The chemical change affected by smelting is much more unexpected than that which transforms clay into pottery. The change from the solid to the liquid state and back again, controlled in casting, is hardly less startling. Hence, it is not surprising that in the earliest historical societies, metallurgists are always *specialists.* Probably from the beginning metallurgy was a craft as well as a technique. The operations of mining and smelting and casting are too elaborate and demand too continuous attention to be normally conducted in the intervals of tilling fields or minding cattle. Metallurgy is a full-time job.

The most important consideration for the spread and extensive use of any metal would have been its availability. The spread of bronze age civilisation was very limited compared to later civilisations using iron as base metal. The limited availability of copper and tin had restricted extensive use of the metal by the common man/peasantry in particular. Even in the field of agriculture, it was not extensively used. Almost all the bronze age civilisations were located on the banks of rivers as flood plains sustained the agriculture. Corollary to this was the limited utility of bronze in the process of forest clearance. Therefore, expansion of civilisation in the thickly forested areas was restricted and the change in the landscape would have been limited.

The situation changed dramatically with the introduction of iron. Iron is one of the commonest elements in the earth's crust and with continuous experiments the production of iron became relatively cheap. Cheap iron democratised agriculture and industry and warfare too. Any peasant could afford an iron axe to clear fresh land for himself and use iron ploughshares to break up ground. The common artisan could own a kit of metal tools that made him independent of the household of the kings or nobles. Thus in the Iron Age civilisation not only spread over a wider area than in the Bronze Age, it also spread deeper.

The purpose of this Unit is to familiarize you with the use of metal and mineral resources and the complex process of their appropriation. The pattern of appropriation and consumption has marked a definite stage in the evolution of civilizations in the world. The consumption of metal and mineral resources to a great extent depended upon the stratification in the society and the availability along with accessibility of these resources. Our focus is on the significance of metal and mineral resources for humans, the broad spatial distribution of metal and mineral resources in India, and the historical evolution of methods of appropriation and patterns of consumption especially in India.

14.1 METAL RESOURCES

Metallurgy is one of the oldest applied sciences. Its history can be traced back to 6000 BC when its form was rudimentary. However, to gain a perspective in Process Metallurgy, it is worthwhile to spend a little time studying the initiation of mankind's association with metals. Currently there are 86 known metals. Prior to nineteenth century only 24 of these metals had been discovered and, of these 24 metals, 12 were discovered in the eighteenth century. Therefore, from the discovery of the first metals - **gold and copper –** until the end of the seventeenth century, only 12 metals were known. Four of these metals, **arsenic, antimony, zinc and bismuth**, were discovered in the thirteenth and fourteenth centuries, while **platinum** was discovered in the sixteenth century. The other seven metals, known as the Metals of Antiquity, were the metals upon which all early civilisations were based. These seven metals in the descending order of their discovery from the earliest, are:

- Gold, (ca) 6000BC
- Copper, (ca) 4200BC
- Silver, (ca) 4000BC
- Lead, (ca) 3500BC
- Tin, (ca) 1750BC
- Iron, smelted, (ca) 1500BC
- Mercury, (ca) 750BC.

Some of these metals were known to the Mesopotamians, Harappans, Egyptians, Greeks and the Romans. Of the seven metals, five can be found in their native states, e.g., gold, silver, copper, iron (from meteors) and mercury. However, the occurrence of these metals was not abundant and the first two metals to be used widely were gold and copper.

In metallurgy it was important that the metal deposit must be identified. In the case of the first metals color was the most important factor as it allowed the metal to be recognized in surrounding rock, stones, gravel and dirt and separated from these. Separation was then the next problem followed by concentration. These three steps are very important and the economics of these steps usually defines whether it is viable to produce the metal from a deposit or not. In the early days all three steps were carried out simultaneously. In the following pages we will take a brief account of the early metals, their nature and their availability to understand their significance as resources of value to the man.

Gold

Gold articles are found extensively in antiquity mainly as jewellery. Early gold artifacts contain significant silver contents. Man learned to convert gold into jewellery and ornaments, on the basis of knowledge that it could be formed into sheets and wires easily. However, because of its malleability, it has little use value except for decorative purposes. As gold is a non-corrosive and tarnish free metal, it served this purpose admirably.

Gold is widely dispersed through the earth's crust and is found in two types of deposits: lode deposits, which are found in solid rock and are mined using conventional mining techniques, and placer deposits which are gravelly deposits found in stream beds and are the products of eroding lode deposits. Since gold is found uncombined in nature, early goldsmiths would collect small nuggets of gold from stream beds etc., and then weld them together by hammering. The scarcity of gold and its value, due to mankind's fascination with its color, have resulted into gold becoming one of the more important metals in daily life.

In the early stages of the development of metallurgy all metals were reduced by either carbon or hydrogen, however, the majority of the metals once smelted were not available in a pure state. Refining of gold, that is the separation of silver from gold, has a very old history. During the second millennium BC, an amalgamation process using molten lead was used to separate the metal from crushed quartz. The lead then being cupelled (refine in a small flat circular vessel) to separate the gold and the silver. Purification was then carried further (but not until the first millennium BC) by a cementing process where a mixture of the alloy was closely mixed with common salt. The silver reacted, formed a chloride which was soluble and easily rinsed off. The cementation process was used until about 1100 AD when other refining processes became popular. One method used sulphur addition to the molten bullion to form silver sulfide which was removed as "black" during gentle beating. Mineral acids were developed by the alchemists. Nitric acid was used to dissolve silver as a purification technique. By the end of the fifteenth century, stibium (antimony sulfide) was also used in the cementation process. Generally, a mixture of salt, stibium and sulphur was heated with the gold foil. Amalgamation processes were also popular. The gold was dissolved in mercury. The amalgam was coated onto the piece and then heated to drive off the mercury leaving a gold coated piece.

Copper

The use of copper in antiquity is of more significance than gold as the first tools, implements and weapons were made from copper during the Chalcolithic period. By 3600 BC the first copper smelted artifacts such as copper rings, bracelets, chisels were found in the Nile valley. By 3000 BC weapons, tools etc. were widely found.

Malachite, a green friable stone, was the source of copper in the early smelters. Earlier it was thought that the smelting of copper was the result of a chance dropping of malachite into campfires but that was found improbable due to low campfire temperatures. It is more probable that early copper smelting was discovered by ancient potters whose clay firing furnaces could reach temperatures of 1100^{0}-1200^{0} C. If Malachite was added to these furnaces copper nodules would easily be found. Although the first smelted copper was found in the Nile valley, it is thought that this copper was brought to Egypt by the Gerzeans and copper smelting was produced first in Western Asia between 4000 and 4300 BC.

Although copper can be found free in nature the most important sources are the minerals cuprite, malachite, azurite, chalcopyrite and bornite. Copper is reddish colored, malleable, ductile and a good conductor of heat and electricity.

Bronze (Tin and Copper Alloy)

Smelted copper was rarely pure. In fact, by 2500 BC the Sumerians had recognized that if different ores were blended together in the smelting process, a different type of copper could be made which flowed more easily, was stronger after forming and was easy to cast. An axe head from 2500 BC revealed that it contained 11% tin and 89% copper. This was of course the discovery of bronze. Bronze was a much more useful alloy than copper as farm implements and weapons could be made from it. However, it needed the discovery of tin to become the alloy of choice.

Native tin is not found in nature. The first tin artifacts date back to 2000 BC. However, it was not until 1800 BC that tin smelting became common in western Asia. Tin was reduced by charcoal and at first was thought to be a form of lead. The Romans referred to both tin and lead as *plumbum* where lead was *plumbum nigrum* and tin was *plumbum candidum*. Tin was rarely used on its own and was most commonly alloyed to copper to form bronze. The most common form of tin ore is the oxide casserite. By 1400 BC bronze was the predominant metal alloy.

Silver

Although silver was found freely in nature, its occurrence was rare. Silver is the most chemically active of the noble metals and is harder than gold but softer than copper. It ranks second in ductility and malleability to gold. It is normally stable in pure air and water but tarnishes when exposed to ozone, hydrogen sulfide or sulfur. Due to its softness, pure silver was used for ornaments, jewellery and as a measure of wealth. In a manner similar to gold, native silver can easily be formed.

Galena always contains a small amount of silver and it was found that if the lead was oxidized into a powdery ash a droplet of silver was left behind. Another development in this process was the discovery that if bone ash was added to the lead oxide, the lead oxide would be adsorbed and a large amount of material could be processed. By 2500 BC the cupellation process was the normal mode of silver manufacture.

Iron

Iron was available to the ancients in small amounts from meteors. This native iron was easily distinguishable because it contained nickel. There is some indication that man-made iron was available as early as 2500 BC, however, iron-making did not become an everyday process until 1200 BC. Hematite, an oxide of iron, was widely used by the ancients for beads and ornaments. It is also readily reduced by carbon. However, if reduced at temperatures below 700^0-800^0 C it is not suitable for forging and must be produced at temperatures above 1100^0 C. Wrought iron was the first form of iron known to man. It is interesting to note that in the early days iron was five times more expensive then gold and its first uses were as ornaments.

Iron weapons revolutionized warfare and iron implements did the same for farming. Iron and steel became the building block for civilization. Interestingly, an iron pillar dating to 400 AD., remains standing today in Delhi, in Qutab Complex. It is made of forged iron and corrosion to the pillar has been minimal. Iron is rarely found in its native state. The only known sources of native iron are in Greenland where iron occurs as nodules in basalt that erupted through beds of coal and two very rare nickel-iron alloys.

Lead

Lead is not found free in nature but Galena (lead sulfide) was used as an eye paint by the ancient Egyptians. Galena has a very metallic looking appearance and was, therefore, likely to attract the attention of early metalworkers. The production of metallic lead from its ore is relatively easy and could have been produced by reduction of Galena in a camp fire. The melting point of lead is 327 C, therefore, it would easily flow to the lowest point in the fireplace and collect. At first lead was not used widely because it was too ductile and the first uses of lead were around 3500 BC Lead is highly malleable, ductile and non-corrosive making it an excellent piping material. Lead pipes bearing the insignia of Roman emperors can still be found.

> The ability of lead to flow and collect at the bottom of the campfire is an important concept in process metallurgy as reduction reactions to be useful must cause a phase separation between the metal and the gangue. Also, the phase separation should also enable the metal to be cast into a desired shape once concentrated.

Mercury

Mercury was also known to the ancients and has been found in tombs in Egypt dating back to 1500 and 1600 BC. Pliny, the Roman chronicler, outlined purification techniques by squeezing it through leather and also noted that it was poisonous. Mercury, also known as quicksilver, is the only metal which is liquid at room temperature. Although it can be found in its native state, it is more commonly found in such ores as calomel, livingstonite, cordierite and its sulfide cinnabar. Extraction is most simply carried out by distillation as mercury compounds decompose at moderate temperatures and volatilize. Mercury was widely used because of its ability to dissolve silver and gold (amalgamation) and was the basis of many plating technologies. There is also indications that it was prized and perhaps worshipped by the Egyptians.

In 315 BC, Dioscorides mentions recovery of quicksilver (which he called hydrargyros, liquid silver) by distillation, stating *"An iron bowl containing cinnabar is put into an earthenware container and sealed with clay. It is then set on a fire and the soot which sticks to the cover is quicksilver"*. Methods changed little until the eighteenth century.

14.2 HISTORICAL EVOLUTION OF METALS

We give here a brief account of the use of metals in different regions of the world and follow it up with details regarding the use of metals in India in the historical context.

14.2.1 In World

The Sumerian city-states are considered as the first major metal-using civilization. They navigated the Euphrates river for commerce, including the transportation of copper from Armenia to the north. At Gerza on the Nile river just south of the modern site of Cairo, the Gerzeans developed a civilization based on the metallurgy of copper which they had learnt from Mesopotamia, in about 3200 BC.

The pyramids and other great buildings of the Egyptian civilization were built of stones that had been quarried and shaped using copper tools. While the rock used in the buildings was found nearby, the Eygptians mined copper in the Sinai Peninsula. The scale of copper mining in the Sinai reached a size that made it the first real industry of the ancient world. The Egyptians mined deposits of the green copper mineral **malachite**. Malachite, a copper carbonate, was prized because it was the easiest copper mineral to reduce to copper metal. The closely related blue copper carbonate mineral **azurite** also was discovered. Near these two copper ore minerals, the early prospectors often found another copper mineral, blue-green turquoise. Turquoise is still prized around the world as a gem stone. Ruins of the old mines, the miners' huts, and inscriptions to the Goddess Hathor, the Lady of the Turquoise, can be found to this day in the Sinai.

Copper reached the island of Crete from Egypt. A copper axe from about 3000 BC was found on the floor of the ruins of a house. Egyptian barges carried copper to the western coast of Asia Minor, where they traded for the famous cedar wood from what is now Lebanon. Ruins of the Cretan civilization hold artifacts with Egyptian influence, such as fresco painting, pottery, and stone statuettes. However, the form of the metal objects is more like that from Asia Minor.

Metallurgy from Asia Minor reached Cyprus about 2600 BC. Egyptians traded fabrics and gold for copper from Cyprus. Myceneans settled near the copper deposit sites in Cyprus.

Early metal-smiths of Sumer, Babylon, and Egypt were highly prized members of their society. Often they were not free, owing their obedience and livelihood to temple priests and authorities. They were so valuable that invading armies made a special effort to carry them off in captivity. Metalsmiths transmitted their secrets to their children. Their guilds may have been the first trade unions in history.

Bronze, came into use at about the same time in Asia. Bronze artifacts dated at 3600 BC have been found in Thailand. Copper is found scattered around East Asia. Tin is found in the peninsula of Malaysia. Chinese written records date the first copper mining at about 2600 BC. and the first casting of copper vessels at about 2200 BC. The Shang dynasty's capital of Anyang in northern China had a bronze-casting industry in 1400 BC.

14.2.2 In India

India witnessed a long sequence of cultures using both stone and copper tools known as Chalcolithic cultures. The innovation in the Chalcolithic cultures was the use of the new technology of smelting and crafting bronze artefacts. The most prominent has been Harappan culture also termed as Bronze Age culture. We shall take up discussion on the use of metals in the historical sequence in which some of the early metals were used by the people.

Copper/Bronze

The copper workings in India have an antiquity dating back to the second millennium BC. They are reported from Barudih in Singhbhum. We also have a small finger ring discovered at Babri, Birbhum, West Bengal which has been formed from the chalcolithic levels and is dateable to about 1000 BC. It seems the copper mines at Chhotanagpur plateau were in use at that point of time and tin as an alloy was being used to obtain bronze.

In the Harappan culture copper tools were used to help cut stone tools in a more fine manner. The Harappans practiced alloying of copper and tin so that a more strong metal, bronze would be available. "Whereas 70 percent of analysed copper artefacts from Mohenjodaro and Harappa have been found to contain one percent tin (probably the same as found in the natural ore), the remaining 30 per cent had tin ranging from 8 to 12 per cent, which indicates that tin was here deliberately mixed with copper. The proportion of bronze within copper artefacts increases significantly with time at Mohenjodaro, and this was probably the case in the Indus civilization generally. Nickel, arsenic and lead were also used as copper alloys (Irfan Habib, *The Indus Civilization, A People's History of India 2*, New Delhi, 2002, p. 29).

The ore for smelting copper in the Harappan culture was most likely obtained from Rajasthan and Baluchistan, though Afghanistan and Persian sources too would have made the supply (Cf. D.P. Aggarwal, 'Archaeometallurgical Studies in India : A Review' in *Archaeology and Interactive Disciplines*, ed. S. Settar, Ravi Kovisettar, New Delhi, 2002, p. 426). "Copper was smelted in brick-lined pits, and wax-and-clay moulds were probably used to cast whole or parts of copper and bronze artefacts. These included tools such as razors, knives, chisels, hooks, sickles, saws and axes... Smaller copper tools include awls, nails, needles and tubular drills.... A considerable number of copper and bronze utensils (pots and pans) suggests that at least richer households could now use metalware in addition to the breakable pottery" (Irfan Habib, *op. cit*, pp. 29-30).

The Chalcolithic cultures, other than the Harappans, also used copper for making different artefacts. A content analysis of these artefacts reveals that the chalcolithic metallurgical traditions and the Harappan tradition had distinct identities and the probability of any direct transmission is precluded (Cf. D.P. Agarwal, *op. cit*, p. 431).

Iron

The studies focusing on the history of introduction of iron in India had earlier believed that iron was introduced between 600 and 700 BC (cf.D. H. Gordon, *Prehistoric Background of Indian Culture*, Bombay, 1950). But the discoveries made at Painted Greyware (PGW) sites has now settled this date around 1000 BC. D.K. Chakrabarti has written a comprehensive work dealing with the discovery and use of iron in India (*The Early Use of Iron in India*, Bombay, 1992). Some of his main findings may be given here to understand the use pattern of iron:

- The probable date of production of iron in India is c 800 BC;
- The use of iron in India is earliest reported from Central India and South India;
- These production centres were located close to the areas from where ore was found;
- There was a continuity in tradition of iron metallurgy upto the pre-industrial period; and
- Any correspondence between the Indian iron tools of the earliest period and the West Asian tools was lacking (Also see D.P. Agarwal, *op. cit.* p. 433).

Zinc

India provides the earliest evidence of metallic zine. "There are references to burning a metal, *rasa*, to produce an eye salve, which should refer to zinc, placing it use in the last centuries of the first millennium BC. The *Rasaratnakara*, ascribed to Nagarjuna, the great Indian scientist who lived in the fourth century AD, describes both the production of brass by the familiar cementation process, and of metallic zinc. Furnaces (*Koshthi*) have been found at the ancient mines of Zawar in Rajasthan (D.P. Agarwal, *op. cit*, pp. 434-35).

The Zawar mines from where zinc was extracted are located at about 35 kms. to the south of Udaipur in Rajasthan. The ore is mainly a mixture of zinc and lead and is obtained in dolomite formations. Agarwal suggests that "zinc and some lead was being mined between the sixth and first centuries BC" (*op. cit*, p. 435). This trend then continued further and as we come to medieval India we find evidence of zinc distillation process on a fairly elaborate scale. P.T. Craddock (*The Early History of Zinc*, 1987) specializes in the study. We give an extract from him explaining the process (as quoted in Aggarwal) : "at first glance the Zawar industry is the most unusual phenomena, a fully fledged technology with neither antecedents nor successors—and apparently no contemporaries either, for even within India it seems unique.... Zinc required a much higher temperature and the total exclusion of air. The form of the Kosthi furnace for holding the retorts seems to have been inspired by the common spottery kiln. The arrangement is of course totally different, instead of a fire beneath to heat the pots stacked above through the perforated floor, in the Kosthi, the fire and retorts were in the upper chamber and the zinc was collected beneath… the Zawar process was certainly one of the most sophisticated and technically exacting process developed in the mediaeval world, one hesitates to use the term 'pre-industrial', for surely this process, with its appreciation of scientific techniques and learning towards mass production, should properly be considered as an early example of an industrial process in the modern sense'' (p. 435).

It is evident from the description given above that metals as a resource had come to grip the society firmly by the time state formation in India began. Thereafter, it was a question of controlling the resources. It is not without reason that the Magadhan state grew in and around Rajgrih which area was a significant iron ore area.

14.3 MINERAL RESOURCES

To be classified as a "true" mineral, a substance must be a solid and have a crystal structure. It must also be an inorganic, naturally-occurring, homogenous substance with a defined chemical composition. Mineral-like substances that do not strictly meet the definition are sometimes classified as mineraloids. A crystal structure refers to the orderly geometric spatial arrangement of atoms in the internal structure of a mineral. This crystal structure is based on regular internal atomic or ionic arrangement that is often visible as the mineral form. Even when the mineral grains are too small to see or are irregularly shaped the crystal structure can be determined by x-ray analysis and/or optical microscopy.

Chemistry and crystal structure define together a mineral. In fact, two or more minerals may have the same chemical composition, but differ in crystal structure (these are known as *polymorphs*). Similarly, some minerals have different chemical compositions, but the same crystal structure. Crystal structure greatly influences a mineral's physical properties. For example, though diamond and graphite have the same composition as both are pure carbon, but graphite is very soft, while diamond is the hardest of all known minerals.

> A mineral is a naturally occurring, inorganic substance with a definite chemical composition and a crystalline structure. A rock is an aggregate of two or more minerals. (A rock may also include organic remains). The specific minerals in a rock can vary a lot. Some minerals, like quartz, mica or feldspar are common, while others have been found in only one or two locations worldwide. Over half of the mineral spices known are so rare that they have only been found in a handful of samples, and many are known from only one or two small grains.
>
> There are currently just over 4,000 known minerals. according to the International Mineralogical Association, which is responsible for the approval of and naming of new mineral spices found in nature.

Minerals may be classified according to their composition. The list below is an approximate order of their abundance in the earth's crust.

- *Silicate Class* **–** the feldspars, quartz, olivines, pyroxenes, amphiboles, garnets, and micas;
- *Carbonate Class* – lime, dolomite, stalactites, and stalagmites;
- Sulfates – anhydrite (calcium sulfate), celestite (strontium sulfate), barite (barium sulfate), and gypsum (hydrated calcium sulfate). The sulfate class also includes the chromate, molybdate, selenate, sulfite, tellurate, and tungstate minerals;
- *Halide Class* – The fluoride, chloride, and iodide minerals;
- *Oxide Class* – hematite, magnetite, chromite, rutile, and ice;
- *Sulfide Class* – selenides, tellurides, arsenides, antimonides, bismuthinides, and sulfosalts;
- *Phosphate Class* – phosphate, arsenate, vanadate, and antimonite minerals.

One of the common use of minerals by humans has been in dietary form. They are inorganic compounds necessary for life and good nutrition. Some of these are minerals such as salt; others are potassium, calcium, iron, zinc, magnesium, and copper. These can be naturally occurring in food or added in elemental or mineral form. For a considerably long period the minerals in dietary form were used by man through experience.

14.4 SUMMARY

The inclusion of metal technology introduced some complexities into the patterns of living, for instance determining who was to control the new technology, since those who were producing the artefacts were not necessarily the same as those in authority. In most of the cultures bronze technology was accompanied by the script, beginning a new chapter in the process of historical evolution. If bronze marks the beginning of the new chapter in the social relations/stratification, then introduction of iron provided tools to colonise the newer terrain, not inhabitable until then. The process of expansion of agriculture received a new and potent tool. It provided tools to not only clear the forest tract but also to exploit the hidden potential of land other than the river denuded ones. Similarly minerals played an imporant role – as dietary supplement and in jewellery.

14.5 EXERCISES

1) The introduction of metals changed the life-style of man in a major way. Comment.

2) Discuss the introduction of bronze in Indian history and assess the significance of this process.

3) Compare the changes introduced in Indian history by bronze and iron.

4) Write a short note on minerals as a resource.

14.6 SUGGESTED READING

Bridget and Raymond Allchin, *The Birth of Indian Civilisation*, India and Pakistan before 500 BC, Penguin, 1968

Alan W. Cramb, *Short History of Metals*, Department of Materials Science and Engineering, Carnegie Mellon University

UNIT 15 MAN-NATURE RELATIONSHIP

Structure

15.0 INTRODUCTION

Since ancient past concern for environment has been an integral part of Indian intellectual and popular traditions. This concern for environment is not something which has come to us from the West as is usually projected. It is indigenously visible in the cultural patterns, religious practices and social norms and needs careful delineation.

This Unit provides you with an insight into various traditions of Indian philosophy with regard to its vision of the environment. Indian philosophy has always considered environment as an organic living entity. Traditions have stressed *a participatory life with environment*. Humans have been seen as one component of this wider reality i.e., environment. They are created by the elements of environment and they finally dissolve in the environment. Here we must stress that Indian philosophical traditions are pluralistic in nature, therefore, we cannot reduce our examination to any single philosophical tradition. Yet a practical approach is to focus on the major philosophical traditions and take up manifestations of environment therein for a detailed study.

Since *Srsti*/Universe figures in almost all the traditions as a representation of nature, we discuss the concept of *Srsti* as visualised in Indian philosophy and its relationship with the humans in detail and also take up a discussion on, and the integration of, various components of environment with the living forms in this Unit. The significance of popular and classical traditions in promoting prudent attitudes towards environment is also part of our discussion. Finally we take up the notion of *Pradushana* of environment i.e. pollution of environment and discuss the treatment of this concept in philosophical traditions keeping in view the role played by human activities.

15.1 MAN'S PLACE IN NATURE

The Indian tradition places man alongside other creatures of the animal world and the world of vegetation. This is a significant feature and we would prefer to dilate on the subject further.

Man enjoys no pristine position though a whole lot of privileges get accrued to man through his intellect. Actually man's place in nature/ environment is two fold – physical and the spiritual. The physical relationship entails interaction with all the other living things and non-living objects that are part of the environmental surroundings. The spiritual relationship, on the other hand, requires a set of the rules of conduct to be followed by man. These rules of conduct specify the duties and obligations towards other living species. The guiding principle in both relationships is that the environment should not be endangered due to the activities of man. There is an element of ethics involved in this and man's place in environment/nature is located within the realm of this ethics.

The treatment given to the issue – man's place in nature – in Indian philosophical traditions too distinguishes between the physical and the spiritual or psychical, as suggested in some treatises. Since the physical relationship is principally determined by those requirements that sustain existence, such as food and living environment, it is a relationship of providing for the material needs. However, material needs and material wealth are two separate notions and these are clearly demarcated in the treatment of man's physical relationship with environment. Unlike the techno-modern objective of mastering environment for extracting the maximum of material resources, the Indian tradition lays great emphasis on inculcating environmental ethics encouraging preservation, protection and conservation of nature.

The psychical or spiritual relationship transcends the material world. In a beautiful verse from *Kathopnishad* the idea is clearly described: 'Higher than the senses (and their objects) is the mind, more excellent than the mind (*manas*) is intellect (*sattvam)*; above the intellect soars the great soul (*mahatma*) and more excellent than the great one is the unmainfested (*avyakta*). And higher than the unmanifested is the soul (*purusa* here) which is all-pervading and without sense' (Cf. Kapila Vatsyayan, 'Indian View of Environment As A Part of Indian Aesthetics' in *Creativity and Environment*, ed. Vidya Niwas Misra, Sahitya Akademi, New Delhi, 1992, p.25). Evidently man is conceived in Indian tradition as representing a microcosm of the larger universe which is the macrocosm. Interestingly the two – micro and macro-cosm – constantly exchange their forms. Thus fire of the nature becomes speech as it enters the mouth; the sun becomes sight as it enters the eyes; wind becomes breath by entering the nostrils; the annual herbs and regents of the forest become hairs as they enter the skin; the moon enters the heart and becomes mind. It also indicates man's and nature's interdependence as also the reality that the two can be comprehended completely only in a state of union. The following verse from *Atharvaveda* illustrates the point nicely:

O earth! Pleasant be thy hills and snow clad mountains and thy woodlands on the earth-brown, black, ruddy and of all colours – the firm earth, the earth protected by the deity (Indra), upon this earth I – unconquered, unslain, unwounded, have set my foot.

15.2 *SRSTI*/UNIVERSE AND ITS ATTRIBUTES

The configuration of environment in Indian thought is expansive enough to include the entire Universe within itself rather than being locative or temporal in character. A more commonly used word for this is *Srsti*. In Indian thought *Srsti* is conceived as a living mechanism where humans along with *Pasu, Paksi and Vanaspati***,** are one of the many living creatures and non-human forms are not the lifeless entity as the physical matter alone. The concept of *Srsti* has been elaborated in terms of its mobility where humans relate with *Srsti* continuously and the concept is therefore continuously redefined. Here one can read an attempt at trying to understand and relate to the greater 'whole' of the nature. In this process emphasis on adaptation has been one of the guiding principles for an interaction between human and natural world.

Indian philosophical traditions have visualized *Srsti* as a creation of the Almighty and so is the case with humans. As both are the creation of God, there is greater stress on maintaining cordial relations between these two in particular and among other components of *Srsti* in general. At the same time man has been considered as the most intelligent creature and therefore it is imperative upon humans to ensure a peaceful co-existence with other living creatures as well as with non-living material world.

The creation of *Srsti*, in the Indian philosophical tradition, is a concept that can be broadly categorized in four groups. An element of history seems to order the groups. We can begin with the Vedic theory as elaborated in the *Vedanta* and *Sankhya* traditions, followed by *Upnisadic* theory. The third theory is termed as *Puranic* traditions and lastly is the tradition as enumerated in the Gita as part of Mahabharta.

Indian philosophical traditions have developed a cosmic vision that is cyclic in nature. The cycle begins with creation and is followed by continuance that finally culminates in destruction; and then a new cycle begins. It suggests that every material object/creature is perishable with the possibility of regeneration. The fragility of the environment has also been carefully stressed in such discourses. Traditional thoughts have proposed a set of *Trinity* i.e., the Creator, the Preserver and the Destroyer.

The Vedic tradition traces the origin of *Srsti* from *Hiranyagarbha* which is golden embryo. The God from his will deposited the seed of creation in a cosmos that was in a state of chaos. This seed became the golden germ, from which was born the *Brahma* or the creator himself. It is interesting to note that *Brahma* is identified as the *Purusa* who is all - pervading and is the supreme reason for all subsequent creations. This *Purusa* is also distinct from all that he created. The *Rigveda* also speculates on the world beyond the moment of creation. Several different names attributed to the creator indicate that the origin of the world is not unidirectional inspite of the fact that origin is always attributed to the God or creator. This also includes a feminine creation of the world. A verse of *Rigveda* locates the cause of creation in Aditi:

The Divinity (Aditi) is the Heaven, mid-region, the mother, the father, the son. The divinity is all deities, five classed men, and all that is born and will be born.

"The above Vedic theory was further expounded by Bhartrhari" say Dwivedi and Tiwari. The sage "discussed the *Vedas* and *Puranas* as visualizations of the divine power in Vedic words. A number of Rigveda hymns are in worship of inspired speech (*Vak*), considered a creation of God" (O.P. Dwivedi and B.N. Tiwari, *Environmenal Crisis and Hindu Religion*, New Delhi, 1987, p.15).

Upanasadic theory of creation suggests that *Purusa* creates matter out of itself and then enters it as the first born.

Purusa Prajapati, creates the waters, enters into them as an egg in order to be born from them, and issues forth from them as Brahma. (*Satapatha Brahman,6.1.1)*

The beginning is traced with *Him* as lone creature who, to combat the solitude, transformed himself into man and woman which became the carrier of his progeny. Likewise he transformed himself into other elements such as earth, water, animals, etc.

The *Puranic* theory considers *Brahma* as *Svayambhu*, who is born at his will. No other cause is responsible for his birth. *Brahma* being desirous of progeny, created waters first. He deposited in the waters a seed out of which *nara* was born and was called *Narayan.* While lying on the Ocean (*Ksir Sagar*) a golden egg arose from his navel which gave birth to *Brahma*. He then divided the egg and made earth and heaven. From that moment on the creation of all things began to take place. (*Brahma Purana* 137-40 as cited by Dwivedi and Tiwari, *op.cit*, p.17).

The theory of creation, according to *Gita*, has been most elaborately expounded in the *Santiparva* of Mahabharata. Yudhishthiva and Bhishma converse about the *Srsti* and the process of its creation: "Yudhishthir asked Bhisma Pitamaha – How was the world created? What was the position of creatures at the time of *Pralaya*? Who is the maker of the sea, sky, mountain, clouds, *Agni*, air and other things of the world? How are all creatures made, how cleanliness and impurity emerged, and how *dharma* (religion) and a*dharma* came into existence. In reply Bhisma said – God is the form of *Srsti*. He created the one out of the one-thousandth part of his body, and that *Purusa* became known as *Manas*

Purusa" (*Mahabharata*, Moksaparva, 182.1-3 as cited by Dwivedi and Tiwari, *op.cit*. p.19).

Further "The Father of all creatures, God, made the sky. From sky he made water and from water he made fire (*Agni*) and air (*Vayu*). From fire and air, *Prithvi* (earth) came into existence. Mountains are his bones, Earth is the flesh, Sea is the blood, Sky is his abdomen. Air is his breath, *Agni* is his *Teja*, rivers are nerves. The sun and moon which are called *Agni* and *Soma* are the eyes of *Brahma*. The upper part of the sky is his head, *Prithvi* (earth) is his feet and direction (*Disa*) are the hands" (*Mahabharata*, Moksaparva, 182.14-19, *op.cit*.).

Gita sums up the situation by declaring that the *Brahma*, created the *Srsti* and decided to protect it and to rectify its malfunctioning by appearing as Vishnu in various incarnations to set things right.

As stated in the beginning *Srsti* is created to provide a stage to all its creatures to perform their assigned roles and then vanish into oblivion. In this process the supreme power undertakes to create *Srsti*, maintains it and then annihilates the entire creation. The universe thus remains completely dependent on the will of the supreme power. Krishna tells Arjuna in *Gita*:

The whole cosmic order is under me. By my will it is manifested again and again and by my will it is annihilated at the end.

The chief attribute of *Srsti* is that it is illusionary, yet when it assumes a physical form the matter gets shaped into seven cardinal elements and five gross material elements. The creatures and vegetation emerging out of this creation receive eleven senses and the three major qualities – the quality of *Sata*, the quality of *Raja*, and the quality of *Tama*. All living creatures are infested with one of the three qualities and are in turn administered under the laws of God. Consciousness is another important attribute which the living creatures receive at the time life is breathed into them by God. *Srsti* is thereafter permitted to run itself.

It is now evident that the creation of *Srsti* and its attributes have a slight variation in the four theories discussed above. One may legitimately probe the reason for this difference. The vedic deities are generally classified according to their natural characteristics. The division available from *Rigveda* classifies them as below:

- Celestial Deities : *Dyaus*, *Varuna*, *Mitra*, *Surya*, *Savitr*, *Pusan*, the *Asvins*, and the Goddesses *Usas* (dawn) and *Ratri* (night);
- Deities of Atmosphere : *Indra*, *Apam*, *Napat*, *Rudra*, *Maruts*, *Vayu*, *Parjanya*, *Apas* (the waters);
- Terrestrial Deities: *Prithvi*, *Agni*, *Som* (Cf. Dwivedi & Tiwari, *op.cit*. p.14).

The four theories give precedence to one of the three attributes of nature in the act of Supreme manifestation in the form of *Srsti*, hence the difference. The difference is in the material cause of the universe not in its essence. *Rigveda* reflects on this essence aptly:

He is one, but the wise call him by different names; such as Indra, Mitra, Varuna, Agni, Divya – one who pervades al the luminous bodies, the source of light, Suparna – the protector and preserver of the universe; whose works are perfect; Matriswa – powerful like wind; Garutman – mighty by nature.

15.3 COMPONENTS OF ENVIRONMENT

Earth with the attributes of smell (Gandha),
water with the quality of viscosity (Sneha),
fire with the quality of energy (teja),
sky with the quality of sound (sabda),
air (vayu) with the quality of touch (sparsa), and
all the Mahatattvas-let all these elements bless our mornings.

This verse from Vamanpurana makes it evident that in Indian thought environment has been visualized as an organic entity where all or most of the components are connected with each other in a complex web of inter-relationship. This thought also perceives that *there is life in all kinds of material or things***.** Thus existence of any of its components in isolation is inconceivable. The emphasis on mutual dependence has been the guiding philosophy of existence in Indian tradition. There cannot be any dichotomy between the numerous components of environment. Mutuality is considered beneficial both for the environment and for the individual elements of its constituent parts.

It has been proposed that in creating the *Srsti Brahma*, the Almighty, shapes primal matter into eight *tattvas* (elements): earth, water, fire, air, sky, mind, intelligence, and ego of which first five are considered basic elements. Almost at the same time the evolution of animal and human world gives rise to the emergence of five senses: sight, hearing, touch, taste and smell. The essential components of environment are the *tattvas* and the senses. *Aitareya Upnishada* provides the details of the process of their evolution:

He is Brahma, he is Indra, he is Parjapati, he is all gods,
He is the five elements, earth, air, space, water and light or fire,
He is the tiny living objects and is similar to them,
He is seed of one kind or another,
He is those born from the egg, born from the womb, born from sweat, born from sprout,
He is the horse, cattle, people and elephants,
He is everything that lives, that moves and flies and which is motionless.

This verse is quite illustrative of the process of creation as well as the compositional features of *Srsti*. The genesis has been attributed to processes that are multiple in character; the objects of creation have been defined as composed of terrestrial, aqueous and avian categories; the amplitude, ranging from minuscule to mammoth has been accounted for; and the cardinal five elements reiterated.

To further illustrate the characteristics of five basic elements of *Srsti* we provide a glimpse into their nature and significance as described in the treatises. There is a chronology of appearance that begins with sky. Sky is considered to be the first among all the five elements. It is also known by terms like, *Dyauh, Svah, Akasa, and Kham*. As we come to water, that is next in importance, we find *Rigveda* considering water great and all-pervading. Water is considered to be propitious and the enhancer of power:

The waters are propitious, the water verily are the enhancer of power. These waters, truly, do support Agni and Soma. May the readily flowering, strong sap of the honey-drops (water) come to me, together with life's breath and lustre.

(*Rigveda*, 3.13.5)

The source of water and the qualities of water have been especially stressed in the *Atharvaveda*:

> *O Man! may the waters from the snowy hills be peace giving to thee. May the spring waters bring calmness to thee. May the swift flowing waters be pleasant for thee. So may the rainy waters be a source of tranquillity to thee.*
>
> *O Man! Sweet be the waters of the oasis upto thee and so may be the waters of the pool. May the waters dug from the earth (i.e., wells) be sweet, as well as those stored in tanks.*

(*Atharveda*, 19.2.1-2)

This verse from *Atharvaveda* is significant from another point of view. It invokes the propitiatory attributes of water and proposes that these be bestowed on *Man*. It thus brings *Man* at the centre of *Srsti* and places at least one of the five cardinal elements at the disposal of the *Man*. The relationship of interdependence is missing and its place is acquired by the features of appropriation even if in rudimentary form. Water is ascribed several qualities. In a text called *Yuktidipika* we get these qualities described in the form of a list: Viscosity, firmness, radiance, brightness, delicacy, gravity, cold, protection, purity, progeny or union are the qualities of water.

These qualities are communicable and depending on the nature of the object the effect shows.

Philosophical traditions of India give the next (third) position to (Air) *Vayu*. It is also considered as *prana* of all the living creatures. It has been suggested that the body of all the living creatures can be sustained only as long as the *prana* inhabits it:

All these creatures enter with the breath (prana) (into the body), and with the breath (prana) they again depart out.

(*Chandogyaa Upanishad*, 1.11.5)

The *prana* is both a psychic as also a cosmic principle that is it is not only the breath of life in men but also the universal breath of life that prevails throughout nature.

Next to follow is energy visible as *agni* Fire. *Agni* is equated with the Sun-the ultimate source of energy. It is accepted as the source of rains and its relation to rains has been clearly brought out in *Satapatha Brahaman*:

From Agni is born steam, from steam the cloud and from the cloud rain.

Agni is also treated as a vehicle of carrying the sacrificial offerings made to God. It is accepted as mouth of the all-pervading *Parmatma* (the Supreme *Atman*/consciousness).

The last of the *Panch Tattva* has been Earth (*Prithvi*) which is attributed feminine qualities and treated as the mother of all living beings. *Prithvi* needs to be worshipped as it bears the material base of our sustenance.

Atharvaveda says

The earth which possesses oceans, rivers and other bodies of water, and which gives us land to produce food grains and on which human being depend for their survival, continue to possess these for all of us.

Further:

May she, our motherland, on whom grow wheat, rice and barley, on whom are born five races of mankind, homage to her, nourished by the cloud, and loved by the rain, …may God, the lord of life, make our motherland, who beareth all precious things in her womb, pleasant to us on every side.

(*Atharvaveda*, 12.1.42-43)

The special significance given to *Prithvi* is easily forthcoming from these two verses. It is recognized most unambiguously that *Prithvi* as mother provides all the necessary means of the sustenance of life. It should therefore be prayed so that the resources do not dwindle and it should be revered so that the value of these resources is not obliterated from our thought.

It is also important to note that in this tradition the fruits of the earth and its bounties are not declared as the sole belonging of the humans. In fact they are for all forms of life to use and get from them the benefits. The following verse from *Atharvaveda* illustrates this point:

> *Born on thee, on thee move mortal creatures;*
> *Thou bearest them- the biped and the quadruped.*

In this tradition the five components of environment, also known as *Pancha Mahabhutas,* are considered essential for the emergence, growth and continuance of the universe. They maintain a peaceful co-existence. The resultant order of nature/environment becomes a ground for a complex interaction of numerous living and non-living entities. The environment, as the life sustaining ambience, commands a sense of respect.

15.4 VEGETATION AND THE ANIMAL WORLD (*VANASPATI AUR PASU – PAKSHI*)

> *Even if there is only one tree full of flowers and fruits in a village that place becomes worthy of worship and respect.*

(*Mahabharata*, *Adiparva*, 138.25)

Trees have been attributed a place of reverence in Indian tradition. The importance given to trees can be assessed from the fact that plants and trees have been seen as epitomising God's existence. V*anaspati* as the creation of God and embodying *Him* has been a common description:

> *From Him the seas and the mountains all,*
> *From Him roll rivers of every kind,*
> *And from Him all herbs, the essence too,*
> *Whereby that inner soul dwell in beings.*

(*Mundakapanisad*, 2.1.9)

Rigveda offers prayer to God for the purpose of making plants and herbs plentiful with beneficial properties:

> *May the plants and herbs be sweet. May the heavens, the waters and the mid regions be all sweet. May the producer of grains and vegetables be sweet.*

Trees are placed equivalent to Humans in significance and importance in so far as the *Srsti* is concerned:

> *Just like a tree, the prince of the forest,*
> *So the man is, in truth,*
> *His hairs are leaves,*
> *His skin resembles the external bark,*
> *Out of his skin streams forth the blood,*
> *Like the juice or the sap out of the tree,*
> *It flows out from the wounded man,*

Like the sap of the tree, when it is cut,
The flesh is comparable to the wood,
The sinews are like the inner bark,
The strong bones are like the inner core of the wood,
The marrow resembles the marrow (pitt) of the tree.

(*Brhandarankya Upaniasad,* 3.9.28)

Any kind of intentional damage to the trees/ *vanaspati* has been condemned in the traditions as trees are considered living creatures. *Chandogaya Upnisad* says:

When one, O dear one, cuts this big tree here at the root, it trickles sap, because it lives. … if life departs from the whole tree, the whole tree withers or dries up, Therefore O dear one, you should mark this.

Similarly,

The cutting of all these trees is condemned. Except for the reason of sacrifice, trees should never be cut, particularly in rainy season.

(*Skanda Purana*, 20.83)

Reverence for the trees as an ancient tradition, was based on the belief that every tree had a *Vriksh Devta.* It was offered water in the morning which ensured continuous care of the trees. Different trees have been identified with different deities to stress the notion of worship.

Traditions with respect to the animal world have been similar to that we witnessed for the *vanaspati*. Moreover it included the humans who were not accorded any priority over other creatures. The central concern was for life forms and all the living beings were given equal treatment. Animal world had been classified in terms of their mobility, origin, features, attributes etc. The term *Jangama* was used to denote the animals and they were classified in terms of their mode of generation:

- *Jarayuja* (producing living young)
- *Swedaja* (born like ant),
- *Ayonija* (non-womb born like worms),
- *Andaja* (egg-born), and
- *Jalaja* (water born like fish).

Animals were attributed different qualities. Animals and birds were believed to possess a certain intelligence and the power to predict future climatic or atmospheric changes as well as the ability to foretell events, good or bad for an individual or with respect to nature.

Since life forms were treated with care, killing of animals was prohibited and it was believed that such an act was liable to incur God's wrath:

> *The Yatudham (killer of animal) who fills himself with the flesh of man, and he who fills himself with the flesh of horses or of other animals, and he who steals the milk of cows– Lord cut off their hands with thy flame.*
>
> (*Rigveda*, 10.87.16)

To further stress the vulnerability of animals and to offer them protection, different animals were identified as the modes of transportation of different Gods. For example lion is the *vahana* (vehicle) of *Durga*, *Indra* rides elephant, *Siva* has bull as his conveyance, *Saraswati* travels on swan and *Vishnu* prefers eagle for transportation purposes.

The Indian textual tradition assumes that, like the rest of the material world, humans are also made up of elements which at death disintegrate and dissolve into nature. At the most general level the five *tattvas* or elements that dissolve into nature at the time of death are: *Earth, Water, Fire, Air, Sky.*

15.5 POPULAR AND CLASSICAL TRADITIONS: REPRESENTATIONS OF ENVIRONMENT

The nature/environment in India is represented by two different but related traditions – the popular and classical. While the reflections of the popular traditions are more visible in practice, the classical or textual tradition offers a complete and systematic analysis of the universe.

It is an interesting fact that the popular tradition is mostly preserved in oral, non-textual form in an uncodified manner. Oral traditions thus constitute a basic method by which we come to know about the knowledge which has not been organised and codified. They also help us to understand those societies for which we have very limited textual information. Day-to-day practices and methods carry the glimpses of ancient past. In oral tradition in India, *environment has been perceived in a symbiotic relationship with the humans where environment is also considered as a living organism which breathes, feels, and possesses sensory perceptions***.** Various components of environment in this relationship either acquire or have been accorded special positions. At times these special considerations are also ritualized.

The trees and animals are one of the basic components of popular folk tales which are part of the popular oral traditions in India. Moreover various attributes of animals are also identified and are used as if they are natural sensory characteristics. The flora has been part of the themes of different stories. It is always kept in mind that human survival is possible only with the conservation of entire flora and fauna. This understanding is also reflected in the religious practices as different animals and plants are worshipped at different times so as to ensure their survival.

Popular traditions consider nature as a reality of which man is an inseparable part at all levels. The myths do not give man a unique position in so far as his origin or his position with respect to other creatures is concerned. It is generally believed in the popular tradition that knowledge came to humans from birds and animals. Man is not the creator of knowledge. Cosmic intelligence is considered to be self existent and source of all knowledge.

The classical traditions are naturally more tilted towards philosophical expositions on environment. In these traditions the world was divided into two halves: the sky and the earth. There also existed a world beyond the sky and another below the earth. The five cardinal elements overlap in the formation of this world and so is the matter with the other world. This explains how biological and social, both aspects of human life were placed in an integral vision of environment in the ancient Indian traditions.

The classical traditions conceive environment as a system with complex inter- relationships of numerous living and non-living entities. Even the non-living organic world has been perceived as a living creature with a soul. It was a very significant concept as it placed man as equal to every other element of our environment as has been repeatedly stressed. To highlight the importance of various components of environment, various rituals have been institutionalized. These rituals ensured that we treated even the non-living world with great care and maintained a harmony with it. For example fire is conceived as messenger of God. Earth has been considered as mother goddess. Sky is worshipped as father.

The non-human living world has been given great attention in Indian philosophic thought. There is a whole tradition of anthropomorphism, where various kinds of plant and animal lives have been ascribed special position. The ancient tradition of worship of *Pashupati Mahadev* is one such example. The tales of *Panchtantra* may also be cited as another composition that highlights the special position given to non-human living world. Animals are given human characteristics of not only language but also faculty of feeling and intellect. The objective of the tales is to give lessons to mankind by highlighting the problems through animal world's characteristics. Different attributes of animals have been identified and are very beautifully utilized in these tales. Indian philosophical thought also highlights the numerous species of flora and fauna and their special position vis-à-vis environment. This all–encompassing view is a great achievement.

The same enveloping view finds reflection in man's visual expression of perceived reality. The Indian tradition looks at this perceived reality as imbibing three composite aspects, each involved in the other and each orienting the other. The order of priority goes like this;

- the first place is for *pratibha* or inspired vision,
- the second is for *vyutpatta* or studious equipment of the creator, and
- the last being *abhayasa* or assiduous practicing.

It is while explaining the details of the second that the theoreticians find an occasion to take environment into their consideration. The term they use for it is *loka* which means the world in all its infinite variety of living and non-living beings.

In Indian philosophy it is generally believed that each creative act comes from direct contact with *prakriti* (nature). The language of the artistic manifestation evolves through the visual and audio perceptions of the objects in nature. Even the smallest sprout in nature becomes the artist's greatest joy. In celebrating nature nothing is considered as useless. The art form becomes a living entity, a part of the self, family, village and that way, the environment, as a whole.

The dance of Shiva is a perfect iconographical statement of ecology. His emblems are *Agni* and *deer*. His locks are the forests. He hides within himself *Ganga* (water). His hair adorns the sun and the moon. His garlands are the snakes. He wears the tiger skin. He brings to this world the cosmic rhythm of his *damaru* in the incessant process of cyclic creation, degeneration and regeneration and finally of enlightenment. His energy is *Sakti*. Without her he is incomplete. She herself, the daughter of the *Himalayas*, must undergo penance and austerities. The emphasis here is on discipline and austerity, with greater integration of environment.

15.6 POLLUTION (*PRADUSHANA)*: TRADITIONAL CONCERNS

Traditionally, the environmental vision in India has been conceived in terms of a universe which is a creation of God and therefore, a definite set of rules seems to govern the universe. These rules are there for every living creature to follow, however, humans being more intelligent, were expected to adhere to the rules more vigorously. We have read above how it was expected of man to follow ethics for righteous path. Traditional Indian thought awards man the role of a steward/ guardian to take care of all the creatures of the earth. Adherence to the pious practices and ethics is considered as an act to ensure the continuance of order and flourishing of civilisation.

> *For one who lives by eternal law,*
> *The winds are full of sweetness;*
> *The rivers pour sweets;*
> *So may plants be full of sweetness for us.*
> *Sweet be the night and sweet the dawns;*
> *Sweet be our Father Heaven to us.*
> *For us may the forest tree be full of sweetness,*
> *Full of sweetness the sun,*
> *And full of sweetness the kine for us.*

(*Rigveda*, 1.90.6-8)

In this situation a violation of the peaceful co-existence among the creatures or material world was considered as *pradushan.* The prime cause of *pradushan* has been identified as human greed and selfishness. Polluted *Srsti* has been described in the following terms: It seems that all stars, planets, moon, sun, air, Agni and nature or directions have been polluted. Seasons also appear to work against the nature, Prithvi in spite of being full of its virtues has lost its *rasa* in all medicinal plants. Medicinal plants are without original qualities and have been polluted. When such pollution will occur human beings will suffer from diseases. Due to pollution of seasons, several types of diseases will crop up and they will ruin the country. Therefore, collect the medicinal plants before the beginning of terrible disease and change in the nature of Prithvi" (*Charaka Samhita*, *Vimansthan*, 3.2 as cited by Dwived & Tiwari, *op.cit*. p.79).

The source of *pradushana* has been explained in terms of non-adherence to the set norms of cleanliness, violation of *maryada* (code of conduct), etc. Cleanliness was greatly stressed in the traditional thoughts. Cleanliness of body and mind are stressed as a weapon to ward off *pradushan*: Unless the body is kept scrupulously clean and free from toxic or morbid material, the procedures for revitalising and strengthening it will not be efficacious as the dirty clothes will not take proper colour. (*Charaka Samhita,* 8.17, as cited by Dwived & Tiwari, *op.cit*, pp.80-81).

Indian traditional thought stressed on the prohibition of any such activity which had the impact of disturbing the natural symphony or causing contamination of any of the elements of the earth. Anybody violating general norms of cleanliness and hygiene was liable to be cursed. Clearly tampering with the environment to generate disharmony was *pradushana*.

15.7 SUMMARY

We now know that resources exist within Indian philosophical tradition for the elaboration of man-nature relationship. There is great emphasis on man's integral relatedness to nature, its elements and the animal and plant life. The environment in which man lives is not an alien environment. He has always to consider it his own, where he is like all other beings but endowed with special faculty of self-reflection and speech. Indeed man is constantly seen as an embodiment of the elements and forces of nature and constantly in relationship to animal and plant life. This gives the world a different character from what is implied in the modern idea of progressive evolution.

15.8 EXERCISES

1) Write an essay explaining the place attributed to man in Indian philosophical doctrine.
2) Explain the creation and characteristics of *Srsti* as exposed in Indian philosophy.
3) Is there a difference between popular and classical traditions of environmental representation in Indian philosophy? Comment.
4) Examine the concept of *pradushana* in Indian thought.

15.9 SUGGESTED READING

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UNIT 16 CONSERVATION THROUGH AGES

Structure

16.0 INTRODUCTION

The conservation of environment is a subject of serious and wider concerns. We are however inadequately equipped to deal with this concern in the absence of any significant documentation of the subject in the textual tradition of India. We have however attempted to piece together the available evidence for examining the significance of conservation and for giving you a brief history of conservation practices in this unit.

The idea of conservation is probably as old as the human existence but the use of the term in the contemporary writings is relatively recent. Moreover, the environmental problems, in recent decades, have attracted a lot of popular and governmental interest. Environmental matters are becoming a critical part of the political discourse in almost every country. The viability of human survival in the wake of an ever- increasing pollution of the earth is becoming a matter of concern for humans. Recent times have witnessed an increase in the popular awareness with respect to the consequence of global environmental degradation and have noted the necessity for conservation. We hope the problem of conservation will be seriously examined and will pave the way for examining the concept of sustainable development and bio-diversity protection.

16.1 UNDERSTANDING CONSERVATION

Conservation of environment does not and cannot have a universally accepted definition. Generally conservation is considered as protection of wild nature where as few see it as an attempt to stress the prudent use of already stressed natural resources. In fact as the human concern about nature has grown so have the definitions evolved. Generally most accepted definition presented at the *World Conservation strategy* by the International Union for Conservation of Nature and Natural Resources is that of “the management of human use of the biosphere so that it may yield the greatest sustainable benefit while maintaining its potential to meet the needs and aspirations of future generations."

Although we do not equate biodiversity conservation with the complete preservation of all species nor the maintenance of the environmental status quo, we are concerned with the current rates of resource exploitation and habitat modification which may be leading to an excessive biodiversity loss. Thus conservation is not simply preservation of wild nature or biodiversity but it also encompasses the larger issue of the usage of natural resources. At the same time it also implies *preservation of some level of biodiversity that is essential to the functioning of the ecosystems and the survival of the mankind along with other living creatures.*

It is generally believed that nature has its own way of functioning and there is an unsaid balance maintained by nature between humans and its resources. It is only now that greater exploitation of natural resources is disturbing this natural balance. This has forced environmentalists to argue for the conservation of environmental systems and the diversity of species. It has been further supported by those who have become disillusioned with the course of development. The debate has larger political dimension and it is believed that Northern countries (Developed Countries) after developing their industry and in the process destroying the natural balance are now forcing the Southern countries (Developing countries) to not develop in the name of conservation of environment and natural resources in particular. It has been pointed out that the level of energy consumption enjoyed by Northern countries is not tenable in the absence of sufficient natural resources. This view was most vehemently argued at the U.N. Conference on the human environment in Stockholm and Northern environmentalists were shocked in 1972 by the positions taken by the South.

Politics apart, it is a matter of concern that all are threatened by the decay of global life support systems. Historically, people in industrialized countries have not perceived the importance of environmental conservation the same way as the people in developing countries have done. North Americans, due to their cultural history, have to glorify nature to decry its defilement and to propose "back to – nature" type solution. As a consequence of their colonial history, Third World people have tended to be much more concerned with the social origins and human consequences of environmental degradation. It is now being argued that environmental leaders and scientists from North and South should learn from each other through repeated discussions and team work. The 1987 report of the *World Commission on Environment and Development* reflects both views. There is a new synthesis arising among world political leaders as well. Among the populace the differences between North and South are diminishing. Northern workers are becoming more politically active with respect to the danger their work has on environments, while Southern people are gaining a broader understanding of the importance of ecological systems and processes for economic development.

Conservation is essential for the survival of humans as well as life forms on earth. Existence of life forms on earth has been made possible by a very complex combination of interaction among innumerable factors. The most important among these factors being the atmosphere, which represents availability of air (oxygen), water, sun, land forms in particular and numerous other materials. It is presumed that any large scale disturbance in the availability or functioning of any of the components of environment would lead to environmental decay and ultimately cause extinction of life. Therefore, conservation of not only the quantity of the components but also the quality of the components is also very important. As such plants are considered as the primary producers but their relevance with respect to generation of oxygen cannot be undermined. Therefore, any factor which hampers the growth of plant life on earth will lead to the paucity of oxygen and will disturb the proper functioning of environment. At the same time we must be careful to note that till date we are not able to identify numerous other factors that also influence the environment.

Certain aspects of conservation, such as the prevention of pollution, have more narrow but immediate importance. There are numerous examples of the serious effect of pollution in air, water, or soil on human health and survival. Moreover, it is now being realised that impact of pollution on humans can not be treated in isolation and we have to extend our concern to other life forms also.

Another related but equally relevant aspect of conservation has been its economic value. Mostly it has been realised in terms of the cost to the humans. Although the floating plants of the ocean, the microscopic phytoplankton, are of little direct economic value to the humans their elimination from the food chain would sooner or later destroy the world’s marine life and eliminate fisheries – the major source of food for large sections of humanity. The same is applicable to an unrestrained cutting of forest for petty gains. The deforestation would ultimately not only influence the food chain but also lead to depletion of oxygen in the atmosphere. Short term economic consideration will ultimately lead to disruption of the functioning of environment and any rectifying measure will be capital intensive, defeating the basic purpose.

Similarly, along with economic considerations of conservation, we must realise the irreparable damage being caused to the aesthetics of environment. Greater the human technological penetration in the functioning of different components of environment it is difficult to explain the real nature of environment to larger population and urban born in particular.

Conservation is also of great scientific value. Because relatively little is known about the past, present and possible future of the earth, we need to preserve some part of our natural environment to conduct the scientific research in the pristine environment. Moreover, there are still numerous undiscovered materials/natural resources waiting for scientific investigations. Any possibility of elimination or pollution of any such natural resource will deprive humans of its possible benefits.

16.2 INDIAN VIEW OF CONSERVATION

Cutting across historical, philosophical debates, the one principle which underlies and provides unity in Indian philosophy as also continuity of vision and perception is the assertion that *Man is only one among all living matter*. Man's life depends upon and is conditioned by all that surrounds him and sustains him, namely, inanimate, mineral and animate, aquatic, vegetative, and gaseous life. It is therefore, Man's duty to constantly remind himself of the environment and the ecology.

In the Indian world view, as also of other ancient civilizations and cultures, life on earth emerges from the eternal waters that hold the potency of fires. Perhaps we have not pondered over the significance of the myth. While on surface myth has a dream like structure, its meaning and value lies in its pointing at the natural phenomenon. Indian science and philosophy and thus culture develop on the postulate of the perpetual movement of *creation, degeneration, and regeneration* of the cosmos.

The traditional society is structured on a four fold control system that orders human life, its subsistence and desires. Life is ordered into four successive stages (*ashramas*) from learning and performing to gradual indifference and final withdrawal. Although seemingly opposed in character, these primal desires stand in an organic and interactive relationship to one another. This fourfold ordering of life is called ***purusartha***, that is, the making of a cultural person (***purusha***). At a higher level of consciousness, the cultural person is transformed into a cosmic person.

The Indian theory of nature and ecology is enormously affected by the theory of creation which recognizes that *every element, object and living being in the universe is created by the same Supreme Being; and the man has no special dominion over nature*. The early Indian socio-religious systems enshrine respect for nature in the following basic elements:

- faith in a supreme power,
- non-dualistic view of this supreme being, and
- a set of rules defining duties in consonance with cosmic order.

The early scriptures of India provide useful references ascribing practical conservation tips that directly relate with this enshrined respect for nature. *Vedas*, *Upanishads*, *Puranas* and other scriptures give detailed descriptions of trees, plants and wildlife along with their importance to the community. Trees have been considered as an essential part of Indian homes. Significance of plants and trees to human life is further exemplified in *Varah Puran* which advocates regular plantation as a means to achieve heaven. In *Matsyapurana* and *Padmapurana* also there is a description of great plantation ceremony – *Vriksha Mahotsave*. In *Matsyapurana* plantation of a tree has been equated with progeny of ten sons.

Indians accept nature as divinity; and as such various trees and plants are used in religious ceremonies and worship. Some trees and plants are considered so sacred that it is assumed that particular Gods and/or Goddesses have made their abode in them. In *Narsimha Puran* tree has been personified as God (*Brahma*) itself. *Atharvaveda* considers *Peepal* tree as abode of various Gods. Names of various trees and their associations with God and Goddesses are:

Ashoka	*Buddha, Indra, Vishnu, Aditi etc.*
Peepal	*Vishnu, Laxmi, Vana Durga etc.*
Tulsi	*Vishnu, Krishna, Jagannath, Laxmi etc.*
Kadamba	*Krishna*
Ber	*Shiv, Durga, Surya, Laxmi*
Vata	*Brahma, Vishnu, Shiv, Kal, Kubera, Krishna, etc.*

The various trees and plants are not only worshipped but cutting green trees has also been prohibited and punishments prescribed for the offender. Indian society had been very much aware of the fact that *indiscriminate destruction of plants and forests would result in diseases and pollution of the atmosphere*.

One of the early historical evidence of this nature comes from the inscriptions engraved on pillars and rocks at the behest of Ashoka, the famous Mauryan Emperor in the third century BC.

The Ashokan inscriptions were put up at centres of population and pilgrimage where crowds of people would gather and read them, and receive the inscription of their messages of morality. One of this pillar edits, No.V found at Rampurwa in Bihar and issued by him in 243 BC provides elaborate injunctions relating to environment. This edict may even be taken as one of the earliest historical record focusing on conservation practices to be followd by people in general. The text of this edict reads as below (English translation):

Thus saith king Priyadarsi, Beloved of the Gods.

Twenty-six years after my coronation, I have declared the following species of animals exempt from slaughter, viz., parrots, mainas, ruddy geese, wild geese, ***nandimukhas gelatas,*** *bats, mango-tree ants, terrapins, boneless fish,* ***vedaveyakas, gangapuputakas****, skate-fish, tortoises and porcupines, leaf-hares, twelve-antler stags, bulls set at liberty, household vermin, rhinoceroses, white pigeons, village pigeons and all the quadrupeds which are neither useful nor edible.*

Those she-goats, ewes and sows, which are either pregnant or milch, are not to be slaughtered, nor their young ones which are less than six months old. Cocks are not to be caponed. Husks containing living beings should not be burnt. Forests much not be burnt either uselessly or in order to destroy living beings. The living must not be fed with the living.

At the three Chaturmasis and at the full-moon of the month of Tishya, for three days in each case, viz., the fourteenth and fifteenth of one fortnight and the first of the next, and invariably on every fast day, fish is exempt from slaughter and should not be sold. And on the same days, not only these but also other species of beings should not be killed in the elephant-forests and in the fisher-men's preserves.

On the eighth of each fortnight and on the fourteenth and fifteenth, on the tishya and Purnarvasu days, on the three Chaturmasi days and on every auspicious day, bulls are not to be castrated. And he-goats, rams, boars and such other animals as are usually castrated should not be castrated on those days. Horses and bullocks should not be branded on the Tishya and Punarvasu days, on the Chaturmasis and during the fortnights associated with the Chaturmasis.

Up to the time when I completed twenty-six years after my coronation, the release of prisoners has been ordered by me twenty-five times during the period in question.

(D.C. Sircar, *Inscriptions of Asoka*, New Delhi, 1957, pp 64-5).

The text of this edict is self-explanatory. It gives a list of creatures which were declared protected and it was forbidden to slaughter them. Injury to living creatures in other ways was also prohibited. The conservation of forests was earnestly propagated. Forests as the living abode of a variety of creatures would help protect a variety of species. The injunctions concerning fish were invoked perhaps with a view to protect them during the breeding season. For its date which is as early as the third century BC the edict is unparalleled in propagating conservation ethics. (Cf. Radha Kumud Mookerji, *Asokan Inscriptions: A Commentary*, Allahabad, 1942).

The Indian culture, in ancient and medieval times, provided a system of moral guidelines towards environmental preservation and conservation. Environmental ethics as propounded by ancient scriptures and the seers continued to exist in society and was practiced by not only common man but even by rulers and kings. These principles were properly knitted with the Indian way of life. Even very minor things creating environmental problems were dealt with giving proper solutions.

We have several examples from medieval Rajasthan highlighting the concern for environment. The attitude towards nature is apparent in the teachings of sects like Bishnois. The founder of the Bishnoi sect, Jambhoji (AD 1451-1536) prescribed twenty-nine rules for his followers. Most of these suggested maintenance of harmony with the environment, such as the prohibition on cutting green trees and animal slaughter.

Jambhoji's teachings, which were congruent with the interests of the common man, became immensely popular. The number of his followers increased manifold but primarily in the arid regions of Bikaner and Jodhpur. His sect became so influential that the rulers of these states were forced to respect his sermons. Maharaja Ajit Singh issued a *parwana* (official order), restraining the cutting of green trees in 1754 vs./AD 1698. Anup Singh, king of Bikaner prohibited cutting of green trees in the villages dominated by Bishnois in 1752 vs./AD 1696. Similarly, in 1878 vs./AD 1821, Man Singh, the king of Jodhpur, issued a similar order with respect to the *khejari* tree. King Takht Singh in 1900 vs./AD 1843 extended the scope of this legislation by prohibiting slaughter of any animal in the villages dominated by *vaishnoi.*

The founder of the Bishnoi sect was not alone in attempting to influence conduct towards living beings via religious and ethical transformation. Another popular saint, Jasnathji (AD 1482-1506) a contemporary of Jambhoji also endorsed such a viewpoint. His followers were known as Jasnathi. Like his contemporary, Jasnathji was also aware of the importance of the preservation of environment. In his teachings, the *jal* tree, which formed the natural vegetation of the region, was accorded special protection. These teachings became popular in the region, which had traditionally sustained goat and sheep rearing. Conservation of green vegetation and prohibition on the slaughter of animals seemed to be an attempt towards protecting their livelihoods. However, restrictions through religious and official sanctions question the older assumptions of prudent use of natural resources and environmental conservation as supposedly practiced by traditional societies.

16.3 CONSERVATION PRACTICES IN HISTORY

Conservation has a chequered history. It has, in the long and coiled process, concerned itself with natural ecosystems and the animal world. Modern attitudes and practices about conservation have evolved largely in the context of the socio-economic mores of western society. These attitudes have been influenced by the political and economic upheavals that western society has undergone. Western notions of conservation have been mainly guided by the philosophical foundations of Judeo-Christian position about man and nature. Two ideas constitute the core of this position:

- the right of exploitation of nature by man, unfettered by any serious ethical consideration; and
- the responsibility of stewardship.

The fundamental Judeo-Christian belief holds that nature was created to serve the human race. Hence, the exploitation of nature is a natural legitimate pursuit. This view does not endow the environment and its inhabitants with protective spirits that prohibit exploitation.

Starting with the voyages of discovery in the fifteenth century, the influence of European culture was spread over the world. By the seventeenth century Europeans were equipped with an increasingly powerful technology and a growing ability to modify large areas of the earth. During this period the attitudes of explorers and colonists were oriented more toward immediate personal aggrandizement of the lands they visited and settled than toward any concern for the long-term health and productivity of the newly discovered countries. Soil erosion as well as the destruction of natural vegetation and wildlife accompanied the spread of European colonization. During the same period, however, some conservation ideas and practices were also being promoted. Forest conservation, for example, developed sound beginnings because of the disappearance of natural forests as a result of the increasing demand for wood fuel for industrial uses. Also a general interest in and concern for wildlife was developing.

The nineteenth century, however, witnessed unusually severe environmental exploitation and destruction. In Africa many forms of wildlife were hunted to extinction, and most of the larger mammals were reduced to numbers that endangered their survival. Even the larger predatory animals were nearly exterminated, and some of them subsequently became extinct. Many types of birds that once had occurred in great abundance were wiped out. Logging and fires combined to menace the once luxurious forests. Livestock populations were allowed to increase to levels far above what the natural forage could support. The process of over foraging damaged the range lands to such a degree that they have not yet recovered. The grasslands were overgrazed and native vegetation was eliminated.

By the middle decades of nineteenth century biology was undergoing a revolutionary change in its view of the natural world i.e. the replacement of a static, creationist view of life by an evolving mechanistic view. This change is best exemplified by the emergence of the theory of *evolution by natural selection*, presented jointly by Charles Darwin and Alfred Wallace. The concept of natural selection replaced the creationist view of the original living species with a mechanistic process of interaction within nature. *The evolutionary view also opened the eyes of many to the fact that change in the environment, including changes caused by humans, could bring about the extinction of many kinds of organisms, as the fossil record demonstrated.*

It could have been predicted that the modern conservation movement would have its beginnings not in the settled lands of the Old World but in those areas of the New World where, within the memory of a single generation, there had been extreme changes in the landscape and similar changes in the abundance of wildlife. Conservation as a national movement was initiated by U.S. President Theodore Roosevelt and his immediate advisers. Roosevelt's chief forester, Gifford Pinchot, is credited with having first used the term "conservation" in its present context.

World War II, suddenly diverted attention from conservation issues. It also initiated an era of unparalleled economic expansion and explosive growth of technology and human population. The result was exponential growth in the pollution of air, land and water by chemicals and chemical wastes.

The emerging situation was frightening. The attention of world community to the issues related with conservation of environment was bound to be attracted by it. In the post-war scenario serious attention was paid to the issue. It was seriously realised that the global commons were being increasingly threatened by a wide variety of real and potential environmental problems.

Since 1950s environmental issues have been catapulted on to the centre stage of global politics. International organisations are now seriously involved and an elusive consensus on a global action plan is being attempted. These developments shall be discussed in detail in Block 7.

16.4 SUMMARY

Various developmental activities are rapidly destroying nature and its finely maintained and fragile balance and interdependence created over million of years. But by destroying nature society is creating a basis for self destruction. The destruction of nature has gathered speed in the last two decades, and we are fast heading towards a complete devastation and destruction of ecology. We are not on the brink of disaster; we have already entered the realm of disaster. *Man by his thoughtless acts is fast turning the globe into a large garbage heap.*

Much of his recent industrialization and agrarian development was ill conceived, and continues to be so. Man and society have ruthlessly robbed nature and have made a desert of the earth. But the worst crime man and society continue to commit is to deprive the planet of its deep-fresh-cover of dense forests, those forests that sustain man and all the living beings and provide them with the life giving oxygen. Virtually every state and country is involved in this criminal act – an act against the humanity. Some people do it for profit, others in the name of providing basic necessities of live, still others purely for pleasure.

Conservation is essential to human survival. Because life depends upon he proper functioning of the biosphere – the relatively narrow zone of air, water, soil, and rock in which all life on earth exists – the ultimate purpose of conservation is to maintain the biosphere in a healthy operating condition. Although it is known that green plants supply oxygen to the atmosphere, that plants and animals recycle nutrients, and that plants and animals help maintain the fertility of soils, many of the elements that contribute to the proper functioning of the biosphere have not yet been identified. Because mankind lives with such environmental uncertainties, an attitude of care and protection toward the earth's living resources is necessary.

The ecological situation has become quite critical today, so critical that if we do not take urgent steps, things will go out of control and beyond redeem. Man's various activities in all fields of daily life, particularly the industrial and agricultural ones, are rapidly destroying nature. By destroying ecology, man is creating conditions for self destruction. What must we do? Obviously the question of protection and regeneration of ecology is the question number one before the world society. The entire strategy of the future development of civilization has to change drastically in all the fields; otherwise our survival is out of question.

16.5 EXERCISES

1) Write a note on the significance of environmental conservation.
2) Discuss conservation practices since the beginning of the modern period.
3) Write an essay on the Indian view of conservation.
4) Write a short note on the meaning of conservation.

16.6 SUGGESTED READING

The Princeton Conference Report, Man's Role in Changing the Face of the Earth, 1958.

O.P. Dwivedi & B.N. Tiwari, *Environmental Crisis and Hindu Religion*, B.N. Tiwari New Delhi, 1987.

James E. Hickey & Linda A. Longmire, ed., *The Environment, Global Problems, Local Solutions*, London, 1994.

UNIT 16 CONSERVATION THROUGH AGES

Structure

16.0 Introduction

16.1 Understanding Conservation

16.2 Indian View of Conservation

16.3 Conservation Practices in History

16.4 Summary

16.5 Exercises

16.6 Suggested Reading

16.0 INTRODUCTION

The conservation of environment is a subject of serious and wider concerns. We are however inadequately equipped to deal with this concern in the absence of any significant documentation of the subject in the textual tradition of India. We have however attempted to piece together the available evidence for examining the significance of conservation and for giving you a brief history of conservation practices in this unit.

The idea of conservation is probably as old as the human existence but the use of the term in the contemporary writings is relatively recent. Moreover, the environmental problems, in recent decades, have attracted a lot of popular and governmental interest. Environmental matters are becoming a critical part of the political discourse in almost every country. The viability of human survival in the wake of an ever- increasing pollution of the earth is becoming a matter of concern for humans. Recent times have witnessed an increase in the popular awareness with respect to the consequence of global environmental degradation and have noted the necessity for conservation. We hope the problem of conservation will be seriously examined and will pave the way for examining the concept of sustainable development and bio-diversity protection.

16.1 UNDERSTANDING CONSERVATION

Conservation of environment does not and cannot have a universally accepted definition. Generally conservation is considered as protection of wild nature where as few see it as an attempt to stress the prudent use of already stressed natural resources. In fact as the human concern about nature has grown so have the definitions evolved. Generally most accepted definition presented at the *World Conservation strategy* by the International Union for Conservation of Nature and Natural Resources is that of “the management of human use of the biosphere so that it may yield the greatest sustainable benefit while maintaining its potential to meet the needs and aspirations of future generations."

Although we do not equate biodiversity conservation with the complete preservation of all species nor the maintenance of the environmental status quo, we are concerned with the current rates of resource exploitation and habitat modification which may be leading to an excessive biodiversity loss. Thus conservation is not simply preservation of wild nature or biodiversity but it also encompasses the larger issue of the usage of natural resources. At the same time it also implies *preservation of some level of biodiversity that is essential to the functioning of the ecosystems and the survival of the mankind along with other living creatures.*

It is generally believed that nature has its own way of functioning and there is an unsaid balance maintained by nature between humans and its resources. It is only now that greater exploitation of natural resources is disturbing this natural balance. This has forced environmentalists to argue for the conservation of environmental systems and the diversity of species. It has been further supported by those who have become disillusioned with the course of development. The debate has larger political dimension and it is believed that Northern countries (Developed Countries) after developing their industry and in the process destroying the natural balance are now forcing the Southern countries (Developing countries) to not develop in the name of conservation of environment and natural resources in particular. It has been pointed out that the level of energy consumption enjoyed by Northern countries is not tenable in the absence of sufficient natural resources. This view was most vehemently argued at the U.N. Conference on the human environment in Stockholm and Northern environmentalists were shocked in 1972 by the positions taken by the South.

Politics apart, it is a matter of concern that all are threatened by the decay of global life support systems. Historically, people in industrialized countries have not perceived the importance of environmental conservation the same way as the people in developing countries have done. North Americans, due to their cultural history, have to glorify nature to decry its defilement and to propose "back to – nature" type solution. As a consequence of their colonial history, Third World people have tended to be much more concerned with the social origins and human consequences of environmental degradation. It is now being argued that environmental leaders and scientists from North and South should learn from each other through repeated discussions and team work. The 1987 report of the *World Commission on Environment and Development* reflects both views. There is a new synthesis arising among world political leaders as well. Among the populace the differences between North and South are diminishing. Northern workers are becoming more politically active with respect to the danger their work has on environments, while Southern people are gaining a broader understanding of the importance of ecological systems and processes for economic development.

Conservation is essential for the survival of humans as well as life forms on earth. Existence of life forms on earth has been made possible by a very complex combination of interaction among innumerable factors. The most important among these factors being the atmosphere, which represents availability of air (oxygen), water, sun, land forms in particular and numerous other materials. It is presumed that any large scale disturbance in the availability or functioning of any of the components of environment would lead to environmental decay and ultimately cause extinction of life. Therefore, conservation of not only the quantity of the components but also the quality of the components is also very important. As such plants are considered as the primary producers but their relevance with respect to generation of oxygen cannot be undermined. Therefore, any factor which hampers the growth of plant life on earth will lead to the paucity of oxygen and will disturb the proper functioning of environment. At the same time we must be careful to note that till date we are not able to identify numerous other factors that also influence the environment.

Certain aspects of conservation, such as the prevention of pollution, have more narrow but immediate importance. There are numerous examples of the serious effect of pollution in air, water, or soil on human health and survival. Moreover, it is now being realised that impact of pollution on humans can not be treated in isolation and we have to extend our concern to other life forms also.

Another related but equally relevant aspect of conservation has been its economic value. Mostly it has been realised in terms of the cost to the humans. Although the floating plants of the ocean, the microscopic phytoplankton, are of little direct economic value to the humans their elimination from the food chain would sooner or later destroy the world's marine life and eliminate fisheries – the major source of food for large sections of humanity. The same is applicable to an unrestrained cutting of forest for petty gains. The deforestation would ultimately not only influence the food chain but also lead to depletion of oxygen in the atmosphere. Short term economic consideration will ultimately lead to disruption of the functioning of environment and any rectifying measure will be capital intensive, defeating the basic purpose.

Similarly, along with economic considerations of conservation, we must realise the irreparable damage being caused to the aesthetics of environment. Greater the human technological penetration in the functioning of different components of environment it is difficult to explain the real nature of environment to larger population and urban born in particular.

Conservation is also of great scientific value. Because relatively little is known about the past, present and possible future of the earth, we need to preserve some part of our natural environment to conduct the scientific research in the pristine environment. Moreover, there are still numerous undiscovered materials/natural resources waiting for scientific investigations. Any possibility of elimination or pollution of any such natural resource will deprive humans of its possible benefits.

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The Indian theory of nature and ecology is enormously affected by the theory of creation which recognizes that *every element, object and living being in the universe is created by the same Supreme Being; and the man has no special dominion over nature***.** The early Indian socio-religious systems enshrine respect for nature in the following basic elements:

- faith in a supreme power,
- non-dualistic view of this supreme being, and
- a set of rules defining duties in consonance with cosmic order.

The early scriptures of India provide useful references ascribing practical conservation tips that directly relate with this enshrined respect for nature. *Vedas*, *Upanishads*, *Puranas* and other scriptures give detailed descriptions of trees, plants and wildlife along with their importance to the community. Trees have been considered as an essential part of Indian homes. Significance of plants and trees to human life is further exemplified in *Varah Puran* which advocates regular plantation as a means to achieve heaven. In *Matsyapurana* and *Padmapurana* also there is a description of great plantation ceremony – *Vriksha Mahotsave***.** In *Matsyapurana* plantation of a tree has been equated with progeny of ten sons.

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The various trees and plants are not only worshipped but cutting green trees has also been prohibited and punishments prescribed for the offender. Indian society had been very much aware of the fact that *indiscriminate destruction of plants and forests would result in diseases and pollution of the atmosphere*.

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On the eighth of each fortnight and on the fourteenth and fifteenth, on the tishya and Purnarvasu days, on the three Chaturmasi days and on every auspicious day, bulls are not to be castrated. And he-goats, rams, boars and such other animals as are usually castrated should not be castrated on those days. Horses and bullocks should not be branded on the Tishya and Punarvasu days, on the Chaturmasis and during the fortnights associated with the Chaturmasis.

Up to the time when I completed twenty-six years after my coronation, the release of prisoners has been ordered by me twenty-five times during the period in question.

(D.C. Sircar, *Inscriptions of Asoka*, New Delhi, 1957, pp 64-5).

The text of this edict is self-explanatory. It gives a list of creatures which were declared protected and it was forbidden to slaughter them. Injury to living creatures in other ways was also prohibited. The conservation of forests was earnestly propagated. Forests as the living abode of a variety of creatures would help protect a variety of species. The injunctions concerning fish were invoked perhaps with a view to protect them during the breeding season. For its date which is as early as the third century BC the edict is unparalleled in propagating conservation ethics. (Cf. Radha Kumud Mookerji, *Asokan Inscriptions: A Commentary*, Allahabad, 1942).

The Indian culture, in ancient and medieval times, provided a system of moral guidelines towards environmental preservation and conservation. Environmental ethics as propounded by ancient scriptures and the seers continued to exist in society and was practiced by not only common man but even by rulers and kings. These principles were properly knitted with the Indian way of life. Even very minor things creating environmental problems were dealt with giving proper solutions.

We have several examples from medieval Rajasthan highlighting the concern for environment. The attitude towards nature is apparent in the teachings of sects like Bishnois. The founder of the Bishnoi sect, Jambhoji (AD 1451-1536) prescribed twenty-nine rules for his followers. Most of these suggested maintenance of harmony with the environment, such as the prohibition on cutting green trees and animal slaughter.

Jambhoji's teachings, which were congruent with the interests of the common man, became immensely popular. The number of his followers increased manifold but primarily in the arid regions of Bikaner and Jodhpur. His sect became so influential that the rulers of these states were forced to respect his sermons. Maharaja Ajit Singh issued a *parwana* (official order), restraining the cutting of green trees in 1754 vs./AD 1698. Anup Singh, king of Bikaner prohibited cutting of green trees in the villages dominated by Bishnois in 1752 vs./AD 1696. Similarly, in 1878 vs./AD 1821, Man Singh, the king of Jodhpur, issued a similar order with respect to the *khejari* tree. King Takht Singh in 1900 vs./AD 1843 extended the scope of this legislation by prohibiting slaughter of any animal in the villages dominated by *vaishnoi.*

The founder of the Bishnoi sect was not alone in attempting to influence conduct towards living beings via religious and ethical transformation. Another popular saint, Jasnathji (AD 1482-1506) a contemporary of Jambhoji also endorsed such a viewpoint. His followers were known as Jasnathi. Like his contemporary, Jasnathji was also aware of the importance of the preservation of environment. In his teachings, the *jal* tree, which formed the natural vegetation of the region, was accorded special protection. These teachings became popular in the region, which had traditionally sustained goat and sheep rearing. Conservation of green vegetation and prohibition on the slaughter of animals seemed to be an attempt towards protecting their livelihoods. However, restrictions through religious and official sanctions question the older assumptions of prudent use of natural resources and environmental conservation as supposedly practiced by traditional societies.

16.3 CONSERVATION PRACTICES IN HISTORY

Conservation has a chequered history. It has, in the long and coiled process, concerned itself with natural ecosystems and the animal world. Modern attitudes and practices about conservation have evolved largely in the context of the socio-economic mores of western society. These attitudes have been influenced by the political and economic upheavals that western society has undergone. Western notions of conservation have been mainly guided by the philosophical foundations of Judeo-Christian position about man and nature. Two ideas constitute the core of this position:

- the right of exploitation of nature by man, unfettered by any serious ethical consideration; and
- the responsibility of stewardship.

The fundamental Judeo-Christian belief holds that nature was created to serve the human race. Hence, the exploitation of nature is a natural legitimate pursuit. This view does not endow the environment and its inhabitants with protective spirits that prohibit exploitation.

Starting with the voyages of discovery in the fifteenth century, the influence of European culture was spread over the world. By the seventeenth century Europeans were equipped with an increasingly powerful technology and a growing ability to modify large areas of the earth. During this period the attitudes of explorers and colonists were oriented more toward immediate personal aggrandizement of the lands they visited and settled than toward any concern for the long-term health and productivity of the newly discovered countries. Soil erosion as well as the destruction of natural vegetation and wildlife accompanied the spread of European colonization. During the same period, however, some conservation ideas and practices were also being promoted. Forest conservation, for example, developed sound beginnings because of the disappearance of natural forests as a result of the increasing demand for wood fuel for industrial uses. Also a general interest in and concern for wildlife was developing.

The nineteenth century, however, witnessed unusually severe environmental exploitation and destruction. In Africa many forms of wildlife were hunted to extinction, and most of the larger mammals were reduced to numbers that endangered their survival. Even the larger predatory animals were nearly exterminated, and some of them subsequently became extinct. Many types of birds that once had occurred in great abundance were wiped out. Logging and fires combined to menace the once luxurious forests. Livestock populations were allowed to increase to levels far above what the natural forage could support. The process of over foraging damaged the range lands to such a degree that they have not yet recovered. The grasslands were overgrazed and native vegetation was eliminated.

By the middle decades of nineteenth century biology was undergoing a revolutionary change in its view of the natural world i.e. the replacement of a static, creationist view of life by an evolving mechanistic view. This change is best exemplified by the emergence of the theory of *evolution by natural selection*, presented jointly by Charles Darwin and Alfred Wallace. The concept of natural selection replaced the creationist view of the original living species with a mechanistic process of interaction within nature. *The evolutionary view also opened the eyes of many to the fact that change in the environment, including changes caused by humans, could bring about the extinction of many kinds of organisms, as the fossil record demonstrated.*

It could have been predicted that the modern conservation movement would have its beginnings not in the settled lands of the Old World but in those areas of the New World where, within the memory of a single generation, there had been extreme changes in the landscape and similar changes in the abundance of wildlife. Conservation as a national movement was initiated by U.S. President Theodore Roosevelt and his immediate advisers. Roosevelt's chief forester, Gifford Pinchot, is credited with having first used the term "conservation" in its present context.

World War II, suddenly diverted attention from conservation issues. It also initiated an era of unparalleled economic expansion and explosive growth of technology and human population. The result was exponential growth in the pollution of air, land and water by chemicals and chemical wastes.

The emerging situation was frightening. The attention of world community to the issues related with conservation of environment was bound to be attracted by it. In the post-war scenario serious attention was paid to the issue. It was seriously realised that the global commons were being increasingly threatened by a wide variety of real and potential environmental problems.

Since 1950s environmental issues have been catapulted on to the centre stage of global politics. International organisations are now seriously involved and an elusive consensus on a global action plan is being attempted. These developments shall be discussed in detail in Block 7.

16.4 SUMMARY

Various developmental activities are rapidly destroying nature and its finely maintained and fragile balance and interdependence created over million of years. But by destroying nature society is creating a basis for self destruction. The destruction of nature has gathered speed in the last two decades, and we are fast heading towards a complete devastation and destruction of ecology. We are not on the brink of disaster; we have already entered the realm of disaster. *Man by his thoughtless acts is fast turning the globe into a large garbage heap.*

Much of his recent industrialization and agrarian development was ill conceived, and continues to be so. Man and society have ruthlessly robbed nature and have made a desert of the earth. But the worst crime man and society continue to commit is to deprive the planet of its deep-fresh-cover of dense forests, those forests that sustain man and all the living beings and provide them with the life giving oxygen. Virtually every state and country is involved in this criminal act – an act against the humanity. Some people do it for profit, others in the name of providing basic necessities of live, still others purely for pleasure.

Conservation is essential to human survival. Because life depends upon he proper functioning of the biosphere – the relatively narrow zone of air, water, soil, and rock in which all life on earth exists – the ultimate purpose of conservation is to maintain the biosphere in a healthy operating condition. Although it is known that green plants supply oxygen to the atmosphere, that plants and animals recycle nutrients, and that plants and animals help maintain the fertility of soils, many of the elements that contribute to the proper functioning of the biosphere have not yet been identified. Because mankind lives with such environmental uncertainties, an attitude of care and protection toward the earth’s living resources is necessary.

The ecological situation has become quite critical today, so critical that if we do not take urgent steps, things will go out of control and beyond redeem. Man’s various activities in all fields of daily life, particularly the industrial and agricultural ones, are rapidly destroying nature. By destroying ecology, man is creating conditions for self destruction. What must we do? Obviously the question of protection and regeneration of ecology is the question number one before the world society. The entire strategy of the future development of civilization has to change drastically in all the fields; otherwise our survival is out of question.

16.5 EXERCISES

1) Write a note on the significance of environmental conservation.
2) Discuss conservation practices since the beginning of the modern period.
3) Write an essay on the Indian view of conservation.
4) Write a short note on the meaning of conservation.

16.6 SUGGESTED READING

The Princeton Conference Report, Man's Role in Changing the Face of the Earth, 1958.

O.P. Dwivedi & B.N. Tiwari, *Environmental Crisis and Hindu Religion*, B.N. Tiwari New Delhi, 1987.

James E. Hickey & Linda A. Longmire, ed., *The Environment, Global Problems, Local Solutions*, London, 1994.

UNIT 18 UNDERSTANDING OF ENVIRONMENT

Structure

18.0 INTRODUCTION

Colonialism is generally considered an environmental turning-point in the history of India. An era of unprecedented resource exploitation begins and natural resources get geared to the requirements of the nascent English industries. The commercial interests come centre-stage and a large chunk of communities dependent on various resources-use practices for their subsistence are marginalised. The twin-processes of industrialisation and colonisation operate in tandem and bring in environmental impoverishment for India. The colonial power, in this process, is guided by its own understanding of the environment of the colony and the policy of resource use unfolds and becomes operational in consonance with this understanding. In the details that follow we attempt a portrayal of this perception. In this task, we are not helped much by evidence that is direct and in any sense prolific. The description is therefore not very elaborate, yet it is informative.

18.1 INDUSTRIALISM: ENVIRONMENTAL DISCOURSE

Industrial Revolution was a momentous occurrence. It signaled a brake for the *biological regimes* and initiated a process of industrialisation that was impregnated with enormous new possibilities of the use of natural resources. Industrialisation was accompanied by technological advances of far reaching impacts and they together unleashed processes that altered completely the prevailing picture of the natural world. Fernand Braudel had said: “In fact, until the eighteenth century, a Jungle Book could have been written about almost any part of the globe” (*The Structures of Everyday Life*, tr. Sian Reynolds, Harper and Row, 1985, p.69). Within a century since then, however, echoes of wailing voices could be heard saying *How Green Was My Valley*?

England was a pioneer in industrialisation. It was a special circumstance that had given England a position of eminence. Industrialisation was a complex process that had got initiated there due to a peculiar combination of factors. The major areas that had come under the splurge of industrialisation were agriculture, demography, inland transport, technology, trade and industry. In fact there was no sector of private or public life in England that was actually immune from industrialisation. An understanding of industrialisation and its working in England is therefore of help to us in gaining insights into the formulation of environmental perceptions of English colonisers.

Agriculture provided the necessary backdrop against which the industrial changes unfolded. Experiments with soil usage and the introduction of a variety of crops was perhaps the first stage where notable changes became evident. The fertilising properties of soil were enhanced by liming and marling the soil (adjusting the right mix of clay and lime in the soil) and a pattern of crop rotation experimented for rejuvenating the different layers of soil. It is an interesting fact that industrial and mechanised equipment in agriculture were introduced only around mid-nineteenth century. Braudel notes that changes in agriculture "come not so much from machines or wonder crops as from new methods of land use; new timetables for ploughing; new forms of crop rotation which eliminated fallow and encouraged grazing, a useful source of fertiliser and therefore a remedy for soil exhaustion; attention to new strains of crops; selective breeding of sheep and cattle; specialised farming for higher yields – all with results which varied according to region, to natural conditions and to the constraints of the market which were never the same in two places. The resulting system was what would in the nineteenth century be called *high farming…*" (*The Perspectives of the World*, tr. Sian Reynolds, Harper and Row, 1984, p.559).

One of the early changes in the industrial sector was the introduction of coke as a fuel replacing charcoal. The most noticeable use of coke was in blast-furnaces for making pig-iron. In "about 1760, the cost price of charcoal-fired smelting was about £ 2 per ton greater than that of iron produced by the rival method" the coke fired blast furnaces (Braudel, *op. cit.* p.569). The other significant change was in the cotton sector where a production boom began to show by the close of the eighteenth century. Here India was directly involved. To quote Braudel again whose succinct remarks are of high value in our discussion: "The cotton revolution, first in England, but very soon all over Europe, began by imitating Indian industry, went on to take revenge by catching up with it, and finally outstripped it. The aim was to produce fabrics of comparable quality at cheaper prices. The only way to do so was to introduce machines – which alone could effectively compete with Indian textile workers. But success did not come immediately. That had to wait for Arkwright's water-frame (1769) and Crompton's mule (1775-8) which made it possible to produce yarn as fine and strong as the Indian product, one that could be used for weaving fabric entirely out of cotton. From now on, the market for Indian cottons would be challenged by the developing English industry – and it was a very large market indeed, covering England and the British Isles, Europe (where various continental cotton industries were however soon putting up their own competition), the coast of Africa, where black slaves were exchanged for lengths of cotton, and the huge market of colonial America, not to mention Turkey and the Levant – or India itself. Cotton was always produced primarily for export: in 1800 it represented a quarter of all British exports; by 1850 this had risen to fifty per cent" (Braudel, *op. cit.*, p.572).

An extraordinary expansion of English trade was one more feature of industrialisation. After 1760 the English overseas trade continuously increased. The centre of gravity of this trade moved towards American colonies and India. Significantly this success, in most cases, was achieved by force. Along side this, came improvements in inland transport. The Canal fever - as the development of navigable waterways is generally known as - began in 1775 and by 1830s wide and narrow canals had crisscrossed the entire country. The main intent was to facilitate haulage of resources on a bulk scale so that growth of English industries would not be stifled for want of natural resources in the proximity of the sites of the industries.

These details point towards two conclusions. In the first place industrialisation resulted into a good deal of destruction, adaptation and restructuring. The traditional structures of agriculture were impaired and the land use patterns changed significantly. For instance, animal farming became more profitable than arable making farmers to shift to forage crops. Since forage crops do best on light and sandy soils, these became the most productive land in England. Heavy clayey soils by contrast, previously regarded as the richest for cereal growing, and unsuitable for forage crops, were hit by the low prices created by higher yields in rival regions (Cf. Braudel, *op. cit.*, p.560). Secondly, industrialism i.e. the adaptation of an industrial mode of life, became the dominant social norm. In other words, this meant a transition from a predominantly agricultural society to one in which manufacture dominated.

The central discourse under industrialisation was about the revolution in the mode of resource use – transforming resources from one form to another and making it possible for resources to be transported over large distances, away from the places of their origin.

Evidently the environmental perception or understanding of the English colonisers was mediated by this discourse. In the English understanding of environmental conditions in India in the eighteenth century but especially since the battle of Plassey the following features were quite dominant:

- The natural resources of India needed to be elevated to the level of commercial use in place of the prevalent general practice of use for subsistence purposes;
- The resource-use practices needed to become free of any restraints so as to enable resource exploitation;

- In this process, community control over resources required to be unshackled even through legal mechanisms if needed; and
- A conflict in the ways of life or cultures was deemed inevitable in this process.

As we shall see in Units 20 and 21, this understanding guided the exploitative working of the colonial policy in the case of water resources and forest resources.

18.2 COLONIALISM: ENVIRONMENTAL DISCOURSE

Colonisation of India was an occurrence of singular significance. The largest colony in the world was created by the classic capitalist power. The long historical process, from about the middle of the eighteenth century till the beginning of the twentieth century, was fraught with devices of resource exploitation of an unprecedented kind interceded by an environmental perception that oriented resources principally towards market. The colonial discourse on environment has been nicely elaborated by Alfred Crosby in his work *Ecological Imperialism: The Biological Expansion of Europe* (CUP, 1986). We use his argument (as given by Gadgil and Guha) here and split and paraphrase it to show the consequences of colonial discourse on environment as below in line with our discussion:

- European colonisers exterminated native ecosystems and populations;
- The complex of weeds, animals and diseases brought by Europeans devastated the flora, fauna and human societies of the colonies;
- It created 'Neo-Europes' that dominate the New World today;
- In this biological expansion of Europe there were three areas that were 'within reach' but 'beyond grasp' – Middle East, China and India;
- Population densities, resistance to disease, agricultural technology and sophisticated socio-political organisations made these areas more resistant to the ecological imperialism of Europe;
- Thus 'the rule (not the law)' was that although Europeans did conquer the tropics, they did not succeed in Europeanizing the tropics, not even country sides with European temperatures (p.134);
- Portmanteau Biota (collective term for the organisms the colonising whites brought with them) enabled the European powers to easily overrun the temperate regions of North and South America as well the continent of Oceania;
- In the case of more ecologically resistant civilisations like India and China a different strategy had to be adopted;

- In India, the British could not create neo-Europes by decimating indigenous populations and their natural resources base;
- But they did intervene and radically after existing food-production systems and their ecological basis;
- Moreover, by exposing their subjects to the seductions of the industrial economy and consumer society, the British ensured that the process of ecological change they initiated would continue, and indeed intensify, after they left India's shores.

The English colonial control of India began with the acquisition of the power to collect land revenue – the *Diwani* rights of Bengal, Bihar and Orissa. What seemed on the face a simple political process had grave and quite far reaching implications. Irfan Habib describes the process and its meaning exquisitely: "The East India Company, which obtained this power, was controlled by the great merchant-capitalists of London. These merchants had so far conducted a trade, based on the import of Indian piece goods (muslin, calico, chintz), silk, indigo and spices, that was financed mainly by the export of treasure. Now, suddenly, they found in their conquests the ultimate bliss that every merchant dreams of: to be able to buy without having to pay, and yet be able to sell at the full price. This could be achieved by treating the entire revenue of the country as gross profits. From these the expenses necessary for maintaining government and army, and law and order – the costs of maintenance of the existing system of exploitation – had to be deducted in order to yield the net profits. These could, in turn, be invested for the purchase of Indian commodities, the so-called 'investments'. The purchase of these commodities in conditions where the buyer had a monopoly, and their sale in markets throughout the world, further enlarged the profits before the 'tribute'–a word freely in use for it at the time –was finally received in England. The revenues from the conquests dwarfed the amount of bullion that had once financed English trade; and, accordingly, the exports of Indian commodities underwent an enormous increase. British imports originating in 'East India' increased from £1.5 million in 1750 –51 to 5.8 million in 1797-98, from 12 per cent of total British imports to 24 per cent. In contrast, the British exports to East India rose only from 6.4 per cent to 9 per cent of total British exports. Unlike the later imperialists, fighting for markets in the colonies, these pre-industrial conquerors were hunting for colonial commodities, which had the whole world as their market" ('Colonialisation of the Indian Economy' in *Essays in Indian History*, New Delhi, 1995, pp.299-300).

Interestingly the profits so gained by English did not come from commerce but were made available through the collection of land revenue. Thus if the profits had to be increased the land revenue too needed to be enhanced. A great pressure was exerted on the farmers/ peasants for maximising the land revenue. The results were terrifying as the agriculture was ruined. The colonial perception of the commercial use of resources had yielded disastrous results.

During the period coinciding with the first half of the nineteenth century "the colonial objective changed from seizing Indian commodities to seizing the Indian market. The changed objective not only made the East India Company's monopoly over Indian internal commerce and overseas trade obsolete, but positively required free trade…

The English exports of manufactures, textiles in the first place, not only practically wiped out the Indian exports of cotton goods, but also entered India to challenge Indian manufactures, in their home market…." (Irfan Habib, *op. cit.* p.319). The result was a second disaster; de-industrialization of India had been effected.

About mid-nineteenth century the capital investment at home (in England) had reached a saturation point. This gave rise to an intensified race for markets and export of capital. In India this capital was used for laying railways. Once this process had progressed up to a certain stage, the influx of imports from England gained momentum. This onslaught of imports had grave consequences for the traditional craft industries of India. They were ruined beyond repair. Such was the ecological-environmental encounter between India and its colonial conquerors, the English.

18.3 CONSERVATION

It is generally argued that the age of discovery and associated maritime travel gave rise to a new way of looking at man-nature relationship. There were two kinds of major changes involved in this new vision. The first related to the emergence of a view that natural environment surrounding the human society was pliable to man's desired changes. The second gave rise to a new kind of significance being attached to nature that was also often imitated. The development of the idea of botanical garden was copied from Middle East (Cf. Richard H. Grove, *Green Imperialism*, New Delhi, 1995, p.24). By the time we arrive at the seventeenth century "a fundamental displacement of social and symbolic meanings away from the confines of religious contexts and into more secular settings" takes place. Soon the "idea of a flawed and fallen natural world in opposition to a spiritual heaven became less attractive as the whole globe became technically and economically more reachable and as its extra-ordinary variety and richness, especially in tropical regions, became apparent and knowledge of it more widely disseminated in printed books" (Richard H. Grove, *op. cit.* , p.51).

The conservation efforts initiated in the colonies were the result of a keen awareness that had developed about an impending global scarcity of timber resources. However, none of these efforts could be linked directly to any methodical efforts at organising the resource-use practices in the colonies to the objective of conservation. A serious threat to the supply of naval timber was the initial impetus for conservation. In the absence of any institutional evolution thus the environments of colonies continued to suffer.

Richard H. Grove has studied the conservation practices of English colonisers in his book *Green Imperialism*. He writes: "The very early incorporation of conservationism as an accepted part of the role of the colonial state in India needs to be set in a broader context. There is no doubt that environmental sensibilities in Britain, for example, were, among some groups, almost as well developed by the 1860s as they were among the scientific services in India. They were very different kinds of sensibilities, and were associated with different kinds of social critique. The biota of Europe was simply not perceived as being threatened by rapid ecological change of the kind that was taking place in India. As a result, embryonic worries about the destruction of rural landscapes and about species extinctions remained the concern of a largely ineffective minority" (pp. 462-3). It is not totally unfair to assume that environmental conservation as a policy was not on the principal agenda of the colonialists. Forest resource, as we shall see in Unit 20, was their major focus. The depleted wood resources back home in England were a blinker. It was not until the early years of twentieth century that serious attention was given to the issue.

18.4 SUMMARY

Colonial understanding of environment was guided by the process of industrialisation and the necessity of controlling resources available in the colonies. The main feature of this understanding was an emphasis on the use of natural resources as commodities. In this the local cohesive communities who had hitherto been sustaining on the natural resource were relegated into background and their place in was occupied by atomised individuals. A major consequence of this was that individual access, in place of community access, to resources was promoted. The natural resources were now oriented towards market and the subsistence pattern of resource-use was seriously ruptured. The conservation practices, taking into consideration the environment as a whole, had not come into vogue. India as a colony was seen as a repository of natural resources, the exploitation of which was seen as a legitimate right.

18.5 EXERCISES

1) How did industrialism shape the colonial perception of environment? Discuss.

2) Did colonisation of India result in environmental degradation? Comment.

3) Write a short note on the colonial conservation practices.

18.6 SUGGESTD READING

Madhav Gadgil & Ramchandra Guha, *This Fisured Land: An Ecological History of India,* Delhi, 1992.

Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1800*, Delhi, 1995.

Irfan Habib, *Essays in Indian History, Towards a Marxist Perception*, New Delhi, 1995.

Richard H. Grove, Vinita Damodaran, Satpal Sangwan, eds., *Nature & The Orient*, *The Environmental History of South and Southeast Asia*, Delhi, 1998.

UNIT 19 ENVIRONMENTAL AGENDA

Structure

19.0 INTRODUCTION

The environmental agenda of the colonial and the post-colonial period in India show a striking continuity in their working doctrine. This continuity is also reflected in the underlying principles of related policies. The early attention of the English colonisers was almost exclusively focused on timber among all the natural resources of India. The environmental agenda was therefore set by the English keeping in mind the forest and its products. The objective was abundantly clear- conversion and utilisation of forest timber as a commodity geared for the market. Interestingly, the forest policy pursued by independent India too was guided by a similar if not identical agenda. There is, however, a divergence of views on specific items of the forest policy of the English colonial powers in India as also the policy pursued by independent India. Since forest resources were invariably located at the centre of colonial interest zone, a discussion of the forest policy will help us understand the characteristics colonial environmental agenda. Similarly for the post-colonial period, the policy discussion mainly focuses on forests that help us portray the objectives of the policy.

19.1 COLONIAL ENVIRONMENTAL AGENDA

Reviewing the book *Nature and the Orient* in the *Economic and Political Weekly* (issue dated July 3-9,1999) David Hardiman had written that the forest agenda of the British colonial powers was subjected to a critical enquiry in the book by protagonists arguing for and against the forest policy adopted by the British. The arguments centered round the current crisis of massive deforestation and while the forest policy of the British colonial period was held responsible for originating the current crisis, it was also contended that the same policy continued to be implemented almost seamlessly in the post-colonial period. This actually was an extension of the position taken by Ramchandra Guha in his writings dating from early eighties (1973 and after). Guha's position was that "the British had established an autocratic forest department which sought to exploit timber for imperial needs by enclosing the forests and excluding the peasantry from using them as a resource-base. This gave rise to disparate protests in the late 19th century and later nationalist-led forest protests of the Gandhian period. With no substantial changes after independence in 1947, the protests continued, giving rise in time to the Chipko movement. Guha was highly critical of the British, who in his account were blamed for both snatching the forests from the people and for providing the institutional base for their commercial exploitation" (Hardiman). This position was contested "by the British scholar Richard Grove, who sought to show that the original 'greens' in India were in fact colonial officials. Colonial forest policy was, in his view, rooted in an enlightened understanding of environmental issues developed in particular by a group of remarkable Scottish medicos serving in the colonies, who sought initially to understand the connection between climate and health, but very quickly became experts in botany and ecology. They argued that there was a close connection between deforestation and environmental desiccation, and pressed strongly for state-led conservation of forests. Through their pressure, the earlier laissez-faire attitude towards forests was replaced from the mid-19th century onwards by active management and control" (Hardiman).

It is evident from the positions taken by both the protagonists as well as the opponents that the colonial environmental agenda as reflected in the British forest policy in India was based on the premise that forest resources were valuable natural assets on which the state possessed absolute proprietary rights. The logical extension of this premise was that the communities exercising traditional rights over forests were not justified in their claims and should be de-legitimized from such claims in order to protect the forest. The details of the forest policy would make this point clear.

The process of extensive use of wood as a forest product had begun in England earlier than Industrial Revolution. But this process was hastened around mid-eighteenth century when use of charcoal was practiced on an extensive scale as fuel to run blast furnaces. By the third quarter of eighteenth century the forest situation was beginning to look grim as vast areas were denuded of all forest cover. Since the famous oak forests of England had been exploited to the extent that even their traces had begun to vanish, quality timber was an urgent requirement. The maritime expansion and wars among colonial powers for grabbing as large a slice in global wealth as one could manage had maintained a constant pressure on ship building industry. India as a colony was therefore a most opportune possession for England. One major pressure on English colonisers was for procuring timber for ship building. In this situation Indian teak was discovered as a product of quality and durability. The worth of Indian timber may be had from the general perception that England was saved in war with Napoleon due to a regular supply of teak timber from India. As stated by Gadgil and Guha, "in the early nineteenth century, and following its defeat of the Marathas, the East India Company razed to the ground teak plantations in Ratnagiri nurtured and grown by the legendary Maratha admiral Kanhoji Angre" (p. 118; cited from *Bombay Gazetteer).*

Another factor responsible for the exploitation of forest was the expansion of railways in India. A phase of laying railway lines all across India that began in the second half of nineteenth century needed a very large number of sleepers for providing the foundational base for placing the railway tracks on it. The sub-Himalayan forests of Garhwal and Kumaon were completely denuded. The destruction was also the consequence of a policy of felling trees without accurately estimating the requirement of sleepers. Large number of felled trees in fact rotted at the felling site itself. The volume of this destruction can be roughly gauged from the figure of 35000 trees needed annually to meet the Madras Presidency requirement of nearly 250000 sleepers. "The crisis had assumed major proportions" write Gadgil and Guha, "as only three Indian timbers –teak, sal, and deodar –were strong enough in their natural state to be utilised as railway sleepers. Sal and teak, being available near railway lines in peninsular India, were very heavily worked in the early years, necessitating expeditions to the north-western Himalaya in search of deodar forests. The deodar of the Sutlej and Yamuna valleys was rapidly exhausted in the years following the inception of the forest department – over 6,500,000 deodar sleepers were supplied from the Yamuna forests alone between 1869 and 1885" (p.122; citing G.P. Paul, *Felling Timber in the Himalaya*, Lahore, 1871 and N. Hearle, *Working Plan of the Tehri /Garhwal Leased Forests, Jaunsar Forest Division, Allahabad*, 1888).

Further, the orientation of the revenue policy of English colonial power also resulted in the destruction of forests. The objective was to increase cultivation and thus enhance the revenue collection of the State. Forests were then treated as unnecessary obstacles in the way of agricultural expansion.

The agenda of the English colonial power was clear as its main objective was to produce large commercial timber. The forests were ruthlessly subjected to this commercial aim. The other objective was to increase the volume of revenue collection. Forests were again treated with disdain as the act of agricultural expansion cleared large areas of all obstructionist wooded growth. In this scheme forest dwellers were to become great sufferers. A note reproduced from the *Bombay Gazette* by Satpal Sangwan describes this aspect vividly: "Here was one Bhugut at his literary best. He recaptured the emotions of the 'Sons of the forests' separated from their mother.

By one direful stroke of pen the poor tribal finds himself at once a proscribed outcaste in his own wilds. His hills and jungles fastnesses are suddenly proclaimed to be state forests. Every vegetable and mineral substance therein is declared to be 'forest produce'. All forest produce is declared to belong to the Crown. And no one is allowed to move any forest produce whatever without the formal permission of the 'Jungle-walla sahib', the new forest king. Does a wretched Varli scratch clean half an acre of slope and cover it with a layer of bushes and scrub, all ready to burn, down comes the forest guard and arrests him for committing waste! Does he lop a ***kheir*** *or an* ***ain*** *tree, or any of the hundred and one kinds specially reserved, he is taken away to* *the magistrate for injuring Crown property. Does he cut a few reeds for his hut, or bamboos for his cattle shed, he is a thief for he has stolen public property. Does he collect a little store of mowha flowers, or korinda berries, or nuts or edible roots, or what not, –poor fool, he little knows that he is committing a crime, that mowha flowers and all other forest produce are no longer his, and that all property in them is transferred to the neighbouring Parsee or Hindu contractor! Of course he is fully informed –that all is done for his own good, that the mowha belongs to the Queen, that illicit distillation must be stopped, that intoxication is a great sin, which cannot be allowed under a moral British raj, etc."* ('Making of a popular debate: The *Indian Forester* and the emerging agenda of state forestry in India, 1875-1904' in *The Indian Economic and Social History Review,* 36, 2, 1999, p. 203).

19.2 POST-COLONIAL SITUATION

Analysing the colonial environmental policy, Gadgil and Guha made a pithy remark: "If in the neo-Europes, ecological imperialism paved the way for political consolidation, in India the causation ran the other way, their political victory equipping the British for an unprecedented intervention in the ecological and social fabric of Indian society. Moreover, by exposing their subjects to the seductions of the industrial economy and consumer society, the British ensured that the process of ecological change they initiated would continue, and indeed intensify, after they left India's shores" (p.118).

In line with this remark the forest policy of independent India has truly continued the basic working concepts of its predecessor, the English colonial power. There are four operative areas where this feature is clearly manifest. A remarkable element of post-colonial forest policy has been its intimate links with wood-based industries and processed wood products. Perhaps for this purpose there has not taken place any change in the ownership of forests. The monopoly set up by the English over Indian forests and the usurpation of the sole right over its resources has continued unabated with only a change in the ownership from a colonial state to the post-colonial state.

The National Forest Policy, 1952 reiterates this monopolistic control by legitimising national priorities as of precedence over local priorities. The settlements on the fringes of forest lines are depossessed of claims over the neighbouring forest resources. The forests are declared a 'national asset' and state control declared as in the interest of the entire country. "The rationale for government ownership is the belief that private individuals and groups will not invest in tree crops whose gestation period often exceeds a lifetime" of the individual (*This Fissured Land*, p.194).

A second feature relates to the continuity of control over forests by technically trained managers. This immediately denies any role in the forest upkeep or management to the traditional local knowledge and practices. The pitfall is that resource use and resource management are segregated as mutually insular categories. Further the commercial exploitation of forest continues even in independent India. The colonial orientation of forest as a revenue generating possession continues in the same manner in the post-colonial state. There is thus a tendency to over exploit the forest. As suggested by Gadgil and Guha, "A narrow commercial orientation is also reflected in research produced individual bibliographies for commercially valuable species such as teak, sal and chir pine, whereas the many varieties of oak, so crucial for sustaining Himalayan agriculture, only merited a single bibliography" (p.195).

Finally, the social groups which are intimately connected with forest do not seem to possess any long-term interest in the upkeep of forest resources. The situation is appalling in view of the fact that the forest management does not leave any scope for such social groups to benefit in any way from the forest resources. The "bureaucratic apparatus, with its diffusion of responsibility and lack of any accountability, provides no motivation to a good officer for the proper management of resources under his charge, or disincentives fro those who mismanage" (*This Fissured Land*, p. 196).

19.3 SUMMARY

The colonial environmental agenda is most aptly reflected in the management policy of the English for forest resources. The denudation of forests in England forced them to reorient forest resource-use in India. Foremost change inflicted was in making forest resources a commodity for the market. This necessitated that various traditional claims on the forest were necessarily pushed aside. The communities sustaining on such resources were completely forbidden from exercising any user right or control over the forest. The demands of the maritime expansion and of navy were fulfilled by recklessly felling trees. Pitiably there was not much change in this situation in the post-colonial period. Commercial use of forest was at the top of the agenda and community exclusion was a logical corollary. The principles of management did not change and forest remained under the control of the state.

19.4 EXERCISES

1) Discuss the agenda of the English colonial power with regard to the forest resources of India.

2) The post-colonial forest policy was a blemish-free continuation of the colonial policy. Comment.

19.5 SUGGESTED READING

Madhav Gadgil & Ramchandra Guha, *This Fissured Land, An Ecological History of India*, Delhi, 1992.

Richard Grove, Vinita Damodaran, Satpal Sangwan eds., *Nature and the Orient, The Environmental History of South and South East Asia*, Delhi, 1998.

UNIT 20 RESOURCE MANAGEMENT: FORESTS

Structure

20.0 INTRODUCTION

The forest cover in our country has assumed an alarmingly low proportion. From a position of abundance in ancient times to a dismal state today, the long time span has been full of contradictions. Increased population pressure, expanding urbanisation, an ever-pressing need for good standards of living and development in industrial technology have long disturbed the harmonious relationship between the humanity and the greens. In all descriptions of forest resource-use, there has been a tendency to see the colonial rule as an ecological 'watershed': the colonial rule working hand in glove with the aggressive values of industrial capitalism did much damage to the native forests. Of late the proponents of the revisionist school have sought to question such stereotypical constructions citing regional evidences. What however goes undisputed is the fact that even if colonial rule, on some occasions, was not directly responsible for the decimation of forests it did create enabling conditions for the same.

In this Unit, we shall learn about the changing patterns of resource-utilisation embedded in the man-forest relationship over a period of time. This description will not only give us a holistic picture of utility patterns of forests as a resource but would also enable us to locate and identify factors and processes that brought about an element of incongruity in sustainable utilisation of the forest wealth. It would help us to comprehend the structure and impact of man's activities on forests over a period of time and discern the forces of continuity and change in the period under discussion. For the convenience of the learners the argument in the Unit is divided into two parts: the first part deals with the changing resource values of forests and the second part with the policies and legislations in accordance with the changing notions of resource exploitation.

PART A

20.1 THE PRE-COLONIAL BACKGROUND

In order to understand the dynamics and undercurrents of colonial impact on the understanding of forest as a resource, we need to understand the strands of human utilisation of the forests in the preceding period.

The period from about 500 BC to 300 AD saw a big advance of agricultural land over rich forest area both in the northern India and the river valley areas (for example Krishna, Godavari, Cauvery, Vaigai) in the peninsular India. Greater agriculture meant larger availability of surplus. Thus tribal chiefdoms started giving way to large states; Mauryas and Kushanas in northern India, the Chalukyas and Sangam Cholas in south India. The ground for further exploitation of forest resources lay in the logic of the empire building exercise. With technological limitations, the only viable alternative for enhancing surplus lay in bringing more land under cultivation. Of course trade was also coming up in a big way but then the ships and boats had to be built out of the forest wood. Another way out was incorporating other territories, which called for better weapons of war. Elephants assumed significance, and elephant forests started coming up. The number of towns increased and the houses came up that were made of wood. Moreover, timber had to be used for construction of furniture, carts, chariots, wooden bridges etc. The concept of 'hunting reserves' also came up, as hunting became a recreational activity. Chanakya says that Brahmanas should be provided forests for plantations, for religious learning and for performance of penance. We have seen earlier also that many philosophical treatises were written in the forests. *Upanishads* and *Aranyakas* were the major ones. The importance of forests is further borne out by the treatment it receives in Kautilya's *Arthashastra*. After the Mauryas, the other important empire builders were the Guptas. But during the Gupta times and more particularly later Gupta times economy began to collapse. There was a manifest decline in trade and towns and the use of monetary system. Inscriptions belonging to the period indicate a trend towards ruralisation of the economy and thus greater pressure on land and consequently on the forest. Amidst all these developments, the forest question lost it's prominence and in the later sources lesser attention was given to the forests.

The Delhi Sultanate saw more demands being put up on the forests. The total population (both human and livestock) increased, as did the number of cities and towns. Consequently urban population also increased. All this led to a proportionate quantitative increase in the demand for fuel wood, fruits, food, fodder etc. Demand for quality timber for construction of boats, bridges, houses, chariots, buildings, carts etc. also went up considerably. The Sultanate rulers did not come out with a positive policy of conservation though of course we see gardens being set up.

On the whole, however, the forest cover did not pose any major problem to the Delhi Sultanate. Though the demand for forest produce increased but the land- man ratio was still very favorable in the Indian context. Land was abundantly available and as such the problem of converting forestland into agricultural land was not so strong. Added to this was the factor of natural regeneration of the forests alive.

The importance of forest increased in Mughal India corresponding with increase in population and urbanisation. According to W.H. Moreland, Indian population at the death of Akbar in 1605 AD was 100 million while R.K. Mukherjee gives the figure of 130 million for the same years (1605AD). Together with the increase in general population, there was also a qualitative and quantitative growth of urban way of life. Thus added to the existing demand of food, fuel, fodder, there was a demand for timber particularly the superior variety. The forest of Bengal, Agra, Allahabad, Sind (Thatta), Lahore, the Western and Eastern Ghats supplied the raw material. Forests served another utilitarian purpose; the forest products formed an important component of the non-agrarian production during the Mughal period. As such the ruling class was keen to encourage the production of many forest products like timber, fruits, fodder, roots, barks, resins, herbs, production of lac, tanning of leather (babul tree), gumlac (red dye, sealing wax), mulberry silk etc. as discussed in Unit 13 of Block 4.

20.2 THE COLONIAL PERIOD

The colonial period saw a qualitative shift in the man-forest relationship for added to the Indian demands were now the demands of the British Raj.

With the advent of the colonial rule an element of conscious and ruthless exploitation begins to determine the man-forest relationship (The East India Company and later the Viceroy represented the interests of colonial forces). For the first time, the proceeds of forest exploitation accrued to an agency, which had no interest in the development of the Indian subcontinent. India was systematically converted into a colony serving the interest of the mother country. The British came to India as a trading nation. The gradual establishment of political hegemony together with development in the field of transport and communication, colonial trading practices and industrial revolution brought about substantial change in this relationship. Forests now came to be seen as resources to cater to the requirements of the expanding colonial political economy.

Indian teak featured as the permanent source of supply of durable timber for the British ship building industry. It saved England during the war with Napoleon and the later maritime explosion. Ships were built in dockyard in Surat and on the Malabar Coast as well as from teak imported in to England. The thrust of agrarian policy of the colonial state also worked to the destruction of forests. Forests were considered 'as an obstruction to agriculture and consequently a bar to prosperity of the Empire'. To enhance the agrarian revenues, cultivation had to be extended; to extend cultivation forests had to be removed. This process was exacerbated with the development of railways after 1853. Major chunks of forest were destroyed to ensure the manufacture of railway sleepers. The sub- Himalayan forests of Garhwal and Kumaon were denuded to meet the early demand. Railways put other demand on forests as well. Before the Raniganj coalmines became operational, the forests also supplied the fuel requirements of the railways. The fuel wood requirements of the railways in the North West Provinces in the 1880's caused considerable deforestation in the Doab. Forests in Madras region suffered wanton destruction causing alternating cycles of flood and drought in the districts of North Arcot and Chingleput. Railway requirements, as has rightly been pointed out by many scholars, formed 'the first and by far for the most formidable' of the forces thinning the forest. Private contractors, both Indian and European, were chiefly responsible for the destruction of the forest cover; even the Indian princes came under their influence and sphere of activity. (Cf. *This Fissured Land*, Delhi, 1992, pp.188-33).

The forest policy of the colonial administration worked within the overall framework of the priorities of the imperial policy. One of the foremost priorities was to generate more and more revenues for a 'self-supporting' British rule. This logic suggested that forest products had to be marketed. The colonial rule made constant efforts to find markets for the multiple species of India's tropical forests. **Table 1** shows the surplus generated on the revenues from the sale of forest products.

Table 1: Revenue and Surplus of Forest Department 1869-1925

Yearly average for the period	Revenue (Rs. Million)	Surplus (Rs. Million)	Percent of column 3 to column 2
1869-70 to 1873-74	5.6	1.7	30
1874-75 to 1878-79	6.7	2.1	31
1879-80 to 1883-84	8.8	3.2	36
1884-85 to 1888-89	11.7	4.2	36
1889 -90 to 1893-94	15.9	7.3	46
1894-95 to 1898-99	17.7	7.9	45
1899-1900 to 1903-4	19.7	8.4	43
1904-1905 to 1908-9	25.7	11.6	45
1909-1910 to 1913-14	29.6	13.2	45
1914 –1915 to 1918-19	37.1	16.0	43
1919-1920 to 1923-4	55.2	18.5	34
1924 to 1925	56.7	21.3	38

(*Ibid.*, p.136; The source of the table has been cited as E.P. Stebbing, *The Forests of India*, Vols. III, London 1927, p.620)

Urban centers required forest products for fuel wood, furnitures, building timber etc. The Himalayan forests provided bamboo, sal and several species of conifer for the urban centers of Punjab and the United Provinces and for the military cantonments and hill stations. Apart from the teak export trade, trade in minor forest produce also picked up in the twentieth century. Resins, turpentine tanning materials essential oils and other associated non-timber forest products had a variety of industrial applications and foreign trade in such items showed a steady rise.

The massive importance of the forests reflected itself in other ways particularly during the two war periods. During the First World War, enormous amounts of timber and bamboo were exported to help British military operations in Egypt and Iraq. The Second World War was more devastating for Indian forests. India became the sole supplier of timber to Middle East and later to the Allied forces in Iraq and the Persian Gulf. **Table 2** gives an idea of the relative importance of the forests during the two wars.

Table 2: India's Forests and Second World War

Year	Outturn of timber and fuel (m. cuft)	Outturn of MFP (Rs. m)	Revenue of FD	Surplus of FD (Rs m)	Area sanctioned Under working Plans (sq. miles)
1937-38	270	11.9	-	—	62,532
1938-39	299	12.3	29.4*	7.2*	64,789
1939-40	294	12.1	32.0	7.5	64,976
1940-41	386	12.5	37.1	13.3	66,407
1941-42	310	12.7	46.2	19.4	66,583
1942-43	336	12.9	65.0	26.7	51,364
1943-44	374	15.5	101.5	44.4	50,474
1944-45	439	16.5	124.4	48.9	50,440

Note: * average for the period 1934-35 to 1938-39

MFP – Minor Forest Produce

FD – Forest Department

(*Ibid*., p.140; Compiled from Indian Forest Statistics, 1939-40 to 1944-45, Delhi, 1949)

Any discussion on the colonial impact on the forest cannot be complete without mentioning one of its most obvious manifestations; the decimation of wildlife. From the middle of nineteenth century, a large-scale slaughter of animals was started by the British. Much of this shooting was motivated by the desire for large 'bags'. Many Indian princes also sought to emulate the shikar exploits of the British, Another related transformation during the colonial period was the deviation of forest lands for the development of tea, coffee and rubber plantations. In fact the state's desire to commercialise the forest went hand in hand with the allotment of vast tracts of forestlands to the planters. The development of road and railway networks to facilitate the export of tea, coffee and rubber hastened the process of deforestation. Besides, the plantation economy itself had a high level of timber demand for fuel and packaging.

The colonial state has been criticised on many other accounts as well. For decline in traditional methods of forest conservation, promotion of single species teak monoculture, socio-economic and cultural marginalisation of tribals and other forest dwellers – all went a long way in bringing in an element of incongruity between forest 'preservation' and human existence.

20.3 POST-INDEPENDENCE PERIOD

During the post independence period large tracts of forestland continued to be diverted to non-forest purposes in the name of 'development'. Although this theme has been discussed in many accounts on forests, we shall only seek to familiarise ourselves with the nature of the problem. The phenomenal growth of population and urbanisation and the consequent extension of agriculture, construction activities, increasing industrial proliferation, mining and quarrying activities all took a massive toll on the forested areas. With the development of a large number of multipurpose projects and dams, thousands of acres of forestland were submerged. The villages and habitats of the tribals were also submerged due to impounding water in the reservoirs. The rehabilitation of the displaced also took place at the cost of neighboring forests. The politics of refugee rehabilitation also affected forest covers in many areas. The mushrooming of criminal gangs smugglers and timber mafia together with the increasing prices of timber has led to a ruthless denudation of forestland. In addition, forests have of late, also becomes a haven of many terrorist and insurgent groups. Many forests, in the North East, Jammu and Kashmir, the Terai, Andhra Pradesh have suffered due to these activities. Some of the conventional factors like forest-fires, over grazing, shifting cultivation, careless use of construction timber have had a devastating effect on forest acreage. Besides these certain other factors, neglected on account of playing a relatively small role in degradation of forest cover, have also to be taken into account. These include industrial emissions, air pollution and harmful effects of plant parasites, insects, fungi and wild animals. **Table 3** gives us a relative idea of diversion of forestlands for non-forest uses.

Table 3: Year-wise diversion of forest land for non-forest use

Year	Forest land diverted (in ha)
1980	Nil
1981	2672.04
1982	3246.54
1983	5702.01
1984	7837.59
1985	10608.07
1986	11963.11
1987	72780.05
1988	18765.35
1989	20365.05
Total	153939.81

Source: N C Saxena, *Forests, People and Profit*

According to some estimates, India is steadily losing about 15 lakh ha of good forestland annually. The number of trees that are felled annually could be almost equal to country's consumption of oil, coal and electricity put together. According to the State of Forest Report, 1995, which is the fifth assessment of the forest cover of India based on visual and digital interpretation of the satellite date pertaining to the period 1991-93, the total forest cover of the country is 639.600 sq. km., which is only 19.45% of the total geographical area of the country. Non-government estimate however differ on the question of the extent of the forest cover in the country and give a figure below eve 19%. Clearly forests have suffered even after independence was achieved.

20.4 RECENT DEBATES

Madhav Gadgil and Ramchandra Guha, in *This Fissured Land: An Ecological History of India*, Delhi, 1992 lay down the basic premises of the recent debate. By portraying a rather romanticised notion of man-forest relationship, the authors say that despite the grave inequalities of caste and class, the pre-colonial Indian Society had a considerable degree of coherence and stability. This permitted a rapid turnover of ruling dynasties without major upheavals at the level of the village. The cultural traditions of prudence ensured the long-term viability of production and of the institution of caste, which was its central underpinning. Elaborating their argument, the authors take the position that in pre-colonial India, resource utilisation was in harmony with nature and resource sharing among various strata of the society was very cordial. The different claims of different resources in the caste system led to a state of equilibrium in turn providing the stability to the resource demand and supply. Caste was seen as consisting of endogamous groupings that were each marked by a particular economic activity and a particular ecological niche. The analysis of the various environmental movements have been explained in terms of disruption caused by the British as it argued that in pre-British time 'there was little or no interference with the customary use of forest and forest produce'.

There have been attempts to challenge the stereotypical portrayal of the villainous role played by British It is argued that it was the 'colonial power' that initiated systematic forest conservation policy in colonies. *Nature and The Orient*, (eds. Richard H. Grove, Vinita Damodaran, Satpal Sangwan, Delhi, 1998) problematises the situation saying that it is an open question, however, as to whether the continuation of supposed customary land uses would have been more successful than the Company forest departments and their post-1857 successors in arresting deforestation for timber and arable cultivation. It is asserted that the evidence from other British colonies that developed forest departments at much later dates suggests that, without exclusionist forest reserve legislation, most surviving forms of 'common property management' would have faded away.

There seems to be a feeling that indigenous people were more responsible for the situation thus either they should have been trained to modern knowledge or prohibited from those areas. Ravi S. Rajan ('Foresters and the politics of colonial agro ecology: The case of shifting cultivation and soil erosion, 1920-1950', *Studies in History*, Vol 14, No. 2 n.s. 1998) argues that the concerns for greater revenue appropriation (agricultural production) and the growing demand for wood led to 'conflict of interests'. Attempts were thus made to attain a balance between agriculture and forests; some lands were identified as suited for agricultural purposes while the marginal lands were to be developed as forests. The primacy of agriculture was thus quite evident. Antagonism between forest and agriculture was not simple as forest were considered necessary for good rains and at the same time it was believed that forest growth were harmful for ground-water as it sustained itself on the ground water only.

Scholars have also attempted to question the notion of a uniform British policy all across India and recent researches have pointed out that there were serious divergences of views on policies related with the forest/land/agriculture. Sivaramakrishnan ('Conservation and production in private forests: Bengal, 1864-1914', *Studies in History*, Vol 14, No. 2 n.s. 1998) tries to locate the debate in the context of the formulation of the Private Forest Bill in Bengal between 1865 and 1878. He tries to explore conflicting interests vis-a vis natural resources. There were several claimants and the state had to consider several probabilities before arriving at any formal policy It was not only scientific knowledge (deforestation and desiccation) which contributed in the debate but various self interests also tried to appropriate the issue and mend the policy in one's favour. The underplay of various socio-economic interests and environmental concerns made the whole debate so complex that ultimately the bill could not be formatted.

The major issue involved in this debate was the property rights sanctioned by permanent settlement. These forests were often termed as *Jungle Mahal*, hence accepted as private property. Any attempt to withdraw or curtail the same would lead to greater resentment. This was the period when forests were much sought due to wood required for the railways. This resulted in greater deforestation, another cause of environment degradation. This has also been related with the problem of soil erosion. Although the tea-planters protested on the issue of deforestation as it caused less rainfall, their demand for more land for tea plantation in turn caused further deforestation.

Initially with the implementation of 'permanent settlement' British expected that marginal lands would also be put to better positive use as landlords will try to maximise the agricultural production on better lands and marginal lands shall be utilised for forests. However, it was not the case in eastern India, and later on, with the growing demand for wood we see a demand for a private forest policy to regulate the land-use. The issue became more controversial as the claims of *raiyat* over the forest produces (which they argued were recognised by tradition) became an issue. The landlords on the other hand argued that it led to degradation in forest cover as also soil erosion. Conversion of private forests to protected forests would lead to the denial of claims to *raiyat*. The problem further compounded as the demand of wood for railways increased. It became an issue of primacy of right to use – commercial exploitation was important or the traditional claims would take precedence.

Some scholars have also taken the debate into the realm of internal divisions with the colonial perspective. Ravi S. Rajan argues that the so-called colonial policy was not a monolithic structure and that there were quite evident heterogeneous views. He tries to explain the issue with respect to soil erosion and shifting cultivation by examining the deliberations at the Empire Forestry Conference.

The problem of conservation of forest- wild was of immense significance especially in the 1930s. The colonial policy differed on controlled sylviculture with the help of shifting cultivation and abandoning cultivation as such. Examples from West Africa were cited to point out the benefits of shifting cultivation, but it was put aside by citing the nature of forests in India. The other related issue was the tussle between the foresters and scientific advisors. 'The political damage caused by shifting cultivation was its inducing nomadic habits on parts of the local population, discouraging agricultural progress and facilitating the evasion of taxes'. The problem caused by shifting cultivation was not only of tax evasion but the larger issue of timber trade\ supply to cater to the needs of British.

The problem of soil erosion on the one hand was caused by the cutting of forests for commercial use and on the other due to clearing of land for agricultural purposes. It was further fuelled by the ever-increasing population pressure and overgrazing. To tackle the problem, scientific studies were encouraged, but, 'given the social roots of the technological experts, it was asserted that the nature of their technical intervention was by no means value neutral'.

Another area of exploration has been the analysis of the various policies having a bearing on the environmental issues. Vasant Saberwal ('Science and the Desiccanationist Discourse of the 20th Century', *Environment and History* 4, 3 (1997)) argues for the growing recognition within the academic ecological community of the complexities of ecosystem functioning and the limits to our predictive and explanatory capabilities with regard to large-scale ecological phenomenon. His explanation brings it out that the concerns for conservation evolved over a long period of time along with the growth in the scientific knowledge about environment. The need to examine the role of state in appropriation of scientific knowledge in support of its claims has been pointed out.

Ajai Skaria ('Being Jangali: The Politics of Wildness', *Studies in History*, Vol 14, No. 2 n.s. 1998, pp. 193-215; Also *Hybrid Histories: Forests, Frontiers and Wildness*, Delhi, 1998) highlights the general negligence of marginal areas and laments the importance of traditional issues. He tries to locate the problems of marginal issues in the context of politics of growth. The same is very important for the construction of ideas such as jangali/tribal/primitive.

Skaria questions the notion whereby tribals were equated with 'wild' and 'primitive' and settled agriculture (under the patronage of state) with civilisation. 'What the British did not realise was that Baroda officials' attitudes were an acknowledgement of the political rather than criminal nature of the *dhad*, its connection with *giras* and shared sovereignties. So a *dhad* usually called not for retaliation but for a renegotiation of shared Sovereignty'. He also explores the various processes of mutual dependence between state and tribal polities. Revenue rights and authority were shared in a complex web of relationship where weakness of the either side was visible in the terms of resource sharing.

PART B

20.5 FOREST POLICIES: A POLITICO-LEGAL ANALYSIS

From a rich source of forest wealth in the pre-independence period, India has been reduced today to a position of minimal forest cover. Reckless exploitation coupled with absence of a comprehensive policy has led to a massive shrinkage in forest resource. As such, the need for a national policy governing all aspects of forest management becomes pertinent. The formulation of a 'suitable' forest policy began in the colonial period itself. From the establishment of the forest department in 1857 to the National Forest Policy, 1988, India has come a long way trying to cope with the problem of declining forest cover. We shall discuss this development in the following sub-sections.

20.5.1 The Colonial Background

Any discussion of the forest question in independent India cannot be complete without a description of colonial forest policies. Motivated ostensibly by exploitative reasons, the British laid the foundations of a forest policy in India. The ever-expanding British Empire was faced with a forest resource crunch. In a pre-industrial society like India, agriculture and forests had to bear the brunt of the burden. We have already discussed avenues of exploitation/colonial onslaught in detail in an earlier Section. In order to rationalise their unbridled exploitation as well as to appease the voices of opposition both within and outside the officialdom, the British took some measures that were given the shape of policy. Let us have a look at the major milestones in the evolution of forest policies under the British rule and in independent India.

1 **Establishment of the Forest Department:** Stating forest administration up to the 1857 rebellion a melancholy failure the Governor-General of India Lord Dalhousie called for the establishment of a department. The motive behind such a step was to ensure a sustained supply of timber for the railways. The Imperial Forest Department was formed

in 1865 and Dietrich Brandis, a German botanist was appointed as the first Inspector General of Forests.

- **First Indian Forest Act 1865:** This act empowered the forest officials to issue local rules for conserving Indian Forests. Hurriedly drafted, this act was the first attempt by the state to assert its monopoly. It was primarily passed to facilitate the acquisition of those forest areas that had been earmarked for the railway supplies. It merely sought to establish the claims of the state to the forests it immediately required, subject to the provision, that existing rights were not abridged.

- **Indian Forest Act 1878:** The forest act of 1865 had been drafted in a haphazard manner and thus had many shortcomings. Immediately after its enactment therefore the search began for a more comprehensive piece of legislation. A preliminary draft prepared by Brandis was circulated for discussion. A conference of forest officers was convened in 1875 to frame a new act. Three positions cropped up during the deliberations on the proposed act:

  - The *annexationists* wanted total state control over all forest areas.
  - The *pragmatists* argued for state management of ecologically sensitive and strategically valuable forests, allowing others to remain under communal systems of management.
  - The third position often called the *populist* position completely rejected all forms of state intervention holding that tribals and peasants must exercise sovereign rights over woodland.

The matter was finally resolved in favour of the annexationists. The concrete proposals were embodied in Brandis' memorandum of 1875, which, together with Baden-Powel's paper (in the forest conference) formed the basis of 1878 Act. The Act cleared all confusions about the proprietary status of the forests and attempted to obliterate centuries old customary rights of the rural populations and forest dwellers.

It classified the forests into 3 categories:

a) 'Reserved' Forest: In such forests, which were compact and connected to the towns, a legal separation of rights was aimed at. A permanent settlement either extinguished all private rights or transferred them elsewhere or in exceptional circumstances allowed their limited exercise.

b) 'Protected' Forests: These were also controlled by the state. Here the rights were recorded but not settled. The state control was firmly maintained by outlining detailed provisions for the reservation of a particular tree species as and when they became commercially viable and for closing the forests whenever required for grazing and fuel wood collection.

c) 'Village' Forests: The name itself explains this category. Such forest was under the control of the villages and were used by their inhabitants.

The new legislation greatly enhanced the punitive powers of the forest officials and prescribed a comprehensive set of penalties for violation of the act.

- **Forest Policy 1894:** In 1894, the British government issued a circular which formed the basis of the future forest policy. Once again, while reiterating the propriety right of the state, the policy also sought to administer the forests for the benefit of the taxpayers and the people living in the vicinity of the forests. One very harsh feature of this policy was the fact that forest preservation was placed secondary to agriculture. It said " wherever an effective demand for culturable land exists and can be supplied by forest area, the land should ordinarily be relinquished without hesitation". Besides, a fourfold classification of forests was also made:

  a) Forests (mainly on hill slopes), the preservation of which is important on physical and climatic grounds;

  b) Forest, which afford a supply of valuable timbers for commercial purpose;

  c) Minor forests, generally meant to meet the fuel, fodder, and timber requirements of the dependent communities;

  d) Pasture lands, to cater to the needs of the local population.

Side by side the policy pronouncements, the government also tried to setup institutes to promote better utilisation of forest resources. Thus a forest school was established at Dehradun in 1878 for the training of forest rangers. This school received the status of a State Forest College in 1906 after which forest officers also began to receive training in India.

- **Indian Forest Act of 1927**: This was the first comprehensive piece of legislation on forests under the British rule. Prior to its enactment the general law relating to forest in British India was contained in the Indian Forest Act 1878 and its amendments. It was an act to consolidate the law relating to the forests, the transit of forest produce and the duty leviable on timber and other forest produce. For the present purpose let us discuss some of the basis features of the 1927 Act.

  a) It enhanced the powers of the state to create reserve forests, village forests and protected forests;

  b) Provided state regulation of the timber and non-timber forest produce;

  c) Prescribed penalties for the violation of the act;

  d) Formalised the duties and powers of forest bureaucracy.

With some amendments in the subsequent years, the Indian Forest Act of 1927 continues to be operational even today.

The British forest policies were conditioned by utilitarian goals. Use rather than conservation was the keynote of the colonial policy. Thus under the garb of promoting the interests of the people and the welfare of the nation what the British actually did was a ruthless exploitation of the forests. Extraction of timber, both quantitatively and qualitatively, was carried out mercilessly. Expansion of agriculture at the cost of forest cover was a blatant device to maximise revenue for the expanding empire. Further, the policies promulgated by them had several shortcomings. There was no provision for development of forest infrastructure or forest based industries. Unlike Industrial and Agricultural Commission, no commission was setup to promote the forest wealth. While the tribals and rural populations were divested of their customary rights no attempt was made to control or regulate the forests of the native states and the *zamindars*. Wildlife protection was never important for them. Forestry research and education however, was one aspect, which was taken up by the state but no follow up action was taken. It was never followed as a long-term positive policy resulting in an increase in the forest field. Even the recommendations of the Agricultural Commission of India (1928) for better management of the forest or Sir Herbet Howard (1944) were net adhered to.

20.5.2 Independent India

India inherited the colonial forest policy (1894) and the Indian Forest Act (1927). However circumstances had changed by then and the spatial and temporal context of the old legislations had been altered. Population had increased substantially and so had the attendant demands of fuel, food, fodder, timber etc. Urbanisation and industrial development had also increased as had the defence requirements. Added to this was the growing realisation of forest as essential to the physical and climatic balance of a country. This assumed particular importance in the context of two factors; firstly rapid deforestation during the two would wars by the colonial state and secondly the reckless exploitation of private forest by native sates and *zamindars* during the last years of British rule . The situation called for a change in approach. Forests had to be brought in the realm of planned economic development. It was admitted by the planners that per capital forest area and per capita consumption of ground wood, pulp etc. was poor. A need therefore was felt for an increase in overall coverage and even regional distribution of forest. A change in approach was what was required. A chronological account of the efforts made in this direction follows.

a) **Central Board of Forestry (1950):** The starting point of the new approach was the constitution of Central Board of Forestry (CBF) to guide the government in the formulation of various polices and programmes. This body became the supreme advisory body for the revision of the old forest policy. The meeting and recommendations of the Central Board resulted in the pronouncement of a new National Forest Policy on May 12, 1952.

b) **National Forest Policy 1952:** The preamble of the National Forest Policy 1952 spelt out six supreme needs for the formulation of the policy.

- Balanced and complementary land use;
- Checking denudation in the mountainous regions, erosion along big rivers and invasion of the sea-lands on the coastal tracts;
- Balanced physical and climatic conditions;
- Supply of progressively increasing demands of grazing, firewood, small wood for agricultural implements;
- Timber and other forest products for the requirements of defence, communication and the industry; and
- Maximisation of annual revenue in perpetuity consistent with the fulfillment of the six vital needs.

Let us now examine some of the tenets of the National Forest Policy of 1952.

i) The new policy presented a functional clarification of the state/ privately owned forest as follows.

   – Protected forests.
   – National forests.
   – Village forests, and
   – Tree lands

This classification was more comprehensive than the 1894 classification and had no relation whatsoever with the classification of Forests under the Indian Forest Act of 1927.

ii) The policy also observed that the villagers residing in the vicinity of forests should be permitted to use minor forest products in a restricted way.

iii) There was to be no diversion of forestland for agricultural purpose anywhere in the country. This was a major departure from the colonial policy.

iv) The need for controlling sand dunes in Rajasthan was emphasized as was checking of erosion and denudation along susceptible regions.

v) The policy also expressed the desirability to expand forest/ tree cover on lands owned by government and public as well as by private institutions.

vi) The policy also advocated that 1/3 of the geographical area of the country should have forest cover and further suggested that mountainous region which was more prone to erosion and denudation should have 60% area under forests whereas the plains can have 20% forested area.

vii) Called for a sustained supply of raw materials for forest-based industries and other associated enterprises like transport and defence. The importance of research arrangement in various branches of forestry and interaction between research institutions and industries was to be encouraged.

viii) Expressed the need to control private forests as well as to check grazing and shifting cultivation.

ix) Recommended proper forest legislation in the states and union territories of India where it had not been enacted and also analyzed the importance of awareness in the preservation of forests and education of forest officers and rangers.

x) Proper attention was to be paid to the preservation of rare fauna like lion' one horned rhino etc. As such sanctuaries and national parks were to be setup.

c) **National Forest Policy, 1988**: The inadequacies and shortcomings of the 1952 policy coupled with the realisation that it had been unable to address the multifarious issues of independent India on a long team basis called for a revision in the existing forest policy. Indications of the necessity of a new approach were already coming.

The Estimates Committee (1968-69) of the Fourth Lok Sabha in its 76th report, expressed the opinion that a reappraisal of the National Forest Policy (1952) should be made by an adhoc body of experts in the light of experience gained during the years of development plans and the research and technologies advance made in the fields of forestry. Subsequently The National Commission on Agriculture (1976) advocated that there were two important points on which the National Forest Policy should rest:

- Meeting the requirement of industrial wood for forest-based industries, defense, communications and other public purpose as well as fuel wood and fodder for the rural community; and
- Meeting the present and future demands for protective and re-creative functions of forests.

The Commission thus sought to adopt a middle path between utilisation and preservation of forest wealth. It recommended:

a) A change of strategy from a more conservation oriented forestry to a more dynamic programme of *production forestry*;

b) The future production programme was to concentrate on clear felling of valuable mixed forests, mixed quality forest and inaccessible hardwood forests and planting these areas with suitable fast growing species yielding higher returns per unit area; and

c) People's demands (mainly villagers and tribals) had to be accommodated in order to save forests. This it suggested was to be achieved through social forestry on village and private lands or on growing trees on lands accessible to village people.

The next development was the passage of the Forest Conservation Act 1980. This act was a departure from the existing utilitarian forest policy as it aimed at conservation. For the first time, an act especially aimed at conservation was enacted in independent India. The basic objective of the act was to limit the power of the state governments to de-reserve forests or divert forestlands for non- forest purposes. Under the provisions of the Act, prior approval of the central government was required for diversion of forestlands for non-forest purposes. This act was amended in 1988 and some new provisions were added. In the meanwhile N.D. Tiwari Committee was constituted in February, 1980 to examine the adequacy of the existing administrative, legal and institutional arrangements for protecting environment. The committee noted that the commercial interests and the needs of the poor for essential fuel and fodder contributed to the denudation of forests and regulation. It thus recommended the inclusion of fuel and fodder supply in the Minimum Needs Programme.

Two years later in 1982 a Forest ministers' meeting was called. Two themes were retreated at the meeting — conservation for environmental and ecological needs and for preservation of wild life and genetic resources and development for rehabilitation of forests and wildlife, for enlarging the resource base through afforestation and social and farm forestry programmes. A meeting of the central board of Forestry held in 1987 was presided by prime minister and attended by chief ministers of different states. It was decided that

- Forest lands would be used for preserving soil and water systems and not for generating state incomes;
- All supplies to the market and industry would be met from farm forestry;
- Small and marginal farmers would be especially encouraged to use their degraded lands for meeting commercial requirements.

The new forest was policy announced in December 1988 which was a marked departure from the 1952 National Forest Policy. Henceforth, forests were not to be exploited for industrial and other commercial purposes but were meant to conserve soil and environment and meet the subsistence requirements of the local people. The main features of the 1988 policy are:

a) Maintenance of environmental stability through preservation and restoration of ecological balance;

b) Conservation of natural heritage by preserving the natural forests and protecting the vast genetic resources for the benefit of the posterity;

c) Meeting the basic needs of the people, especially fuel wood, fodder and small timber for the rural and tribal people;

d) Maintaining the intrinsic relationship between forests and the tribal and other poor people living in and around forests by protecting their customary rights and concessions in the forests.

The implementation the policy was facilitated by the Government. of India by issuing a resolution on 1st June, 1990. *The June 1990 Guidelines* make it possible for the forest department to involve people in the management of forest.

20.6 SUMMARY

We have seen that basic texture of man-forest relationship underwent a massive change over a period of time. From a position where the forests were venerated and cared for, to one of conscious exploitation, things have changed dramatically The fact that this indiscriminate exploitation still goes on is a thing to seriously ponder upon.

In spite of massive changes in scenario, our forests continue to be governed by a law enacted almost 75 years ago. Since 1927, our priorities and demands have changed just on the population pressure. Added to this are the inherent contradictions in our forest policies.

The constant need for suitable forest legislation has led to enactment of many acts and promulgation of many policies during the colonial and postcolonial period. The requirements of forest preservation have not been advanced completely even after the 1988 Forest policy.

20.7 EXERCISES

1) Write an essay on the forest resources and their management in Colonial India.

2) Summarise the views of the following about forest resources in about 200 words each:

   i) Madhav Gadgil and Ramchandra Guha

   ii) Ravi S. Rajan

   iii) Ajai Skaria

3) Examine the main thrust of the following in about 300 words each:

   i) Colonial forest policies

   ii) National Forest Policy 1952

20.8 SUGGESTED READING

Madhav Gadgil & Ramchandra Guha, *This Fisured Land: An Ecological History of India*, Delhi, 1992.

Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1800*, Delhi, 1995.

Richard H. Grove, Vinita Damodaran, Satpal Sangwan, eds., *Nature & The Orient, The Environmental History of South and Southeast Asia,* Delhi, 1998.

Ajai Skaria, *Hybrid Histories: Forests, Frontiers and Wildness*, Delhi, 1988.

UNIT 21 RESOURCE MANAGEMENT: WATER

Structure

21.0 INTRODUCTION

Water resources occupy an extremely important position in the environmental discourse both in history and in the contemporary period. It is such a paradox that the total availability of water on planet earth is so much that water had for long time been considered an inexhaustible natural resource, yet water scarcities are today staring the human civilization so starkly in its face that none would even imagine the bounty of nature with regard to water as a reality ever. World oceans cover about three fourth of earth's surface. The total amount of water on earth is about 1400 million cubic kilometre (m.cu.km.). However the proportion of fresh water in this expanse is very small. About 2.7 per cent of the total water available on the earth is fresh water of which about 75.2 percent lies frozen in Polar Regions and another 22.6 per cent is available as ground water. The rest is available in lakes, rivers, atmosphere, moisture, soil and vegetation. What is therefore effectively available for consumption by the living beings and for other uses is a small proportion of the quantity available in rivers, lakes and as ground water. According to World Health Organization (WHO), only 0.0075 per cent of all water is readily available for human consumption. And, yet we are unable to manage our water resources with any degree of rationality leave alone wisdom.

Freshwater is not only precious and scarce but also a finite resource, which is unevenly distributed. In Africa 40 per cent of the population is still without access to water, which is 20 per cent in Asia and 15 per cent in Latin America and the Caribbean region. The World Development Report, 1992 points out that the global renewable water resource can be roughly estimated at 41,000 cubic kilometers. India sustains about 17 per cent of world population with only 4.6 per cent of the total average runoff i.e. 1900 cu.km. Its availability in nature, though is highly uneven both spatially and temporally. India is one of the wettest countries of the world with an annual average rainfall of 117 cm over the plains— about one and a half times the annual average over the land areas of the globe taken together. This position is graphically illustrated by the following chart:

India's Water Profile (in Cu.Km.)

Annual Precipitation Volume (Including snowfall)		4000
Average Annual Potential flow in Rivers		1869
Per Capita Water Availability (1997)		1967
Estimated Utilizable Water Resources		1122
(a) Surface Water Resources	690 Cu.Km.	
(b) Ground Water Resources	432 Cu.Km.	

Source: Ministry of Water Resources, Government of India.

Given this position we propose to discuss the theme of water resource and its utilisation and management in this unit. It will use and incorporate information from the post-colonial period also to illustrate the current situation with regard to water resources in India.

21.1 SITUATING WATER RESOURCES: COLONIAL PERIOD

The evidence for the use of water resources by the earliest settled societies is sufficient to merit an analytical attention. We have examined a part of this evidence in Block 4 and composed descriptive information. We have seen that the practice of irrigation since the establishment of settled agriculture during the Indus Valley Civilization was an established feature. As agricultural development was the pillar of the economy, all large powerful empires paid special attention to development of irrigation systems. Early in history, during the Mauryan period, a big reservoir called Sudarshana was created at the foot of mount Girnar in Saurashtra for supporting irrigation in the semi-arid conditions of the place. In the south, perennial irrigation may have begun with the construction of the Grand Anicut by the Cholas as early as second century AD to utilise the water of the Kaveri River for agricultural purpose. Wherever the topography and terrain permitted, it became a practice in the region to impound the surface drainage water in tanks or reservoirs by raising dams/embankments across the flow channel.

The references relating to the use of water resources in the medieval period are as plentiful as for the earlier period. Rapid advances took place in the construction of inundation canals. Water was blocked by constructing bunds across streams. The Tughlaqs encouraged the digging of canals and Firuz Shah Tughlaq is considered to be the greatest canal builder before the nineteenth century. In south India too the situation was the same. Irrigation is said to have been one of the major reasons for the growth and expansion of the Vijayanagar Empire in the fifteenth century. The Mughals had known the importance of water as they promoted irrigation facilities by providing loans to farmers to install irrigational devices. Water is said to have played such an important role in the life of a city that Delhi was abandoned and rehabilitated seven times in search of abundant water resources. Shahjahanabad, the Mughal Capital was located along the riverbank keeping the factor of easily accessible water resources in view. It may be noted that, but for exceptional cases, most of the canal irrigation prior to the arrival of the British was of the diversionary nature. In the early nineteenth century, however, the colonial rule initiated a 'sharp break' in the technique by introducing perennial canal irrigation in several parts of the South Asian subcontinent.

The colonial interface with water resources began with the development of irrigation works — the renovation, improvement and extension of existing network. Soon afterwards was started what is known as the 'era of modern irrigation'. For the first time, permanent head works in the form of barrages and weirs were thrown across riverbeds and their waters diverted through intricate and extensive canal systems. These barrages and weirs were equipped with a series of shutters to regulate flows by impounding water during lean season and diverting it into canals and, on the reverse, the former could be flipped open to release waters during periods of the river's peak discharges. In effect, by flattening the river's variable flow regime at certain points along its course, irrigation was sought to be transformed from a seasonal to a perennial possibility. The ensuing period saw the construction of several large canal irrigation schemes like the Bari Doab Canal (1859), Godavari (1852), Ganges (1854), the Krishna (1855), the Sirhind (1889) climaxing with the grandest irrigation project of the colonial period – the Triple Canal Project (1916).

The recurrence of drought and famines during the second half of the nineteenth century also necessitated the development of irrigation works as a protection against the failure of crops. As irrigation works in low rainfall tracts were not considered likely to meet the productivity test, they had to be financed from current revenues. Significant protective works constructed during the period included the Betwa Canal, the Nira Left Bank Canal, the Gokak Canal, the Khaswad Tank and the Rushikulya Canal. The colonial irrigation policies were significantly influenced and reiterated by the famine and irrigation commissions. The First Famine Commission (1880) emphasized the need for direct state initiative in the development of irrigational works while the First Irrigation Commission (1901) recommended the renovation of several existing defunct or dilapidated irrigation works while proposing new schemes. It drew up a 20-year plan envisaging a huge public expenditure to irrigate 2.6 million hectares of fields. Some storage works in the South, tank irrigation projects in Central and South India, and tube-well irrigation schemes in western Uttar Pradesh were also implemented.

The 1930s saw the implementation of a new hydraulic principle in India. Known as the Multi-Purpose River valley Development (MPRVD), the new model of water resource development was sculpted on the lines of the Tennessee Valley Association (TVA) in the post-depression United States. The new technique envisaged focusing upon the entire river basin instead of merely the channel. The intention was to train the river through a sequence of interconnected dams, reservoirs, and diversions from its catchment all the way to its estuary by 'harnessing' its waters simultaneously for navigation, irrigation, flood control, and power generation. Between 1943 and 1946, the colonial government approved plans to build MPRVD schemes on the Damodar, Mahanadi, and Kosi rivers, besides setting up the Central Water, Irrigation and Navigation Commission (CWINC) as a professional water bureaucracy for formulating and implementing other MPRVD schemes.

MPRVD schemes continued to remain the dominant strategy of water resource management in independent India. Multi-Purpose river projects looked the best solution as India engaged in planned economic activities to achieve self-reliance, foster economic development and improve the standard of living of its people. Some important projects were initiated such as the Damodar Valley Project. Completed in 1963 across the Sutlej River, Bhakra-Nangal Project was the joint venture of Punjab, Haryana and Rajasthan governments; built across the river Rihand (a tributary of Son River), the largest multi-purpose project of Uttar Pardesh, Rihand Dam Project was completed in 1966 with a cost of 375 million rupees; the Hirakud Project involved construction of three dams across Mahanadi at Hirakud, Tikarpara and Naraj; The Chambal Project was a joint venture of the Rajasthan and Madhya Pradesh state governments; the Kosi Project was the result of a joint agreement between the governments of Bihar (India) and Nepal in 1954. Its main objective was to construct a barrage near Hanuman Nagar in Nepal along both banks of the river; the Tungabhadra Project was a joint undertaking of the governments of Karnataka and Andhra Pradesh; the Nagarjuna Sagar project was another of the same type. The harness of water resources on a large scale had become the priority of the state policy.

21.2 THE CONTESTED DOMAIN: STATE, ENVIRONMENT AND WATER RESOURCES

The themes of water, community, state and environment form an integral part of the contemporary discourse on environment and are rooted in the current politics of development. As David Mosse says at least two major political and policy positions currently shape questions around water resources and their development in India. Both narratives invoke polarized notions of state and the community and both emphasise and find justification in the existence of long-term, successful, indigenous community managed irrigation systems, conceptualised as a counterpart to resource management by the state. The first is the critique of the modernising development strategies of the centralised state and the dominance of western technical perspectives on the irrigation and water resources over those of the indigenous community; a critique sharply focused in recent years by the controversy over large dams, the Sardar Sarovar in particular, but which in India derives from the visions of Gandhi and his followers. The second is a reformist policy arguing for devolution of irrigation management responsibilities from the state to the community of users, which forms a part of the international consensus on public sector reform underpinned by ideologies of privatisation, free-state, and a reduced role for the development state.

The relationship between state and resource management has often been explained in terms of a linear grand or mega narrative. The dominant thrust of such overarching explanation known as a 'standard environmental narrative' or 'new-traditionalist' discourse puts all the blame on the state. According to such narratives, the pre-colonial India is seen as a period of 'harmonious' and sustainable resource management. Colonialism is seen as the 'breaking-point' and it is argued that the intervention of the state, particularly the colonial state and the attendant revenue and proprietary rights regime, played havoc with common resources leading to the demise of village traditions of sustainable resource use. The process was accelerated by the post-colonial forms of government. The dichotomies of community/state, pre-colonial/ colonial, tradition/modernity, and indigenous/foreign are extremely polarized in the traditional narratives.

In their search for a grand causal theory, the environmental protagonists of water resources extend the 'standard environmental narrative' to highlight what they consider as the breaking point in traditional water management systems. Modeled on the lines of Mahatma Gandhi's environmentalism, the classic argument comes from the authors of *Dying Wisdom* (Anil Agarwal and Sunita Narain, *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems*, New Delhi, 1997). Accordingly Indian water harvesting systems are represented as rooted in a pre-colonial 'organic village economy' wherein the autonomous 'village republics' were the primary locus of management of natural resources and economic and political affairs. With the rise of the state control over common water resources, there was an 'erosion of the autonomous functioning of village management systems'. Colonial rule converted village common property into state property, denied customary rights and weakened traditional village authority transforming managed commons into degraded free access resources; it placed the decentralised village water systems under the control of centralised bureaucracies which prioritised modern engineering knowledge, large-scale irrigation and the expansion of commercial agriculture neglecting indigenous skills. On the other hand, punitive colonial revenue regimes impoverished the peasantry and undermined the local financial base of water harvesting systems. This dismal state of India's traditional water harvesting systems only worsened with the 'arrogance of the post-Independence Indian political leadership and the irrigation bureaucracy' which preferred Nehru's vision of independent India with large dams as temples to Gandhi's vision of independent India founded upon its village heritage. It also calls for the revival of community control and traditional water harvesting systems. There is therefore a need for serious investment in research and development of traditional water harvesting systems through integrated and participatory renovation of tanks and the deforestation of catchments, drawing on indigenous knowledge of water-land relationships and involving all sections of community.

The relationships between the state and the community were more complex and problematic than has been made out to be in traditional accounts. David Mosse points out in his study of statecraft, ecology and collective action in South India that the impact of colonial governance on the water commons defies a simple representation and has more to do with changing systems of state than the erosion of village tradition. Indeed, traditional village water management system proves extremely elusive, and identification of the moment of their collapse is an impossible task involving a seemingly endless journey back in the time. Thus the decisive moment of a loss can be variously located in:

i) the present government's neglect of indigenous knowledge and traditions;

ii) the 1960s-70s green revolution expansion of capitalist agriculture and ground water irrigation;

iii) changes brought about in the 1950s following Independence (for example, the abolition of Zamindari estate and establishment of structures of local government);

iv) the colonial commercialisation of dry land agriculture in the late 19th and 20th centuries ;

v) the centralisation of the colonial government and the building of technocratic irrigation bureaucracy from the 1850s ;

vi) the consolidation of British power, its revenue systems and property law by the 1840s;

vii) the dismantling of the south Indian old regimes around 1800;

viii) the wars of the immediate pre-colonial period of the 1790s;

ix) the neglect of decentralised systems under the Mughal rule during the 18th century;

x) the disruption generated by the rise of the Vijayanagar empire in south India after 1350; and

xi) the collapse of the Chola empire and its system of locality and village government.

21.3 SURFACE WATER AND GROUND WATER

The annual precipitation including snowfall, which is the main source of the water in the country is estimated to be of the order of 4000 cu.km. According to the National water Policy, 2002 (**Appendix 1**) as per the latest estimate (1993), out of a total precipitation (including snowfall) of around 4000 billion cu.m in the country, the availability from surface water and worthy-of-replenishment ground water is put at 1869 billion cu.m based on basin wise estimates of Central Water Commission. Due to various constraints of topography and uneven distribution of resource over space and time, it has been estimated that of 1869 cu.km., only about 1122 cu.km. can be put to beneficial use. From this nearly 690 cu. km. shall be due to surface water resources. The availability of water is highly uneven in time and space. Precipitation is confined only to monsoon months every year varying from 100 mm in Rajasthan to over 10000 mm at Cherrapunji in Meghalaya. Rivers and underground water aquifers often cut across state boundaries. Based on 199l Census, the per capita availability of water works out to **220 cu.m.**

There are two main sources of water resources: surface water and ground water. Rivers are main source of surface water; the following chart makes clear the potential of surface water:

Basin-wise Surface Water Potential of India ***(Cubic Km/Year)***

Sl. No	Name of the River Basin	Average annual potential in river
1.	Indus (up to Border)	73.31
2.	a) Ganga	525.02
	b) Brahmaputra Barak & Others	585.60
3.	Godavari	110.54
4.	Krishna	78.12
5.	Cauvery	21.36
6.	Pennar	6.32
7.	East Flowing Rivers Between Mahanadi & Pennar	22.52
8.	East Flowing Rivers Between Pennar and Kanyakumari	16.46
9.	Mahanadi	66.88
10.	Brahmani & Baitarni	28.48
11.	Subernarekha	12.37
12.	Sabarmati	3.81
13.	Mahi	11.02
14.	West Flowing Rivers of Kutch, Sabarmati including Luni	15.10
15.	Narmada	45.64
16.	Tapi	14.88
17.	West Flowing Rivers from Tapi to Tadri	87.41
18.	West Flowing Rivers from Tadri to Kanyakumari	113.53
19.	Area of Inland drainage in Rajasthan desert	NEGLIGIBLE
20.	Minor River Basins Drainage into Bangladesh & Burma	31.00
	Total	1869.35

Source: Ministry of Water Resources, Government of India.

Inland water resources of the country can be classified as rivers and canals; reservoirs; tanks and ponds; jheels, oxbow lakes, derelict water; and brackish water. K L Rao points out that the total quantity of water annually carried by the rivers of the country is about 16,45,000 million cu.m.

Of the rivers and canals, Uttar Pradesh occupies the first place with the total length of 31.2 thousand km, followed by Jammu & Kashmir and Madhya Pradesh. The next in the order of geographical coverage of inland water bodies are the tanks and ponds occupying 2.9 m.ha. and then come the reservoirs covering 2.1 m.ha. Most of the area under tanks and ponds lies in southern states of Andhra Pradesh, Karnataka and Tamil Nadu. Along with West Bengal, Rajasthan and Uttar Pradesh, these states account for 62 per cent of total area under tanks and ponds in the country. As far as reservoirs are concerned, major states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttar Pradesh account for a larger portion of area under reservoirs. More than 77 per cent of area under jheels, oxbow lakes and derelict water lies in the states of Orissa, Uttar Pradesh and Assam. Orissa ranks first in relation to the availability of brackish water followed by Gujarat, Kerala and West Bengal.

The importance of groundwater as a source for meeting drinking, industrial and irrigation requirements for an ever-increasing population cannot be denied. It caters to around 50 per cent of the total irrigation in the country. India has a vast area for ground water resources. Around 22 per cent of India’s rainfall percolates under the ground. Of this total, about 430 billion cu.m reaches up to the upper surface of the soil. Nearly 384 billion cu.m reaches the pervious strata, which can be obtained by digging wells. According to a rough estimate the total ground water reserve at a depth of 300 m is 3700 m ham. This is almost 10 times the annual rainfall. The Central Ground Water Board (CGWB) estimates the annual exploitable potential at 42.3 m ham of which les than ¼ is presently being exploited. In terms of exploitation of ground water potential Punjab comes on the top (93.85 per cent), followed by Haryana (83.88 per cent), Tamil Nadu (60.44 per cent), Rajasthan (50.63 per cent), Gujarat (41.45 per cent), Uttar Pradesh (37.67 per cent), Maharashtra (30.39 per cent), West Bengal (24.18 per cent), and Andhra Pradesh (23.63 per cent). States like Assam, Bihar, Madhya Pradesh, and Orissa have not been able to utilize even one-fifth of their total ground water potential.

Basin-wise Ground Water Potential of Country *(Cubic Km/Year)*

Sl. No.	Name of Basin	Total Replenishable Ground Water Resources
1.	Brahmai with Baitarni	4.05
2.	Brahmaputra	26.55
3.	Cambai Composite	7.19
4.	Cauvery	12.30
5.	Ganga	170.99
6.	Godavari	40.65
7.	Indus	26.49
8.	Krishna	26.41
9.	Kutch & Saurashtra Composite	11.23
10.	Madras and South Tamil Nadu	18.22
11.	Mahanadi	16.46
12.	Meghna	8.52
13.	Narmada	10.83
14.	Northeast Composite	18.84
15.	Pennar	4.93
16.	Subarnrekha	1.82
17.	Tapi	8.27
18.	Western Ghat	17.69
	Total	431.42

Source: Ministry of Water Resources, Government of India.

Although the ground water is a resource that can be replenished annually, its availability is non-uniform in space and time. A wide range of factors; climatic conditions, relief (topography), geological structure and local hydrological conditions control the ground water occurrence and movement. No precise techniques are available for assessment of recharge and discharge therefore the methods employed for ground water resource estimation are all indirect. Ground water being a dynamic and replenishable resource is generally estimated based on the component of annual recharge, which could be developed by means of suitable ground water structures. An understanding of the behaviour and characteristics of the water bearing rock formation known as aquifer is crucial for the quantification of ground water resources. An aquifer has two main functions — (i) to transit water (conduit function) and (ii) to store it (storage function). The ground water resources in unconfined aquifers can be classified as static and dynamic. The static resources can be defined as the amount of ground water available in the permeable portion of the aquifer below the zone of water level fluctuation. The dynamic resources can be defined as the amount of ground water available in the zone of water level fluctuation. The replenishable ground water resource is essentially a dynamic resource, which is replenished annually or periodically by precipitation, irrigation return flow, canal seepage, tank seepage, influent seepage, etc. The methodologies adopted for computing ground water resources, are generally based on the hydrological budget techniques. The hydrologic equation for ground water regime is a specialised form of water balance equation that requires quantification of the items of inflow to and outflow from a ground water reservoir, as well as of changes in storage there in.

The main problems associated with the unscientific and unregulated development of groundwater are the over-exploitation of the resource leading to a fall in water levels causing failure of wells/tube wells; or deepening of the structure resulting in higher cost of pumping, seepage from sewer systems, industrial and urban waste disposal sites etc., and landward movement of sea water/fresh water interface in the coastal aquifers. Excessive withdrawal of water from the coastal aquifers has resulted in the landward movement of sea water/fresh water interface in some areas of Tamil Nadu and Saurashtra region.

For an effective water security system, it is imperative to take steps for augmentation of ground water storage through artificial recharge concurrent with the measures for development of the resource. The CWGB has carried out a number of artificial recharge and ground water conservation studies to develop the methodologies and technologies and to assess the economic viability of these measures. These studies conducted in Gujarat, Maharashtra and Tamil Nadu have established the feasibility of various recharge measures such as spreading, recharge through injection wells and induced recharge from surface water bodies and conservation of sub-surface flows through construction of sub-surface dykes. Percolation tanks have been found to be particularly effective in checking the surface runoff during the monsoons and conserving the same water recharging the underlying aquifers. Pilot projects have been carried out by CWGB in Karnataka, Maharashtra, Delhi and Chandigarh in this regard. Efforts have also been made to intercept and recharge the rooftop runoff during the rainy season by encouraging the installation of simple water harvesting systems.

There is however a need for suitable legislation to control and regulate various aspects related to the utilisation and development of ground water. The Ministry of Water Resources, Government of India has prepared a model bill in this regard. Known as the **Model Bill to Regulate and Control the Development and Management of Ground Water (2005**), its provisions include the establishment of a ground water authority, powers to notify areas to regulate and control the development and management of ground water, grant of permits, registration of users, penalties for offences, efforts at promoting rain water harvesting etc. **(Appendix 2).**

21.4 WATER-RESOURCES: SPATIAL AND TEMPORAL VARIATIONS

- Rajasthan, which accounts for almost 8 per cent of India's population, is endowed with only 1 per cent of the country's water resource.

- The annual average runoff per capita in the country varies between 18147 cu.m in the Brahmaputra basin and 631 cu.m. in the west-flowing rivers of Kutch and Saurashtra to 411 cu.m. in the east flowing rivers from Pennar to Kanyakumari in the south.

- About 80 to 90 per cent of the annual rainfall occurs during the four monsoon months (June to September) every year. For six to eight months of the year, the rainfall is either scanty or nil over most parts of the country.

- Rainfall in India shows unequal geographical distribution and the frequent departures from the normal. It generally exceeds 1000 mm in areas to the East of Longitude 78 degree E to 2500 mm along almost the entire West Coast and Western Ghats and over most of Assam and sub-Himalayan West Bengal. On the west of the line joining Porbandar and Delhi and thence to Ferozpur, the rainfall diminishes rapidly from 500 mm to less than 150 mm in the extreme west. The peninsular region has large areas of rainfall less than 600 mm with pockets of even 500 mm.

- Of the major rivers, the Ganga – Brahmaputra - Meghana system is the biggest system with a catchment area measuring nearly 110 m.ha, which is more than 43 per cent of the catchment area of all the major rivers in the country. The other major rivers with catchment area more than 10 m.ha are Indus (32.1 m.ha.), Godavari (31.3 m.ha.), Krishna, (25.9 m.ha.) and Mahanadi (14.2 m.ha).

- As against the national per capita annual availability of water of 2208 cu. m., the average availability in Brahmaputra and Barak is as high as 16589 cu m. while it is as low as 360 cu.m. in the Sabarmati basin.

- The total area of inland water resources is unevenly distributed over the country with five states namely Orissa, Andhra Pradesh, Gujarat, Karnataka and West Bengal accounting for more than half of the country's inland water bodies.

21.5 CURRENT ISSUES

The water resource management in India is today faced with some important issues. We must address them in order to understand the underlying conceptual operatives and also to find a way out from the impending impasse that threatens to make water resources the most contested and bitterly disputed matter. A list of such issues may be formed as below:

- Inter-State Water Disputes
- Inter-Linking Rivers: The National Water Grid
- Big Dams versus Small Dams
- Flood Control versus Flood Management
- Water Pollution

21.5.1 Inter-State Water Disputes

Most of the major rivers in India are inter-state in character; having catchments/ water sheds in two or more states. Often, water disputes arise amongst the basin states with regard to the use, distribution or control of the waters in respect of many inter-state rivers or river valleys or in the interpretation and implementation of the terms of any agreement relating to the use, distribution or control of such waters or in the levy of any water rate in contravention of various prohibitions. During the British period, inter-state disputes were settled by the central government. Upon adopting a constitution the Republic of India made irrigation a state subject. The state governments could now exercise control over planning, development, regulation, and distribution of water flowing through their territories. Over a period of time certain legislations have been enacted which enable the central government to intervene in matters of inter-state dispute. According to the Water Dispute Act, 1956, the central government can constitute a tribunal for the settlement of an inter-state water dispute when a request is received from a state government. The River Board Act, 1956 authorizes the central government to constitute river boards in consultation with the state governments for regulation and development of inter-state rivers. The Government of India formed rules on 30 June, 1959 to settle inter-state water disputes. By the Inter-state Water Dispute Act, 1968, the central government has been given the responsibility of regulation and development of inter-state rivers to the extent to which such regulation and development under the control of the Union is declared by the Parliament by law to be expedient in the public interest. Above all, under Article 262 of the Constitution, the Parliament is empowered to provide for the adjudication or control of the water of any inter-state river. The following chart gives a preliminary idea of the inter-state river water disputes:

River in Question	States Involved
Kaveri	Karnataka, Kerala and Tamil Nadu
Krishna	Maharashtra, Karnataka and Tamil Nadu
Tungabhadra	Andhra Pradesh and Karnataka
Godavari	Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Orissa
Narmada	Gujarat, Madhya Pradesh, Maharashtra and Rajasthan
Mahi	Gujarat, Rajasthan and Madhya Pradesh

Ravi and Beas	Punjab, Haryana, Rajasthan, Delhi, Jammu and Kashmir
Yamuna	Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi
Karmanasa	Uttar Pradesh and Bihar
Barak	Assam and Manipur
Mandvi	Goa and Karnataka
Mahadeyi	Maharashtra, Goa and Karnataka
Bhavani	Tamil Nadu and Kerala
Indravati	Orissa and Chhattisgarh

The central government has set up five Inter-State Water Disputes Tribunals so far, namely: Godavari Water Disputes Tribunal (April, 1969); Krishna Water Disputes Tribunal (April, 1969); Narmada Water Disputes Tribunal (October, 1969); Ravi and Beas Waters Tribunal (April, 1986); and Cauvery Water Disputes Tribunal (June, 1990). While the first three tribunals have already given their final awards, the remaining two tribunals are still adjudicating the issues referred to them. Most of the inter-state water disputes have been settled on the basis of equitable apportionment, which is the universally accepted principle. In addition, India also has some disputes with neighbouring countries like Nepal, Bangladesh, China over sharing of river waters.

21.5.2 Inter-Linking Rivers: The National Water Grid

It was in the middle of the nineteenth century that schemes for linking the rivers of entire Indian sub-continent were first planned. Since then almost a century passed before a similar idea was proposed again. In 1960s, K.L.Rao the Union Minister of State for Power and Irrigation spoke about the Ganga-Cauvery Link Canal. Later in the seventies, he developed the plans for a national water grid, which would transfer the surplus waters of the Ganges and Brahmaputra to the parched regions of central and southern states. The main Ganga-Cauvery link was to be composed of a canal 2640 km long. In the meantime Captain Dastur had proposed a similar idea. Popularly known as the 'Garland Canal', the project envisaged a 4200 km long 300 m wide Himalayan Canal aligned along the southern slopes of the mountain range and another 9300 km Central and Southern Garland Canal. Both these canals were to be linked at Delhi and Patna. In 1982, the Government of India formed the National Water Development Agency (NWDA) to identify river links for a national grid, to prepare feasibility studies and to execute detailed project reports. NWDA has in the last two decades identified a possible 30 river links, which would connect every major river in the Indian mainland and has prepared feasibility reports on six of these. It estimates that the cost of the entire project would be 5.6 lakh crores and would take 30 years to execute. The issue came alive again in 2002 when, following a directive from the Supreme Court, the Government of India set up a task force to prepare and outline an action plan for implementing a project to link the rivers of India and the Prime Minister declared that the task would be taken up on a war footing. Critics have pointed out many issues that crop up with this grand plan:

- It is said that the plan tantamounts to altering nature and redrawing the geography of the country.
- Questions have also been raised on the technical feasibilities of the plan. The concept of transferring water from surplus source basins hinges on the availability of surplus in source basins. It has been pointed out that surplus water in source basins might not always be true in India. According to the internationally accepted definitions, eight of the twenty basins of India are water-scarce today and by 2025 (when the water grid is expected to be fully functional) thirteen river basins will be below the water-scarcity level. It is also argued that all the basins will qualify as water stressed, with the exception of Brahmaputra-Barak system.
- Where would the funds for the plan come from? The estimated cost of 112 million is more than India's outstanding external debt and the Task Force (on Inter-Linking) has not indicated how and from where the funds would come. All over the world, inter-basin transfers have proved to be the most expensive option to develop water next only to sea-water desalinisation. Raising the funds would be a big constraint and the cost overruns would make the project prohibitively costly.
- The environmental cost of the inter-basin transfer is another factor to be taken into account. It has been argued by hydrologists and ecologists that as opposed to being merely moving masses of water out to be regulated and dammed, rivers are fluvial regimes with complex geomorphologic, chemical and biological processes in motion. They are made up of a wide variety of aquatic and riparian species. Rivers with highly altered and regulated flows lose their ability to support natural processes. Experience from the U.S. (California), Israel, and former Soviet Union indicates high environmental costs of inter-basin transfer.
- Water transfers can be made only with the consent of the states concerned. The NWDA assessment that surpluses are available in the Mahanadi and the Godavari is not shared by Orissa and Andhra Pradesh. Apart from the techno-economic feasibility, on which the Ganga-Cauvery link idea was abandoned earlier, the diversion of Ganga water would have international implications. In view of some water issues with our neighbouring countries, Bangladesh and Nepal, it is not likely that they would take this very kindly. The following chart illustrates some of the promises and pitfalls of the planned inter-basin transfer:

Promises	Pitfalls
Transfer 173 billion cubic meters of water to water-stressed regions.	More inter-state water disputes; diplomatic row with Bangladesh and Nepal.
Building 11,000 km of canal network.	Increased incidence of water-logging and submergence of 19292 ha of forests.
Generate 34,000 MW of power.	Raising funds a constraint; cost overrun to make the project prohibitively costly.
Boost GDP growth by 4 percent.	4.5 lakh people to be displaced

Source: The Hindu Survey of Environment, 2003.

It has been suggested that the feasibility of inter-basin transfers should be examined for contiguous basins, on a case-by-case basis unlike the current National Water Grid project which is an "all-or-nothing" linking of major river systems. People-centered sustainable local solutions have been posed as the more viable alternatives. Community efforts at harvesting rainwater and recharging the aquifers have been a major success in Alwar. Its success has revived the Arvari River which had not flown in the last forty years. Similar district and watershed-level experiences from Maharashtra, Madhya Pradesh and Andhra Pradesh hint at the potential possibilities of community based and participatory water management.

21.5.3 Big Dams versus Small Dams

India has around 4300 dams of which 2256 were built in a peak period between 1971 and 1990. Around three-quarters of the completed dams are situated in three western agricultural states. The large dams in India are constructed and owned by state governments. However droughts in recent years have raised some very vital questions regarding big dams. The supporters of large dam projects argue that:

- dams confer many benefits and without them, the growing needs of food, water and energy cannot be met and any harm they may cause can be anticipated and remedied;
- some of the adverse consequences attributed to the dams really arise from certain 'political economy' factors prevalent in the country; and
- small dams, local watershed development, and water harvesting etc. are no substitute for large dams- they are complimentary measures that can meet only a small part of the overall requirements.

On the other hand, those who question the acceptability of such claims contend:

- benefits, supposedly coming from many dams are overstated and the cost understated;

- impact and consequences are rarely assessed in advance and cannot be fully foreseen, much less remedied; many adverse effects are irremediable;

- needs of the future can be met without recourse to large dams, through smaller structures and demand side management.

The central question is whether the price of environmental damage and social disruption of indigenous and other communities is worth the ostensible benefits of providing water and power. The debate has become increasingly heated and has assumed the shape of a broader conflict between top-down, technocratic, and interventionist approaches to development and bottom-up, participatory and locally appropriate alternatives. The debate in India has been exemplified by a number of protest movements against big dams, the most well known being the Narmada Bachao Andolan. The nature of the conflict is even reflected in Government of India's rejection of the report on the World Commission on Dams (WCD) on the grounds that it was incompatible with country's development priorities. While acknowledging the fact that the dams have made a big contribution to human development, the WCD report indicated that the same had been accompanied in many cases by unacceptable social and environmental costs. In the last few years there has been an intense debate in India over alternative modes of storage (like tanks, small and medium sized dams) and in-situ capture through integrated watershed development and rainwater harvesting. The process has received a boost by numerous case studies of successful revitalisation of traditional collective water management systems and local level participatory management systems involving community mobilisation.

21.5.4 Flood Control versus Flood Management

Even after adding 16,199 kms of new embankments during 1954-1993 and spending crores of rupees on flood detention reservoirs, the area liable to floods in India has actually shown an increase. From roughly 19 million hectares in 1953, the flood prone area increased to 40 million-60 million hectares based on the different estimates. The trend has therefore been upwards. The expenditure on flood control has also been on the rise in the post-independence period from Rs. 13.21 crores in the First Plan to a high of 1691.68 crores in the Eighth Plan. India in fact remains the most flood-affected country in the world after Bangladesh. The massive infrastructure of storage reservoirs, pumping stations and more than 1000 kms of canals planned for linking the rivers might further hinder the already impaired drainage in most basins thereby exacerbating the flood situation. The simple question that follows relates to 50 years of embankments and large dam centered approach that has perhaps increased India's vulnerability to the floods. Environmentalists have pointed to a paradigm shift in the approach to the floods worldwide– from flood control to flood management and its application in the Indian context. . It has been argued that recovering the experiences of flood utilisation would be an important component for forging a more viable response to the flood situation in the long run.

21.5.5 Water Pollution

According to Centre for Science and Environment, Delhi, 25 large towns and cities along Ganges discharge close to 1340 million litres per day of sewage mostly untreated waste including traces of heavy metals in the river. Agricultural runoff, mainly fertilizers and pesticides, also find their way through the drains and tributaries. Similarly from the time Yamuna enters Delhi at Wazirabad it is loaded with close to 1700 million litres per day of untreated sewage. In the south, the Noyyal tributary, which flows into the Kaveri River, has over 800 dyeing and bleaching units pouring soda ash, caustic soda, sulphuric acid, hydrochloric acid, sodium peroxide and other chemicals into the river. Even ground water is severely affected by pollution. Over-pumping in some coastal areas has let in sea-water; in others, contaminants such as fluorides and arsenic have been released from rock–strata; and in yet others, agricultural chemicals and industrial wastes have seeped into aquifers. There are some estimates, which indicate that pollution also reduces the volume of available water. According to one such estimate, there is a 6 to 7 per cent decrease in available ground water due to sewage, wastewater and garbage.

21.6 SUMMARY

India is facing an acute water crisis with soaring costs to public health due to pollution and water-borne diseases. The crisis is also due to the lack of access to safe water supply to millions of people as a result of inadequate water management and environmental degradation. The country's huge and growing population is putting a severe strain on all of the country's natural resources. While the total population has risen to one billion people, its supply of water continues to be increasingly contaminated by pesticides, heavy metals and natural pollutants. Every drop of water is locked into the global hydrological cycle. Human actions modify the hydrological cycle and often seriously pollute available freshwater. Climate change is also affecting the hydrological cycle significantly thereby affecting freshwater production and its distribution. Population growth, urbanization and increasing demand from competing uses for drinking, agriculture, industry and energy- the pressures on this finite resource are mounting every day.

India has made progress in the supply of safe water to its people, but gross disparity in coverage exists across the country. Official figures show that around 90 per cent of India's population has access to drinking water. But people who work at improving the water supply say only just over half the country can count on its water being safe and constantly available. The deprivation of these two fundamental human needs impacts every facet of their existence: their health, dignity, environment, livelihoods and indeed the sustainable development of their societies and consequently their nations. The shortage of water and its growing pollution has acquired the proportion of a crisis especially for the 'poorest of the poor'. And yet there is a false sense of complacency that not only is water an infinite resource but that it also has to be available at no cost resulting in waste, inefficient usage and pollution. Water users barely pay for even the operating costs. There is absolutely no contribution to capital outlays, which are met by domestic governments and external assistance by way of aid or loans. Irrigated farming is generally heavily subsidized placing a severe burden on the budgets of local authorities. Per capita average annual availability of freshwater in the country has reduced from 5,177 cubic metres in 1951 to 1,869 cubic metres in 2001 and would fall further to 1,341 cubic metres in 2025. In a recent study of 27 Asian cities with populations of over 1,000,000, the World Bank says that two Indian cities — New Delhi in the north and Chennai in the south - are the worst performing centers in terms of hours of water availability per day. Mumbai, a western Indian city, is the second worst performer and Calcutta, the fourth. Experts say Delhi could even run out of water within 25 years if strict conservation measures are not brought in soon. Environmental analysts assert that there are at least 100,000 Indian villages facing severe water shortages. If the present consumption patterns continue, two out of every three persons will be living under 'water stressed' conditions by the year 2025. Drastic measures are needed to redeem the situation.

21.7 EXERCISES

1) Write an essay on the importance of water as a natural resource.

2) Bring out the changes in water management methods from pre-colonial to colonial period.

3) Write short notes on the following:

   i) Inter-State Water Disputes

   ii) Interlinking of Rivers

   iii) Big dams versus small dams

21.8 SUGGESTED READING

David Mosse, *The Rule of Water: Statecraft, Ecology and Collective Action in South India,* New Delhi, 2003

Chhatrapati Singh, *Water Law in India,* New Delhi, 1992

UNIT 22 DEVELOPMENT AND ENVIRONMENTAL CONCERNS

Structure

22.0 INTRODUCTION

It is now a well known fact that environmental preservation has taken a back seat with the unfolding of developmental initiatives. Development has today become such a dominant idea that anything contrary or appearing to retard the pace of development is considered the most undesirable impediment. For this reason it was not realised for long that environmental preservation and development were not mutually exclusive concerns. In fact environmental problems in developing countries like India are in many ways the result of lack of development The development here implies disproportionate access/ control over tangible and intangible assets/resources. This disproportionate access and control not only results in marginalisation and consequent deprivation due to class and caste location but also promotes use of resources in such manner as to result in an enviro-development crisis. In other words, inequality and deprivation pushes social groups in exploiting the available environmental resources in their proximity and use them in a manner that the process of erosion of these resources sets in. Thus environmental degradation and lopsided development become the two different sides of the same coin.

The term developing country is used for those countries that borrowed an industry led economic growth model of the Northern industrialised countries. The 'newcomers' were to draw on experiences in previously industrialised countries but faced different conditions and hence were largely unsuccessful (Tornquist,1999).

In order to understand the connection between environmental concerns and development, we will first analyse the dominant concept of development and its implications. Thereafter we will discuss the responses from the mainstream school of thought, that have tried to grapple with the linkage between environmental concerns and developmental issues. Subsequently we will review the response of the reformist school of thought to the relationship between the emergent environment and development, and also examine the critical discourse on the subject.

22.1 UNDERSTANDING DEVELOPMENT AND ENVIRONMENTAL CONCERNS

The history of development in the colonial and postcolonial world unfolded itself in a manner that it accepted the supremacy of enlightenment in thought and practice in both socio-economic and intellectual domains. Partha Chatterjee argues that anti-colonial nationalism in Asia and Africa in general and India in particular accepted unquestionably the superiority of west in the material domain. He writes '… the material is the domain … of the economy and of the statecraft, of science and technology, a domain where west has proved its superiority and the east has succumbed. In this domain the western superiority has to be acknowledged and its accomplishment carefully studied and replicated…' ('Nation and Its Fragments: Colonial and Post-colonial Histories'in *Partha Chatterjee Omnibus*, New Delhi, 1999).

22.2.1 Mainstream View

In India as well as in other countries development was dominantly understood as:

- A mechanistic world view and the emergence of a scientific methodology that had together created a corpus of scientific (natural and social) knowledge and scientific tools and techniques;
- The scientific knowledge and techniques, that would induce, if opted, changes in economy (shift from agriculture to industry based economy);
- The industrial economy which had the potential of creating a strong service sector and was expected to absorb surplus labour freed from agriculture;
- The industrial advancement creating a framework for sustained economic growth; and
- The industrialised economy, supported by democratic state (universal adult franchise) and modernised society (equality between citizens) geared to serve the goal of continuous macro-economic growth synonymous with development.

Evidently universal standard of progress based on a set of values in the social and political field were accepted as the bedrock of development. Translated into practice it meant the adoption of scientific knowledge to bring in industrial growth by displacing traditional agricultural activity.

Though this model gave a particular awareness of backwardness and thus made it lopsided, the 'universal standards' themselves and the means to achieve them were never considered fundamentally flawed. Further, the political economy discourses within Liberal Democracy and Marxism, the two major paradigms, also showed that there was no disagreement between them so far as the understanding of the means to achieve economic growth/development was concerned.

This discursive unity reflected a singularity of purpose regarding the strategies and development programmes that were designed from a presupposed objective. The vision of development enshrined in the mainstream school of thought gave rise to the following:

Promoting the replication of history of the western societies in the countries of South. This allowed to it the luxury of considering history of development as unilinear, apolitical and technology-driven, independent of specific socio-political and cultural factors.

Reflecting an 'elitist and deterministic' view as far as distribution of economic growth and consequent social relations were concerned, i.e. it assumed that the whole society, irrespective of varying social locations within, would work towards the end objective of development. Hence, energy of the dominant categories as well as 'backward and gendered mass' was to be channelised in this particular direction. It was premised, in the words of Partha Chatterjee, on "one rational consciousness and one will – that of the whole. Particular interests needed to be subsumed within the whole and made consistent with the general interest" for the benefit of the whole. ('Development Planning and Indian State' in Partha Chatterjee, ed., *State and Politics in India*, Delhi, 1997).

This view promoted development policies which stood in contradiction to the needs and demands of marginalised social categories as is clear from the following table prepared by Robert Chambers:

Interpretation of Development by Professionals [Dominant Social Categories]	**Interpretation of Local People [Marginalised Social Categories]**
Universal	Local Specific
Simplified	Complex
Reductionist	Holistic
Standardised	Diverse
Physical	Experiential
Quantified	Unquantified
Low Income and hence Poverty	Multi-Dimensional deprivation
Employment	Livelihood

('Poverty and Livelihoods: Whose Reality Counts?' in *Environment and Urbanisation*, Vol. 7 No.1, 1995).

1 The liberty of considering a particular section of the people weaker and the other section enlightened. Hence, allowing the latter to chart out a course of progress for the former from their standpoint.

- Ignoring the agency of the subordinate section of the society in the process of development and making them mere instruments in achieving the end objectives defined on their behalf by the dominant social categories. This also disallowed the common people from being in charge of evaluating and controlling the path of development. This made the development prone to control of experts and highly centralised in its approach.
- Envisaging a pattern of economic growth (hence development) that would never take into account the limits to the use of environmental resources. This would promote energy intensive and unsustainable industrialisation and a reckless intervention in the systems of nature.

This model of development has been severely criticised both from within as well as outside the environment and development policy establishment. The response to these criticisms came from institutions as well as independent writers, policy analysts and activists. We will discuss them in the ensuing pages.

22.1.2 Reformist View

The institutional response to a supposedly interconnected crisis of environment and development was articulated in formulations of World Commission on Environment and Development Report (WCED), popularly known as Brundtland Report. This report resulted in a wide debate on the main issues concerning environment and development and finally resulted in the United Nations Conference on Environment and Development (UNCED, 1992 also known as Agenda 21). The report and the subsequent conference have shaped the theory and practice of environment and development in the past decade. The WCED Report discusses four important factors, which contribute to a present day crisis in matters relating to environment. These are: poverty, growth, survival, and economic crisis. (Our *Common Future: Report of the World Commission on Environment and Development*, New York, 1987).

The cause of poverty is traced to several national and international factors. International factors include disadvantageous terms of technological transfer, protectionism, and inadequate financial flow. At the National level poverty is the result of unequal distribution of land and other assets, increasing population, and commercialisation of natural resources (*Ibid*). The Report further points out that economic growth increases total amount of resource use while at the same time also results in increased human intervention in natural cycles besides emphasising on energy intensive growth. While discussing survival the Report points out the vulnerability of human survival due to threats like green house gases, radioactivity, toxic wastes etc. Finally, the Report points out that environmental degradation also results in the slowing down, and often reversal, of economic growth and development leading to economic crisis.

The root cause of the above-discussed problem, according to Report, is "fragmented nature of institutions and policies" which is not able to integrate production with "resource conservation and enhancement". Hence, the Report advocates, "sustainable development" (which meets the need of the present generation without compromising with the ability of the natural resource base to meet the demands of the future generations) with the help of "reviving growth". It also stresses on "changing the quality of growth" (less energy intensive) in order to meet the essential human needs In the realm of natural resource management, it promotes effective decentralisation of powers for implementing, monitoring and evaluating the developmental projects in order to make such initiatives sustainable and to enable the poor to "achieve sustainable livelihoods".

Similarly Agenda 21 points out the necessity of achieving sustainable development at every level of society. People's organisation, women's group and non-governmental organisations are identified as important source of innovation and action at the local level having a strong interest and proven ability to promote sustainable livelihood. It further asserts that governments in cooperation with Non-Government Organisations (NGOs) should support a community-driven approach to sustainability, which can give communities a large measure of participation in sustainable management and protection of the local natural resources in order to enhance their productive capacity. It stresses on the necessity to take special measures to empower women through full participation in decision making, and of promoting sharing of experience and knowledge between communities (UNCED, 1992).

This Conference triggered a lively debate on the concept of sustainable development which had become a buzzword and was used by authors and critics belonging to all schools of thought almost universally. It was argued that the concept of sustainable development had proven to be quite ambiguous due to its conceptual and ideological similarities with mainstream view. This perhaps was due to the fact that the top priority accorded by the strategic imperatives was for economic growth ("reviving growth") or development rather than shifting the focus from there and placing it on environment. The goal again remained the same, i.e., rapid industrialisation with modernisation. The assumption again remained the same, that the benefits of growth would trickle down and produce a similar growth in other sectors of the economy, which would absorb the surplus labour through creating non-skilled jobs in abundance. This would in turn tackle the problem of inequality and poverty. (*World Development Report New* York, 1990).

This model of growth is a shift from the earlier model of mixed economy (as far as India is concerned) only to an extent that State's role in administration and allocation of resources in various sectors of the economy has to be substituted by the market mechanism with the corollary of minimising the resource-base of the State. The State is supposed to lay the market rules, ensure their operation and intervene only in case of their violation or in case of market failure (*Ibid*.). This has also resulted in drastic cuts in social expenditure and has diminished subsidies. In the context of agriculture and rural development, this model emphasises commercialised and export oriented agriculture economy. Even in the food grain sector, the target, and accordingly, the policies, are designed to meet the food security of the country rather than the food security at the household level, especially of the marginalised social categories.

The WECD report and subsequent other reports provide an insightful diagnosis of the interconnected enviro-development crisis. It is clearly recognised by all the reports that there is a close linkage between poverty and unsustainable use of resources, but when it comes to solutions it does not go much beyond conventional ideas and methods. Moreover as we see the development at the level of praxis we do not find it to be a satisfactory experience. A report prepared by United Nations after the completion of five years of UNCED points out: "Although economic growth – reinforced by globalisation –has allowed some countries to reduce the proportion of people in poverty, for others marginalisation have increased. Too many have seen economic condition worsen and public services deteriorate; the total number of people in the world living in poverty has increased. Income inequalities has increased among countries and also within them, unemployment has worsened in many countries, and the gap between the least developed countries and other countries has grown rapidly in recent years. …[Besides] the state of global environment has continued to deteriorate and significant environmental problems remain deeply embedded in the socio-economic fabric of countries in all regions" (United Nations, 1997, *Earth Summit +5: Programme for the Further Implementation of Agenda 21*, UN, New York 1997).

The subsequent reports which have come from United Nations and its associated organs are also well researched. But it is interesting to note that researchers, critics, analyst from various schools of thought – all vouch for the same model of development, i.e. "decentralised", "participatory", "defined from below". They try to incorporate solutions always maintaining primacy of democratic rule and free market economy as a precondition for any acceptance of reforms. This results in an increased emphasis both in theory and practice on how to deepen democracy. The assumption in this emphasis is that a vibrant democratic society will create a strong civil society, which will pressurise the governments to perform. However historical experience indicates that democracy does not always result in the growth of vibrant civil society. Tornquist points that an elite led democratisation as seen in Philippines resulted in "boss-rule" at the local level and "personalised populism" at the national level. He cites the case of India and asserts that centralised democracy there coupled with liberalisation has resulted in populist mobilisation on the basis of religious or cultural identities. Similarly, in authoritarian regimes, privatisation and deregulation has "enabled most of the old power- holders to reorganise their network and legalise their virtually private possession of the greater part of the resources they had already earlier controlled". This is even true of the 'socialist' countries like China. (Olle Tornquist, *Politics and Development: A Critical*

Introduction, New Delhi, 1999).

22.1.3 Further Views

The mainstream view and the reformist view both have been subjected to scrutiny and both have received indicting criticism with regard to their true intentions in the enviro-development debate. Against the backdrop of such criticism United Nation's Development Programme (UNDP) proposed two closely interrelated policy recommendations – *Sustainable Human Development*, (*World Human Development Report, New* York, 1994) and *Governance for Sustainable Livelihoods: Operational Issues* (UNDP,1998). The former is defined as a programme of development focussed on the "protection of the life opportunities of future generations as well as present generations and respecting the natural systems on which all life depends." A very important shift here is the recognition that economic growth measured in terms of increased Gross Domestic Produce (GDP) does not amount to sustainable human development ('Reconceptualising Governance: Discussion Paper 2' at http://www.undp.org/1997). The latter is a set of practical recommendations for implementing the former. It suggests that sustainable human development and sustainable livelihood can be achieved through articulation of local level needs with the assistance of sustained mobilisation of social capital through distribution or decentralisation of political power to local level constitutional as well as civil society institutions. UNDP defines Sustainable livelihood quite comprehensively taking both income and non-income factors into account: "Sustainable livelihood is the capability of people to make a living and improve their quality of life without jeopardizing the livelihood options of others, either now or in the future. Conceptually, livelihoods connote the means, activities, entitlements and assets by which people make a living. Assets, in this particular context, are defined as not only natural/biological (i.e., land, water, common-property resources, flora, fauna), but also social and political (i.e., community, family, social networks, participation, empowerment, human (i.e., knowledge, creation by skills), and physical (i.e., roads, markets, clinics, schools, bridges). The sustainability of livelihoods becomes a function of how men and women utilize asset portfolios on both a short and long-term basis. Sustainability should be defined in a broad manner and implies: a) The ability to cope with and recover from shocks and stresses; b) Economic effectiveness, or the use of minimal inputs to generate a given amount of outputs; c)Ecological integrity, ensuring that livelihood activities do not irreversibly degrade natural resources within a given ecosystem; and d)Social equity which suggests that promotion of livelihood opportunities for one group should not foreclose options for other groups, either now or in the future" (UNDP, 1998). Here social Capital is distinguished from physical, financial and human capital and refers to cultural, political, educational attributes of a community, which ostensibly allows them to function in a mutually supportive manner. It is assumed that once such capital is open to the use, it can contribute significantly in improving economic performance, especially growth. It also lays emphasis on *confirmation* or institutionalisation of such rules that have permitted such a change. Market can be a useful ally to sustainable livelihood strategy as far as it allows the "local actors to have more influence over their own affairs". It is also emphasised that macro level rule and regulation should adjust to development needs defined from below rather than vice-versa thereby giving increased emphasis to civil society institutions and the role of social capital in building these institution.

It is argued that division of labour and pattern of subordination and exploitation is so complex in any developing country in general and India in particular that any simplistic understanding of democracy results in institutions of formal democracy and not substantive democracy. The evidences, at least in theory, suggest that this paradigm of civil society ignores the caste class gender location and assumes citizens to be equal. This seems to be quite a vicious circle because historical evidence suggests that emergence of civil society is closely associated with the "rise of relatively independent socio-economic relations as against the family, the feudal lord and the absolutist state"(Olle Tornquist, *Politics and Development: A Critical Introduction*, New Delhi, 1999). The overwhelming presence of primordial loyalties and consequent economic relations will never allow autonomous civil society to emerge and civil society cannot operate effectively in presence of such social and economic relationship. Further, the argument that markets create an equal opportunity for all depends on the critical assumption that initial distribution of property right is equal. The markets exclude people as producers or sellers if they have no asset or capabilities. Hence social categories lacking in assets, physical and financial, which can be used to earn interest, rent or profit are simply excluded from the market. Their position becomes even more vulnerable in those societies where distribution of capabilities is also unequal (Deepak Nayyar, 'Economic Development and Political Democracy: Interaction of Economics and Politics in Independent India' in *Economic and Political Weekly*, December 5, 1998). In such a context no amount of efforts can bring the whole community together in order to function in a mutually supportive manner.

22.2 CRITICAL DISCOURSE

Ever since environment has come centre-stage in the discussions concerning the directions in which the developmental paradigm should be moulded several views have emerged that discard the primacy of humans as the pre-eminent beneficiary of development and the consequent results of development. We have clubbed them together under the appellation Critical Discourse. In the following sub-sections we discuss the four major categories of these views.

22.2.1 Deep Ecology

This school of thought rejects the human centred view of development and supports a discourse which is eco-centred. It suggests a fundamental restructuring in the principles of societal development. It promotes the ethics of conducting human affairs according to the laws of nature. This school of thought believes that the present crisis in the realm of environment and development is due to support and promotion of ecological policies by mainstream environmental groups whose main aim is to protect those parcels of nature that are useful/necessary for the present well being of humans. This is termed as shallow ecology. Hence the need of the time is to promote value based ‘Deep Ecology’.

Deep Ecology is founded on two basic principles: one is that scientific insight into the interrelatedness of all systems of life on Earth is possible; and that the idea of *anthropocentrism* – human-centeredness – is a misguided way of seeing things. Put in other words it argues for equality of all natural things – ecosystems, life and landscape – and agrees that all of them have an intrinsic right to co-exist. This eco-centric attitude is more consistent with the truth about the nature of life on Earth. Instead of regarding humans as something completely unique or chosen by God, they see us as integral threads in the fabric of life. Hence it demands a less aggressive human attitude towards nature. In the words of Naess “Living a simple life, a human will effect the earth minimally: Simple in means, rich in end” (Arne Naess, *Deep Ecology,* 1988 at http://www.proinco.net/staff/mogens/deepeco/english/).

The second component of Deep Ecology is what Arne Naess calls the need for human self-realisation. Instead of identifying with our egos or our immediate families, we would learn to identify with trees and animals and plants, indeed the whole ecosphere. This would involve a pretty radical change of consciousness, but it would make our behaviour more consistent with what science tells us is necessary for the well being of life on Earth. The propositions of Deep Ecology have been compared with the dominant worldview in the following table to place them in perspective:

Dominant Worldview	Deep Ecology
Dominance over Nature	Harmony with Nature
Natural Environment as resource for humans	All nature has intrinsic worth/equality of bio-species
Material/economic growth for growing human population	Elegantly simple material needs (material goals serving the larger goal of self-realisation)
Belief in ample resource reserves	Earth “supplies” limited
High Technological progress and solutions	Appropriate technology; non-dominating science
Consumerism	Doing with enough/recycling
National/centralized community	Minority tradition/ bioregion

22.2.2 Social Ecology

Murray Bookchin who is considered as the founder of this school of thought points out that in order to understand the present day problems-ecological as well as economic and political – we must examine their social causes and remedy them through social methods. He writes: “simply to put society against nature, humanity against the bio-sphere and reason, technology and science against less developed, often primitive forms of human interaction with the natural world allows us to study only the social symptoms rather than the social cause”. The analysis which brings out the social symptoms conceal vast differences, often bitter antagonism that exists between the privileged whites and people of colour, men and women, rich and poor, oppressor and oppressed. (Murray Bookchin, ‘Society and Ecology’ in John Dryzek & David Schlosberg, *Debating the Earth: The Environmental Politics Reader,* Oxford, 1988).

Further it is pointed out “all ecological problems are social problems” (*Ibid*). Hence in order to understand and explain the social facts and social problems, it is also recommended to extend the traditional boundaries of sociology beyond the interface of economy, polity, social structure and culture by incorporating a fifth basic category of ecological infrastructure of human society – that is, soil, water, flora fauna, climate etc. The rationale for this is that the ecological infrastructure powerfully conditions the evolution and direction of human’s economic life, political relations, social structures and ideology. (Ramchandra Guha, 1994, *Social Ecology*, New Delhi, 1994). Such an analysis may provide a clue to the present enviro-development crisis and consequent livelihood constraints on marginalised social categories. The Social Ecologists point out that the present crisis is due to domination within human society and domination of nature by human society. They support remaking of the society by conscious struggle against all forms of domination – within human society and of nature by humans.

22.2.3 Eco-Socialism and Eco-Feminism

The eco-socialist gives attention to political economy aspect of enviro-development crisis. Marx’s analysis of capitalism and his recommendation of ideal communist society, according to eco-socialist, can overcome the present enviro-development crisis. There is however a debate within the school which claims that Marx failed to lay equal emphasis on the appropriation of nature and women’s unpaid labour. The former is termed as second contradiction of capital. As capitalism refuses to take the cost of destruction of the conditions of production into account, its practice leads to an ecological crisis. Eco-Socialism responds to this second crisis in capitalism. (James O’Connor,, 1994, ‘The Second Contradiction of Capitalism’ in *CES/CNS Pamphlet* 1, 1994).

Despite differences between various authors the principle eco-feminist position emanates from the understanding that the institution of patriarchy, coupled with capitalism, deprived women of their control over natural resources. These resources were appropriated for commodity production and maximisation of surplus value. The prescription favoured by Eco-Feminism is gyno-centrism i.e. according centrality to women, their knowledge and their production and reproduction related activities.

22.3 SUMMARY

We see that both the reformist school as well as the critical school agree that there is a close inter-connection between the crisis of development as well as environmental destruction. The remedy suggested by the reformist school is giving some kind of control for the management of natural resources to the local level people's institutions. There is a call for deepening democracy through creation of a vibrant civil society. On the other hand critical discourse wants a fundamental shift not only in the model(s) of development but also in the attitude of community/ individuals towards the use of natural resources.

22.4 EXERCISES

1) Is there an inevitable conflict between development and environmental concerns? Discuss and give different views on the subject.

2) Write short notes on the following:

   i) Deep Ecology

   ii) Social Ecology

   iii) Eco-Socialism and Eco-Feminism

22.5 SUGGESTED READING

Partha Chatterjee, *Partha Chatterjee Omnibus*, New Delhi, 1999.

Partha Chatterjee, ed., *State and Politics in India*, Delhi, 1997.

Robert Chambers, 'Poverty and Livelihoods: Whose Reality Counts?' in *Environment and Urbanisation,* Vol.7, No.1, 1995.

Our Common Future, Report of the World Commission on Environment and Development, New York, 1987.

World Development Report, World Bank, New York, 1990.

Olle Tornquist, *Politics and Development: A Critical Introduction*, New Delhi, 1999.

Deepak Nayyar , 'Economic Development and Political Democracy: Interaction of Economics and Politics in Independent India' in *Economic and Political Weekly,* December 5, 1998.

UNIT 23 BIODIVERSITY

Structure

23.0 INTRODUCTION

An understanding of biodiversity or the diversity of life-forms is central to any programme of ecosystem and environmental studies. India is richly endowed in this biological wealth. The numerous types of plants and animals that survive on Indian sub-continent accord it a special position. It is a unique situation that India is home to genetic, species, and ecosystem biodiversity resulting from diverse kind of landforms and climates providing habitats to life forms. However, it is also correct that excessive human interference in this wealth and a relative ignorance about its value is fast eating into our biological resources. In spite of governmental efforts, biodiversity depletion continues at an alarming rate. In fact biodiversity protection is one of the more important concerns of modern India and a familiarity with basic concepts related with biodiversity, we understand, is of help in this matter.

In this unit, we propose to focus attention on the prominent aspects of biodiversity. Thus issues like definition, distribution and depletion will come under discussion. We also look into the various government policies and legislations aimed at protection of our biological wealth. In addition an attempt is made to explore aspects of public participation in biodiversity management.

23.1 BIODIVERSITY: MEANING & IMPORTANCE

Biodiversity is a combination of two words – biological and diversity, meaning diversity of life forms. It has been used very generally for nature and its biological wealth. Based on this understanding several definitions have also been put forward. Biodiversity is generally defined as the number and variability of all the life forms pertaining to plants, animals and micro-organisms and the ecological complex they inhabit.

The other definition seeks to define biodiversity in terms of three fundamental and hierarchically related levels of biological organisation whereby it is understood in terms of the variability of ecosystems, species and genes. Since biodiversity refers to the entire gamut of life forms, the relationship between plants and animal life as also with other living organisms is also covered under this definition.

Biodiversity has been an important aspect of human existence. "Perhaps the most important value of biodiversity, particularly in a country like India, is that it meets the basic survival needs of a vast number of people. Even today there are any number of traditional communities which depend, wholly or partially, on the surrounding natural resources for their daily needs of food shelter, clothing, household goods, medicines, fertilizers, entertainment etc." (*Biodiversity*, ed. Kiran B. Chhokar, World Resources Institute, USA & Centre for Environment Education, Ahmedabad, India, published OUP, Delhi, 1997, p.20). Among the other benefits of biodiversity, an important one that comes to our mind relates to the conservation of food chain. We know that each species in a food web is dependent on the other. The loss of any one species therefore, may unleash a chain reaction where many known and unknown life forms would vanish altogether. The importance of bio-diversity in maintaining a food chain in itself speaks a lot about it's potential. The two documented benefits of biodiversity are:

- Consumptive and productive uses – grains, vegetables, fruits, plants, medicines, timber, oils, forest products, milk products, eggs, the list of items on this account is endless;
- Non consumptive benefit where we have biodiversity's role in providing raw materials for biotechnology, regulation of water and other nutrient cycles, regulation of climatic conditions, carbon fixation etc.

The economic value of biodiversity is also of great benefit. "Each species is of potential value to humans. So are healthy ecosystems. The global collection of genes, species, habitats and ecosystems is a resource that provides for human needs now, and is essential for human survival in the future. Human depend on other species for all of their food and for many medicines and industrial products.

Up to 80 per cent of the people in developing countries depend on traditional medicine for primary health care, most of which is derived from plants and some from animal and mineral sources. About 20,000 species of plans are used for medicinal purposes in these countries. Nearly one-quarter of all prescription drugs used in the developed world are based on plants, including 21 indispensable mainstream drugs. These include aspirin from the plant *Filipendula ulmaria* and *Quinine* from the bark of several species of the *Cinchona* tree. In addition, plants contain complex chemical structures which may be possible to synthesize in a laboratory, and which might provide important clues for new medicines (ODA 1991). (See box "Indigenous Systems of Medicine".) Genetic diversity is important in breeding crops and livestock. The loss of crop species has severe implications for global food security. Crop breeders need a diversity of crop varieties in order to breed new varieties that resist evolving pests and diseases. Many crops have been "rescued" with genetic material from wild relatives or traditional varieties. Sugarcane in India, for example, was prone to the red rot disease which limited its commercial production. Resistance to the disease was acquired from the genes of the wild cane *Saccharum spontaneum* from Indonesia (CSE 1985). Genes from a wild rice from India resurrected rice cultivation in many parts of Asia in the early 1970s. Scientists at the International Rice Research Institute searched 6,723 samples for genes resistant to the widespread grassy stunt virus. They found it only in one – a single sample of *Oryza nivara* collected from eastern UP in 1963. The strain of rice evolved by using that sample is now widely grown all over South and South-east Asia (CSE 1985).

Biodiversity, therefore, represents a "living library of options for adapting to local and global change." (*Biodiversity, op. cit., pp.20-22)*

Perhaps the most important value of biodiversity is in its providing solutions to many problems of an unforeseen and an undesirable future.

Indigenous Systems of Medicine

Traditional medicine in India has relied heavily on the rich biodiversity of the region. Three traditional systems of medicine are widely prevalent in the country – Ayurveda, Siddha and Unani.

The Ayurvedic system subscribes to the view that there is no plant on the earth which is not a medicine. The story goes that Brahma ordered the sage Jivaka to find a tree or a herb which had no medicinal property. Jivaka wandered for eleven long years in search of such a plant but could not find one. When he returned and informed Brahma of his failure, much of his surprise Brahma recognised him as a great physician !

Ayurveda has given to the world the drug reserpine used a tranquilizer and for the treatment of hypertension, anxiety and schizophrenia. Reserpine is extracted from the forest shrub Rauvolfia serpentina.

(*Biodiversity*, *op. cit*. p. 21*)*

23.2 INDIA'S BIODIVERSITY

As we discuss India's biodiversity we become aware of the centrally of Indian situation in the rich biodiversity of the country. The prime reason for such a rich biodiversity has been the peculiarity of Indian landscape that we have discussed in detail in the opening Block. It is notable that a wide variety in physical features and climatic situations has resulted in a diversity of ecological habitats like forests, grasslands, wetlands, coastal and marine ecosystems and desert ecosystems. Various national and international agencies and conventions have acknowledged India's potential in terms of biodiversity. The two prominent features that emerge are:

- *VAVILOV CENTRE:* India is a Vavilov centre of high crop genetic diversity. This is so named after the Russian agro - botanist N.Y. Vavilov, who identified eight such centres around the world in 1951. He "classified the world's crop producing regions into eight centres of plant origin. Of these areas of crop genetic diversity, India was central to what he called the "Hindustan Centre of Origin". Vavilov's terminology for India was well justified, for this region has produced a significant share of the major crops used the world over. At least 166 species of crops (6.7 per cent of total crop species in the world) and 320 species of wild relatives of cultivated crop species are believed to have originated here".

- *MEGADIVERSITY:* India is one among the seventeen 'megadiversity' countries in the world, a concept which was introduced by R.A. Mittermier and T.B. Vernier. Megadiversity is a much less discussed subject than biodiversity. This term and another term 'Hot Spots' have recently been used by World Bank and other World bodies for species diversity and endemism in the World's selected few rich floral and faunal zones. "Just as the G-7 countries concentrate a major portion of the world's economic wealth, the 17 Megadiversity Countries have within their borders more than two thirds of our planet's biological wealth, its biodiversity," explains Conservation International's President Dr. Russell A. Mittermeier. The Megadiversity concept was created in an attempt to prioritise conservation efforts around the world. More than half of the world's forests have already disappeared, and more are destroyed each year. Thousands of species, most of them unknown to science, are being led to extinction. Filled with the beauty and variety of landscapes, plants, and animals from around the world, this video explains the Megadiversity approach and highlights the biologically remarkable countries. Megadiversity is not only a concept, it is a call for action to ensure the survival of all forms of life on earth. Two spots identified as 'Megadiversity' and 'Hot Spots' in India are North-eastern Himalayas and Western Ghat. But India as a whole has been marked a megadiversity area. Indians are not yet very much conscious and concerned about biodiversity loss and degradation of entire ecosystem. As the conservation need is urgent in the face of depletion India needs a well designed strategy to protect these resources.

The distribution of biodiversity in India is also important. India, which occupies just two percent (2.4%) of the total landmass of the world, harbors a rich biodiversity comprising about 8% of the known biodiversity of the world. For our purposes, a broader picture of bio-diversity distribution will emerge if we divide the distribution in quantitative and geographical terms.

A glance at some of the numerical estimates of the familiar categories of living organisms would gives us some idea of our biodiversity wealth.

India has :

- 81,000 species of animals, which includes 50,000 species of insects and 12,000 species of birds; it also has
- 45000 species of various other categories of plants that include 15,000 species of flowering plants.

It has to be borne in mind that these figure are based on survey of about 70% of the geographical area of the country the results of which have been recorded. A vast area yet needs to be surveyed and documented. Further, within these species and the figures that we have just mentioned, there are several sub-species which in turn may have countless varieties.

The biodiversity that our country has is widely distributed through its length and breadth. Various attempts have been made to classify them in terms of geographical areas. The most accepted and followed classification is the one developed at Wildlife Institute of India by Rodgers and Panwar (1988). It divides India into 10 bio-geographic regions/zones. These zones reflect major species groupings. In addition, they have a distinct set of physical, climatic and historical conditions. The ten zones are:

1. Trans Himalayan
2. Himalayan
3. Indian desert
4. Semi arid
5. Western Ghats
6. Deccan Peninsula
7. Gangetic Plain
8. North-East India
9. Islands
10. Coasts.

23.3 BIODIVERSITY DEPLETION & CONSERVATION

In spite of the established benefits of biodiversity, we are faced today with a problem of accelerated depletion of life forms. The main factors of this depletion have been human interventions and habitat destruction, over exploitation for commercial reasons, accidental or deliberate introduction of exotic species, loss of gene flow, outbreak of diseases, increasing pollution (air, water and land), climatic and environmental changes etc. This is in addition to the natural rates of extinction of life forms. The end result has been extinction of many species altogether while still others are threatened. It needs to be pointed out that many species may have been lost without being documented. Another alarming aspect of this problem is that even if all human activities were to cease immediately, species extinction due to impacts that have already taken place would continue for decades. Some instances of biodiversity loss in India, are:

- Many animals have become extinct like cheetah, pink-headed duck while many more are extremely threatened and endangered;

- Among plants, out of 15000-16000 species of flowering plants about 10% have already come under various categories of threatened plants. According to an estimate, out of the 427 endangered species published in the Red Data Books of India, 28 species are supposed to be extinct, 24 endangered, 81 vulnerable 160 are rare while 34 have been insufficiently seen;

- By 1986, India had only 6,15,095 sq. km. of wildlife habitat. Of its original 30,17,009 sq. km wildlife habitat it amounts to a loss of about 80%;

- As discussed above, the study of 'hotspots' shows that out of 18 regions or 'hotspots' that are characterised by high conservation of endemic species and are experiencing unusually rapid rates of habitat modification, two are in India. They are Eastern Himalayas and the Western Ghats;

- The adverse effects of a biotic (devoid of life) pressures on fisheries is very noticeable in the Damodar and Hoogly rivers in West Bengal, Choliyar river near Calicut and Kalu river near Kalyan, Bombay. Abiotic pressures are also responsible for the silting of the Dal lake in Srinagar (Jammu and Kashmir) and the Naini lake in Nainital (U.P.).

The demonstrated and potential benefits of biodiversity make it an imperative to take corrective measures. Conservation efforts are particularly necessary in the wake of loss of life forms on a daily basis. In India, conservation practice based on local knowledge systems and community efforts date back to several centuries. In the modern period scientific agencies have mapped various life forms and prepared a taxonomic database. The Botanical Survey of India, (established in 1980), the Zoological Survey of India (1961), and the National Institute of Oceanography together with various organisations and universities are involved in survey and documentation of life forms. What is needed is a comprehensive strategy to conserve the languishing biodiversity. This can be done in two ways; **Ex-situ conservation** – off site conservation, and **In- situ conservation** – on site conservation.

Ex-situ conservation: refers to conservation of life forms in areas outside their natural habitat. Such a situation may arise when populations of a threatened species become so fragile that its survival may not be possible in the wild, or for reasons of distance, logistics or legality, its conservation in natural habitat is not possible. Ex-situ conservation can be done in different ways :

a) By establishing zoological parks and botanical gardens;

b) Through research centres, aquaria and similar institutions; and

c) By applying in-vitro storage techniques for the conservation of plant biodiversity field gene banks and seed banks;

d) In case the concerned species shows signs of recovery and propagation at the ex-situ sites, they can be re-introduced in the wilds.

In–situ conservation applies to conservation of the threatened species in their natural habitats. In situ conservation can be carried out in the following areas:

- National Parks and Sanctuaries;
- Reserved and Protected Forests;
- Biosphere Reserves;
- Nature Reserves.

The Government of India has taken a variety of steps to ensure biodiversity conservation. While some of them are directly and specifically targeted at conservation of life forms, other play an incidental role in rehabilitation and propagation of different species and ecosystems. These measures may be listed thus:

a) Around 4.2% of the total geographical area of the country has been earmarked for Protected Areas, National Parks and Sanctuaries. India has 85 National Parks and 498 wildlife sanctuaries.

b) Various projects like Project Hangul, Tigers, Lion, Brow-Antlered Deer, Elephant, Crocodile etc. have been launched in protected areas for conservation of threatened species.

c) To conserve representative ecosystems, ten ‘Biosphere Reserves’ have been formed. These reserves also serve as laboratories for evolving alternative models of development.

d) Various programmes and action plans have been launched for scientific management of fragile ecosystems like Wetlands, Mangroves, Coral Reefs, deserts and other areas.

e) In pursuance of ex-situ conservation, the government has set up several zoological and botanical gardens. There are about 70 Botanic Gardens including 33 university Botanic Gardens. There are also around 275 centres of ex-situ wildlife preservation in the form of zoos, deer parks, safari parks, aquaria etc. A Central Zoo Authority has also been formed.

f) Several legislations like Wildlife Protection Act, Forest Acts, Environment Protection Act etc. have been enacted to protect and propagate life forms. A list of such acts is being given in the Appendix. A Biodiversity Bill is already under consideration in the Parliament.

g) Conservation or Biological Diversity (CBD) – India is also a signatory to the International Convention on Biodiversity (CBD) held in 1992. Pursuant to ratification of CBD on 18 February 1994 several steps have been taken. A National Action Plan on biodiversity is under finalization; an Inter-ministerial Task Force on Bio-safety was constituted, and steps to build up a Biodiversity Information Network have been initiated. In addition, consultations with state governments, NGO’s, grass root institutions, experts and lawyers are also being undertaken to evolve a viable methodology for protection of our biodiversity.

The government efforts have to be matched by efforts of the people as a whole. Besides, the government programmes have to be more targeted and focused. Some suggestions are:

- For in-situ conservation, sufficient bio-reserves, bio-parks etc. have to be set up in different agro-ecological and bio-climate regions.
- For ex-situ conservations, there is a need to build more resource centres, conservation parks and germ plasma banks of various kinds.
- There has to be a massive awareness generation and mass mobilisation programme focussing upon the importance of biological wealth. Biodiversity conservation has to be a national effort.
- Research activities pertaining to biodiversity should be given greater attention and survey of hitherto inaccessible areas like the Himalayas, Andaman and Nicobar Islands and Exclusive Economic Zone should be carried out.
- Strict enforcement of rules and regulations particularly in biologically degraded areas are needed.
- Preparing a comprehensive database in the form of a Biodiveristy Register is also very important.
- Involvement of tribals, rural communities NGO's and other grass root institutions in species management plans is of great help. Traditional wisdom and community efforts at preservation of biodivesity are now increasingly being applauded. The need is to involve them in a comprehensive way. Some experts have also floated the concept of People's Biodiversity Register (PBR).

23.4 PEOPLE'S INITIATIVES

There are ample examples where people, rural communities, tribals, village folk in association with academician, NGO's researchers and in some cases with government officials have shown remarkable enterprise in management of life-forms. Let us have a look at some of the examples.

1) The Bishnoi community spread over Barmer, Jodhpur and Jaisalmer district of Rajasthan have been successfully preserving the Khejri trees, the pea-fowl and certain mammals like the chinkara, nilgai and the black buck. They are enjoined by their religious traditions to preserve nature.

2) There are many examples of women involvement in biodiversity preservation from Himachal Pradesh. Women organized into *Mahila Mandals* have successfully protected patches of forest all over Karsog in Mandi district. Similarly Mahila Mandals are protecting forests in Chular valley of Mandi from timber smugglers and sometimes from their own men.

3) The Nature Conservation Society (NCS) formed in 1976 by a group of college and university teachers and forest department officials have been successfully involved in research promotion, awareness generation and biological documentation in Palamau Tiger Reserve in Bihar.

4) *Navdanya* is a grossroots people's movement for in-situ conservation of genetic resources linked to agricultural crop diversity in the Garhwal- Deccan region.

These are very few examples, to demonstrate people's ability is conserving our biological wealth. The need in to emulate and prorogate such efforts in other parts of the country.

23.5 SUMMARY

Biodiversity depletion is fast assuming alarming proportions in India. In spite of the efforts of the governmental biodiversity conservation programme has not become a success in India. The need therefore is to make our approach much more broad based and involve people's in this important exercise.

23.6 EXERCISES

1) What do you understand by Biodiversity?

2) What is meant by ex-situ and in-situ conservation? Describe.

3) Examine of the importance of biodiversity.

23.7 SUGGESTED READING

A. Kothari, *Conserving Life: Implications of the Biodiversity Convention for India*, Second edition, Kalpavriksh, New Delhi, 1995.

V. Shiva (ed.), *Biodiversity: Social and Ecological Perspectives*. Natraj Publishers, Dehra Dun, in association with World Rainforest Movement, Penang.

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UNIT 24 ENVIRONMENTAL RESOURCES AND PATENTS

Structure

24.0 INTRODUCTION

For centuries colonial and neo-colonial powers have freely taken resources and knowledge from the erstwhile-colonised world. Colonial powers extracted environmental resources and indigenous knowledge from the societies of the South and through working on such material, developed new biological forms. They also enforced a system with the help of which benefits from such materials and products were prevented from percolating down to the South. This was done by invoking the protective walls of patents, known appropriately as Intellectual Property Rights (IPR). The patents or IPRs were the instruments that were used to make the exploitation of the environmental resources from underdeveloped or developing regions of the world a one way process. The benefits emanating from this exploitation were barred from reaching the under-developed/developing world. Environmental resources and patents thus came to signify a hegemonic relationship in which the true beneficiary was the developed world and the ultimate sufferer was the underdeveloped world.

This unit concerns itself with the troubled relationship between environmental resources and the patent regime. It is important to note that after a long hiatus the South has finally awakened to this discrimination and is now demanding a share in what rightfully belongs to it. Convention of Biodiversity 1992 is one such instrument through which the underdeveloped/developing world expects to correct this disparity. Unfortunately, little more than a year after the CBD was adopted the developed world had propelled a new and stringent IPR regime threatening to subvert the goals laid down in the CBD. The new regime has been named the Trade Related Aspects of Intellectual Property Rights or TRIPS. This name belies the actual content of this regime which encompasses all kinds of IPR and often hardly has anything to do with trade. We thus have two main international instruments that represent the two main doctrines governing the issue of environmental resources and patents.

Interestingly the two legally binding international agreements are inconsistent and even contradict each other on three major levels namely- i) Objectives, ii) Principles laid down to justify the objectives, and iii) Legal obligations resulting from them. This is likely to have serious national and international ramifications in not too distant a future. The broad background of the debate concerning environmental resources and patents is provided by the above. We propose to discuss in this Unit, the details of this debate and the nature of international instruments central to the issue and their long term impacts.

24.1 CONVENTION OF BIODIVERSITY

Biodiversity (biological diversity) is the word used to describe all living organisms their genetic make up and the communities they form. Global theory views the planet earth as an integrated and interdependent ecosystem. Concerns have been growing amongst scientists, policy makers and public at the accelerating loss of biodiversity resulting from human impact. (Cf., Suzzane Biggs, 'The Biodiversity Convention And Global Sustained Development' in Keily and Marfleet, *Globalisation and the Third World*, London, Routledge,1998 p.116). International efforts at conserving life forms are not new. " There are over 150 bilateral, multilateral and global treaties on environment." [Register of environment treaties and other agreements in the field of environment, UNEP, Nairobi, May 1991 (Document No UNEP/GC 16/INF 4) cited at Ashish Kothari, 'Politics of Biodiversity Convention', *Economic and Political Weekly*, April 11-18, 1992 p 749]. Many of these deal with various aspects and parts of biodiversity, starting with convention relating to Fauna and Flora in their Natural State, 1933. But most of these were specific and sectoral in nature, and there was a need for a comprehensive treaty. The Convention on Biological Diversity, 1992 (CBD) is a legally binding commitment to stop this destruction and secure the conservation and sustainable use of biological diversity. CBD is a result of prolonged international pressure to respond to the destruction of, and unequal profits derived by the colonial powers from, the biodiversity of the South. After years of debate, the Convention was agreed upon in 1992 at Rio de Janeiro and came into force in 1993.

As felt by many, bio-diversity conservation is today as much political an issue as any other. The core debate is woven around the contentious issue of transfer of biotechnology from North to South on one hand and bio-resources (genetic resources) from South to North on the other. As alleged by the developing world the IPR regimes like TRIPS hamper the former, by laying down strict IPR measures, and encourage the latter by not checking bio-piracy.

Vandana Shiva, a noted activist, has explained contradictions of the crisis at hand in a precise manner thus:, " While the crisis of biodiversity is focused as an exclusively tropical and third world phenomenon, the thinking and planning of biodiversity conservation is projected as a monopoly of institutes and agencies based in and controlled by the industrial world" (*Biodiversity, Social And Economic Perspectives*, London, p.6).

Both developed and developing nations (more than 150 states) discussed these divisive issues in (Rio de Janeiro in, 1992, and agreed on a convention which recognised the wide ranging implications of biodiversity use and conservation and its 'ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values'. The CBD opened up new prospects for developing countries in dealing with their resources and it affirmed the sovereign right of nation-states to their own biological resources. The CBD comprises of 31 articles. The first few articles deal with general principles, definitions and objectives and the last few deal with formal details (e.g. structural details of the conference of parties, the secretariat etc), and implementation details. The substantial parts (articles 5 to 17), deal with various aspects of biodiversity such as identification and monitoring, conservation in natural or human modified surroundings, rational or sustainable use, creation of awareness, impact assessment of activities likely to effect biodiversity, access to genetic material, safeguarding of relevant traditional knowledge and practices and exchanges of information and technology between the countries. But unfortunately the convention remains a weak instrument; it instructs the states to bring about certain changes in their laws and in functioning to achieve the Convention's objectives but neither lays down a specific time frame (like TRIPS does) nor provides a method to do this. It is vague on many important issues and ineffective in implementation which is its biggest drawback. We discuss below some of the specific provisions that relate to environmental resources.

Article 3, of the Convention of Biodiversity says: "states have, in accordance with the Charter of the United Nations and the Principles of International Law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause (harm to) the environment of other states or of areas beyond the limits of national jurisdiction".

This is considered to be the most important article of CBD, which rejects the 'common resources' and 'common heritage' argument put forward by the developed world. By using this common heritage argument the former colonial powers have exploited the resources of the colonies for centuries without sharing the benefits. No wonder then that in the negotiations for the convention, countries of the South fought for the deletion of the term 'common heritage'. They instead pressed for and got accepted the principle of national sovereignty over biological resources. (Cf., Ashish Kothari, 'Politics of Biodiversity Convention', *Economic and Political Weekly* April 11-18, 1992, p.751.)

Another Article 8(j) of the Convention of Biodiversity reads: "Subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote there wider applications with the approval and involvement of the holders of such knowledge, innovation and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovation and practices".

This Article again stresses that use or exploitation of biological resources including traditional knowledge must give rise to equitable shared benefits. Secondly it also lays emphasis on preserving practices, which is very important for continuation of related lifestyles. Although these formulations are weakly and unclearly worded, they could work for the advantages of developing nations and traditional communities given adequate pressure for strengthening them.

These are some of the Articles, which are central to the subject under discussion here and may also find mention in the ensuing sections. Apart from these, Article 16(2) says: "Access to and transfer of technology to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed and where necessary, in accordance with the financial mechanism established by Articles 20 and 21". Similarly Article 16(5) of the CBD also enshrines principles aimed at resolving potential conflicts.

24.2 TRADE RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (TRIPS)

In 1993 the World Trade Organisation (WTO) gave a package of agreements in which there was one agreement that was called the agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs). The TRIPs agreement sets the minimum standards for patents and other intellectual property rights (IPRs). These standards are applicable on the member countries of the WTO (presently being 148 in number).

The agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) is the most expansive multilateral agreement on intellectual property to date. The agreement not only aims at protecting intellectual property and rewarding creativity and inventiveness but also makes knowledge a saleable market commodity. Therefore, by implication the environmental resources, especially plants and animals get converted form public assets to private goods. The genesis of this agreement is traceable to the perception of a number of industrialised countries that inadequate patent protection had eroded their advantage in higher technology areas. The TRIPS agreement was pushed through by the developed countries, who were its primary benefactors. The developing countries on the other hand did not give willing consent to TRIPs and relented only on certain conditions.

It is believed that the arm-twisting done by US by imposing many stringent bilateral IPR agreements on a number of nations prior to TRIPS was the real reason for developing countries to agree to TRIPs. It was felt by many nations that a uniform global regime was better than bilateral agreements of the kind US has entered into. TRIPS consist of seven parts namely- Copyrights, Trademarks, Geographical indicators, Industrial designs, Patent, Integrated Circuits and Undisclosed Information. The agreement sets out the minimum protection that must be given for each category of IPR in the domestic laws of each of the WTO members. Each of the major elements to be protected, i.e. subject matter to be protected, the rights to be conferred and permissible exceptions to these rights, have been clearly defined. The emphasis is on the implementation of the clauses of the agreement. The specific features of TRIPs that deal with environmental resources have been discussed below.

The provision of patent protection in TRIPs is given under Article 27. This requires the patents to be granted in all fields of technology for the process and products simultaneously. Thus biological processes and their products both come under the control of a patent regime. There has, however, been one exception made in this patent regime.

Article 27(3)b says that members may exclude from patentability plants and animals other than micro-organisms and essential biological processes for the production of plants and animals other than non-biological and micro-biological processes. However, the members shall provide for the protection of plant varieties either by patents or by an effective *sui-generis* system or by any combination thereof. This provision shall be reviewed four years after the date of entry. This is the most controversial Article in TRIPS related to environmental issues. This Article currently requires all member states to provide protection for intellectual property, either through patents or an ‘effective *sui generis* system’ or both for plant varieties. No effective definition is given, yet developing countries must put such systems in place if they choose this as an alternative to patenting and if they wish to avoid punitive trade sanctions.

Most developing countries have already taken or are planning to take the *sui-generis* route to compliance, instead of patenting. A number of influential bodies, including the WTO itself, are pushing for a narrowing of *sui-generis* option to one legislative model provided by Union for the Protection of Plant Varieties or UPOV (1978 & 1991). This is unfair and uncalled for. UPOV is not mentioned in the TRIPs agreement whereas the other relevant IPR treaties are. Independent legal and economic experts have reiterated in many fora and publications that UPOV’s offering should not be swallowed as an effective *sui generis* system and that there is ample scope for manoeuvre, flexibility and national discretion in interpreting the *sui-generis* option.(Cf., Biodiversity on TRIPS at http://www.grain.org/publications/issue1-en.cfm). *Sui generis* protection gives members more flexibility to adapt to particular circumstances arising from the technical characteristics of inventions in the field of plant varieties such as novelty. *Sui generis* effectively means a self-generated system that is specifically designed to protect specific plant varieties. (Cf., Jayant Bagchi, *World Trade Organization*, Eastern Law House, Calcutta 2000, p. 58).

Another provision that deals with environment related issues is Article 27.2. As stated by Jayashree Watal "TRIPs does deal with the ethical, moral aspects of biotechnology (and other technologies) or biosafety by allowing under Article 27.2 patent exclusions of inventions 'the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment'. Thus while such exclusions can be made, the caveat that the prohibitions of commercial exploitation was necessary would apply. This also means that countries that choose to exercise this option would then forego the benefits of the new innovations: ('Intellectual property and biotechnology: trade interests of developing countries' in *International Journal of Biotechnology*, Vol.2, Nos. 1/2/3, 2000, pp.45-46).

Several studies have shown that all bio-technological innovations in the field of agriculture or medicine are based on or developed from bio-resources. Traditional knowledge resources in developing countries are being stolen without any compensation or even acknowledgement. According to certain analysts since micro-organisms are living organisms, their patenting could be the slippery route that could lead to patenting of all life forms. (Cf., Arun Goyal and Noor Mohd, *WTO In The New Millennium*, Delhi, 2001).

24.3 CONTRADICTIONS AND CONFLICTS

The TRIPS agreement seems to further the hypothesis that only the intellectual contributions of the corporate-sponsored scientists need intellectual property protection and compensation. It pays no attention to the fact that there has been an uncompensated free flow of resources and knowledge from the developing countries to the first world especially when knowledge and biological resources are inalienable for most communities living in the third world countries. (Cf., Dr. Vandana Shiva, "Farmers Rights, Biodiversity and International Treaties", *Economic and Political Weekly*, April 3, 1993). Convention of Biodiversity recognizes this fact and provides protection to these biological resources and knowledge and prevents their exploitation. This difference in approaches and focus of the two agreements gives rise to a host of contradictions. The two legally binding international agreements are inconsistent and even contradict each other as said earlier on three major levels namely,- i) Objectives, ii) Principles, and iii) Legal Obligations. We comment on each in the following paragraphs.

CBD and TRIPS: Conflicting Objectives

CBD strengthens the capacities of the developing countries' to conserve and use biological diversity on a long-term basis, taking into account all their rights over those resources including the right to enjoy the benefits of their resource base. However, due of unequal distribution of capital resources and technological prowess between countries rich in biological diversity and those that have well developed economic and legal structures, the South has been consistently exploited. The CBD is designed with the intentions of remedying this anomaly. Thus its unstated objective is also to provide a platform to South from where it can enter the area of environmental resource management on equal footing with North. Those specific steps that have been undertaken in CBD to meet this objective may be described as below:

- Empowering the South to regulate access to its bio-diversity;
- Conditioning access to South's biodiversity by requiring prior informed consent and sharing of benefits;
- Providing for transfer of technology from North to South. [As expressed through Article 16(2)]; and
- Recognising the collective rights of local communities in developing countries who are the source of biodiversity and traditional knowledge and whose role in conservation is now universally acknowledged as of fundamental nature. (Gaia/Grain, 'TRIPS versus CBD, Conflicts between the WTO regime of intellectual property rights and sustainable biodiversity management', *Global Trade and Biodiversity in Conflict* Issue no. 1, April 1998).

The objective of TRIPS is to make available proprietary claims and rights over products and processes. These products/processes may be related with biodiversity or not. The proprietary rights ensured in TRIPS have to benefit the trading and the corporate world and have been so framed as provisions of the TRIPS that they become applicable globally. The legal safeguard intended in TRIPS are likely to guarantee monopoly of the products and processes to the people and groups who establish inventions of new plants and micro-organisms etc. and/or processes related with them.

As stated by Grain, "All member states of CBD and TRIPS agreements face an inescapable problem. Both treaties are legally binding for signatories, but their obligations pull countries in completely different directions. It is likely that a country, which in all good faith seeks to implement community rights, and does so within the CBD framework, could find itself in serious contravention of the TRIPS Agreement" (*Global Trade and Biodiversity in Conflict Issue no. 1, April 1998*). For example Article 16(5) requires states to ensure that such rights (intellectual property) are supportive of and do not run counter to its objectives. Hence if states try to introduce provisions such as fair and equitable transfer they might impede their obligations under TRIPS in pursuance of which they have to incorporate the internationally accepted IPR standards in their domestic laws.

Sovereignty Principle

The provisions of CBD allow different nations to exercise absolute national, sovereign rights over their biological resources. On the contrary TRIPS would subject biological resources to private proprietary control. Obviously there develop contradictions between national sovereign rights and private proprietary controls. It would also imply that countries posses the right to prohibit IPR applicability on life forms. TRIPS, on the other hand would prefer to overlook this sovereign right and would like the provision of IPR on micro-organisms, non-biological and microbiological process, as well as patents and/or *sui generis* protection of plant varieties be made applicable.

Biological Resources and Traditional Knowledge

CBD holds that the use or exploitation of biological resources and traditional indigenous or community knowledge must give rise to equitably shared benefits. But TRIPS contradicts this by laying down that patents must be provided for all fields of technology, therefore the use or exploitation of biological resources must be protected by IPR. (Cf. Ashish Kothari, ‘Politics of Biopiracy’, *Economic and Political Weekly* April 11-18, 1992 p.751). There is no mechanism for sharing benefits between a patent holder in one country and the donor of material in another country from which the invention is derived. Simply put, CBD gives developing countries a legal basis to demand a share in benefits. TRIPS negate this legal authority (Cf. Gaia/Grain, op. cit.).

Access to Biological and Genetic Resources and Bio-piracy

Under CBD, access to bio resources requires the prior informed consent of the country of origin. It also requires the ‘approval and involvement’ of local communities. But under TRIPS regime there is no provision requiring prior informed consent for access to biological resources, which may subsequently be protected by IPR. Principle of prior informed consent is expected to diminish the incidence of bio-piracy, although doubts have been raised over its implementation. TRIPS would ignore this authority and thus promote bio-piracy. (Cf. Dan Leskien, “Bio-piracy-Ten Years Post Rio”, South-South Bio-piracy Summit Hosted by Bio-watch South Africa, 22-23 August 2002; Johannesburg, South Africa).

Public Interest Vs Private Property

The principles laid down in CBD imply that states should promote the conservation and sustainable use of biodiversity as a common concern of human kind taking into account all rights over biological resources. TRIPS has certain token provisions to protect public health and morality but in actual working the safeguarding of public health, nutrition and public interest in general have been subjected to the private interests of IPR holders. Hence both the agreements differ in emphasis; former lays emphasis on general and community interest whereas the latter strengthens private property and vested interests. In other words the agenda of TRIPS is to privatize, not protect biodiversity (Cf. Gaia/Grain, op. cit.).

Transfer of Technology and Benefits

The Convention of Biodiversity through Articles 16 to 19 promotes and instructs the member states to felicitate transfer of technology including biotechnology, living organisms and information and distribution of benefits arising thereof. Article 16(5) of CBD clearly lays down that states should ensure that intellectual property rights are supportive of and do not run counter to such objectives. But TRIPS through Articles 26 and 27 [specially 27(3)] seeks to bring even living and biological material under the patent or *sui generis* regime. It hampers the easy and smooth transfer of technology and benefits through sterner IPR instruments. IPRs by nature are exclusive in character i.e. they prevent the use of the object or process by anybody else. If the respective state fails to act under TRIPS, it can be compelled to do it through the Dispute Settlement Mechanism. Hence we see that CBD facilitates transfer of technology whereas TRIPS may hamper this.

24.4 DEVELOPMENTS IN INDIA

In this section we shall discuss the two statutes which have been enacted in India due to obligations under TRIPS and CBD. These two acts shall illustrate how India is coping with contradictory obligations under the two instruments and how far has its approach been successful.

Biodiversity Act, 2002

This Act aims at promoting the conservation and sustainable use of biological resources and the equitable sharing of the benefits arising out of such resources. *The Act provides for the establishment of the National Biodiversity Authority at the Central level, State Biodiversity Boards at the State level and Biodiversity Management Committees at the level of the local self-government in India.*

The CBD stresses on the sovereign rights of the states over its bio-resources and recognises the rights of the communities over the biodiversity related knowledge systems. *Both these principles have not been adequately reiterated in the Act.* Unlike foreign nationals, the citizens and corporations in India are permitted to use country’s bio-resources and the traditional knowledge thereof by just taking the permission from the State Biodiversity Boards. This may lead to collusion between Indian Corporations/Citizens and foreign multinational Corporations.

The exclusive jurisdiction to decide access to genetic resources and traditional knowledge rests with the National Biodiversity Authority. It has been criticised on the ground that the authority is neither autonomous nor independent nor democratic.

Although the Act, through Section 3(1), expressly prohibits the obtaining of any biological resources occurring in India or knowledge associated thereto, value added products have been excluded from this Section. This enables not only Indian industries but also foreign corporations to manufacture and sell many plant-based products, for example *Ayurvedi*c medicines, without the permission of the National Biodiversity Authority.

Evidently the Act in it-self is a welcome development but since it suffers from certain basic flaws it would require major restructuring if it were to achieve its objective.

The Protection of Plant Varieties and Farmers Rights Act, 2001

The mandate of the TRIPS Agreement in Article 27(3) b resulted in the passing of this Act. This Act protects genera and species of plant both extant varieties and farmers varieties notified by the Central Government. The criterion of granting protection has been deemed to be novelty, distinctiveness, uniformity and stability. The Act also gives the Central Government power to exclude any genera or species from protection on the ground of public interest. As the Act does not define 'Public Interest' it is opined that this provision gives enormous and unabridged powers to the Government. Again in the case of 'benefit sharing' as required under the CBD, this Act provides that this can happen only if the Central Government notifies this. Considering the level of education and pervasive ignorance, it is highly unlikely that Indian farmers would stake their claim in this regard and avail of this provision.

On the whole it seems to be a half-hearted and piecemeal measure to somehow wriggle out of an international obligation. The *sui generis* regime seems to be weak and impaired by implementation problems. The intention seems to be to fulfill India's obligation without causing any major difference in the ground situation. Although many have criticised this approach we find that this (Act is vague and on the whole vests large powers with the Central Government. Government can, by using the public interest clause, protect many living species and knowledge form being patented which can be an effective method to bypass some of the ill effects of TRIPS and prevent any conflict with principles of CBD.

24.5 CASE STUDIES

In Section 24.3 we have discussed how TRIPS and CBD are contradictory at the level of principles. Here we give a few case studies to show how these instruments are not only contradictory at a theoretical level but even at a practical level they work in conflicting ways.

Neem

Neem (*azadirachta indica*) tree grows widely in India. From a very early time in history the medicinal and curative properties of Neem have been known to Indians. The parts of this tree have also been, similarly used for the purposes of pesticide and also sometimes as fertilizer. Numerous *neem* products have received patents. Several of these have been granted to Indian companies for a range of products (for example one to Godrej Soaps in 1994). However, the patents which are at the center of a controversy are the ones granted to US company W.R.Grace for extraction and storage processes. Following are the details:

Storage stability- A US patent was granted in 1990 for improving the storage stability of *neem* seed extracts containing *azadarachtin* (a substance obtained from *neem*).

Stable insecticidal composition- In 1994 a US patent was granted for storage of stable insecticidal composition comprising *neem* seed extracts. The main part related to a lasting shelf life of the *azaderachtin* composition.

Oil-extraction- In 1995 the European Patent Office granted a joint Patent to US Department of Agriculture and W.R.Grace for a process to extract oil from the *neem* tree.

The W.R.Grace patents have resulted into a situation of conflict. The Government of India filed a complaint to the US Patent Office accusing the multinational for copying the Indian invention (Cf. Peter Gallaghar, *Guide to the WTO Developing Countries*, Hague, 2000, p.297). However in the end, the government withdrew its complaint with regard to the first two patents (first two given above).

In the third case it was a major victory for India. The European Patent Office (EPO) has withdrawn the joint patent granted to W.R.Grace and the U.S. Department of Agriculture. The four-member panel of the EPO upheld the objections by three Indian parties, on the ground of 'lack of novelty' and stated that it amounted to **biopiracy**. It was found that a manufacturer from Delhi, Abhay Pathak who was in the *neem* business for 25 years, had developed a process in 1985, which had astonishing similarities to W.R.Grace. It was also revealed that the controversial patent was one of the 21 *neem* patents granted by EPO since 1989. (Cf. Jayant Bagchi, *World Trade Organization*, Calcutta, 2000 pp 65-66).

This case exhibits how traditional community knowledge is being exploited by multinationals. Medicinal and other qualities of *neem* have been a part of common knowledge and age-old tradition in India. Indian farmers have used *neem* as pesticide since ages. This knowledge is hijacked by the multinationals and used as the basis for further research without any remuneration or even recognition to the indigenous communities (in this case farmers). Pesticides made through such means would then be sold to farmers of the South at inflated prices. Farmers have through trial and error method developed these products over centuries. It must be reminded that a large number of patents are still valid under the IPR regimes and only a few have been cancelled. Such patents are recognised as valid and enforceable under TRIPS and these run counter to the provisions of the CBD.

Phyllanthus Niruri

Western allopathic systems have no medical cure for jaundice or viral hepatitis. Indian systems of medicine- *Ayurvada*, *Unani* and *Siddha* – and folk traditions have various plants for the treatment of jaundice. *Phyllanthus niruri* is one such medicinal plant used widely in India. It is a part of Ayurvedic system as well as of local and community traditions. The plant is called *Bhudharti* in Sanskrit, *Jar Amla* in Hindi and *Bhuin Amla* in Bengali. (Cf. Mira and Vandana Shiva, *Patents of Phyllanthus Niruri: The plant for Indigenous Medical Cure for Jaundice New Delhi 1995).* The Fox Chase Cancer Centre of Philadelphia, US has applied for a patent of this plant to the European Patent Office for its use in curing hepatitis. The patent claim is for the manufacture of a medicament for treating viral hepatitis B.

This is a clear case of biopiracy. TRIPS provide no check to prevent this. The patent, if granted, would be valid under TRIPS. CBD requires prior informed consent and equitable benefit sharing. Both these principles have been violated in the above case. One can very clearly see that even in their working the two agreements are divergent. It is also evident that under the present patent regime environmental resources are always prone to exploitation.

24.6 AN OVERVIEW

Environmental resources and patents is a modern concern which can only be ignored at the peril of losing precious biological resources and the associated benefits to multi-national corporations and other big players active in the field of 'bio-piracy'. The two major international agreements, related with the subject of environmental resources, and in operation today are CBD and TRIPS. There are, however, contradictions between the two and the debate on contradictions and conflicts between TRIPS and CBD is not new and has been going on for a number of years. It is not an issue of domestic debate anymore as it has become a subject of international consideration. Many countries are trying to address the conflicts between the two through international channels to devise a solution. Here it would be beneficial to briefly refer to the international deliberations on this issue.

On the question whether or not there is a conflict between the TRIPS agreement and the CBD there are primarily three views and as expected developed and developing states have taken counter positions:

- That there is an inherent conflict between the two instruments is a position taken by India, Kenya, African group and Zambia. (Cf. '*The Relationship Between The TRIPS Agreement And The Convention of Biodiversity*',. Note by The Secretariat WTO, *Journal of Biotechnology No.2, Vol.58A*, 18 June 2002 p2);
- That there is no conflict between the two instruments is a position taken by EC, US, and Japan (*ibid*);
- That there is no inherent conflict but there could be a potential for conflict at the level of implementation is a position advocated by Australia, Czech Republic and Norway (*ibid*).

Similarly there are also different opinions with regard to the solutions. Proponents of the first view hold that Article 27.(3) b. of the TRIPS agreement should be amended so as to oblige all members to make life forms and parts thereof non-patentable. Further there has been a suggestion that patents inconsistent with Article 15 of the CBD may not be granted and such an obligation be incorporated into TRIPS agreement. To support the second view it is stated that governments can implement the two in a mutually supportive way through national legislations. It is further stated that there is no need for amending any of the instruments. With regard to the third view it is stated that solution or remedy lies in finding how TRIPS can be implemented in a way supportive of the CBD (*ibid* pp 3-4).

On the question of the inconsistencies between TRIPS agreement and principles such as prior informed consent and benefit sharing once again developed and developing nations find themselves in opposite camps. India, Brazil, Pakistan and Kenya suggest that in all WTO member states, patent applications should include the following:

a) Source of any genetic material used;

b) Any related traditional knowledge used in the invention;

c) Evidence of prior informed consent from the country of origin; and

d) Evidence of fair and equitable benefit sharing (Cf. WTO Note, *op.cit.*, p.6).

These suggestions have been strongly contested by the EC and the US. They suggest that these principles shall be implemented by voluntary contracts between the authority competent to grant access to genetic resources and traditional knowledge and those wishing to use such material or knowledge. Here it is submitted that, in the light of biopiracy and problems of jurisdiction, it is highly unlikely that any company or individual would ever voluntarily disclose the source of the genetic material especially when it would lead to additional costs for the seeker and no complementary benefit. The view taken by the developing nations seems to be sound as only a mandatory requirement at the time of seeking patents can be effectively implemented.

Hence we see that consensus on this issue would be very difficult. Considering the deeply entrenched and hostile positions of the developing and the developed world, a viable and practical solution that may be accepted by all the parties is near impossible. Any proposal of giving primacy to one instrument over the other would seem to be highly ambitious and impractical in the present international set up.

By way of conclusion we may suggest below certain long-term approaches which may be taken up by the international community. These have been deliberately termed long term as short-term solutions seem highly unlikely:

- It is now a well recognised fact that bio-piracy is an issue of international significance. Bio-piracy should therefore be addressed by the international community as an issue of immediate attention at all levels- local, national and international. One way of dealing with the matter is to give bio-piracy importance under TRIPS; alternatively a dispute resolution mechanism of the WTO should be created under CBD.

- The other area of importance is that related with traditional knowledge and its protection. New systems for the protection of traditional and local knowledge should be devised. These systems should also be adequately equipped with necessary legal and legislative provisions. Traditional knowledge can be best protected and preserved by recognising it as area of essential merit vis-a-vis innovations. Also, it is necessary to recognise local communities for their innovative work as joint investors, joint breeders, joint authors etc. This might lead to greater sharing of new bio-materials and the recognition to community whose knowledge and resources are being used as raw material.

- At the time of granting patents, information of the source of the genetic material used, prior consent of the country of origin and method for benefit sharing should be made compulsory. The *sui-generis* clause [27(3)b] should be used to protect interests of the third world. Along with this documentation of the traditional knowledge systems and methods should be immediately taken up, as these evidences can prove to be of critical importance at the time of any dispute.

24.7 EXERCISES

1) What are the main issues pertaining to the patents of environmental resources? Discuss.

2) Examine the main areas of conflict between CBD and TRIPS.

3) How has India attempted to address the issues raised in CBD and TRIPS? Describe.

4) Write a note on the possible solution to the areas of conflict between CBD and TRIPS.

24.8 SUGGESTED READING

Bhagirath Lal Das, *The World Trade Organization*, Chennai, 1999.

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UNIT 25 ALTERNATIVES

Structure

25.0 INTRODUCTION

Development has generally been understood to mean an unfettered march of the material forces to ever escalating heights; always in search of newer areas of progress; and growth of a socio-economic system that is solely guided in its search of fresh pastures by corporeal considerations. Beginning with Industrial Revolution this view of development has dominated the discourse of progress and growth for the past two and a half centuries. In Unit 22 of this Block we have read about environmental concerns occupying a place within this dominant developmental paradigm. The present Unit aims at providing information on the alternative discourse/s to the aforesaid idea of development. We have selected two cases providing alternatives to 'development' and 'environmental conservation' respectively. The cases have been selected with a view to highlight concrete alternatives and feasible processes of developmental and conservational transitions in India.

25.1 DEVELOPMENT – GANDHIAN ALTERNATIVES

The development priorities of India and their viability began to be considered seriously as a realistic proposition in the foreseeable future by the leadership in national movement in the 1920s. As the prospects of independence became brighter the discussions on developmental model for independent India too became intense and elaborate. There were now two major protagonists – Gandhi and Nehru who supported two different models. While Gandhi was of the firm view that the road to development charted its path through the villages of India, Nehru was a strong votary of modern, industrial model of development. As the most suitable proposition for India, Gandhi believed, the path to progress and development passed through villages. The Gandhian model of development thus steered clear of the modernisation based on the heavy industry mode of development. At first perhaps the Gandhian model would look somewhat anachronistic, but a scrutiny of its underlying tenets would reveal an analytical, organised system at work that clearly provided a viable alternative to the modern industrial mode of development. In the following passages we discuss its genesis and the main propositions that defined it as an alternative.

The Gandhian model of development is, in its most compact form, discussed in *Hind Swaraj*, a text of seminal significance in so far as outlining the broad contours of Gandhian philosophy of civilization is concerned. *Hind Swaraj*, with its succinct remarks on the Western ideals of techno-modernism and its formulation of the constitutional determinants of *Swaraj* (Indian Home Rule – translated by Gandhiji himself), provides valuable theoretical and methodological insights into Gandhian thought and vision of Indian nation. It is here that one is enabled to look at many of the revealed and hidden concepts of Gandhian thought and action. *Hind Swaraj* also unfolds, among several other notions, Gandhi's precepts of 'true civilisation' and his delineation of the conduct for the polity of nation-India to model itself upon for attaining 'home-rule'. *Hind Swaraj* is not a narrative text, but a critical dialogue addressing problems of understanding and explanation. Unlike the documentary conception of a text, it is an imaginative reconstruction of lived experience which is suggestive of some of the most significant and subtle processes at work in the transformation of Indian society and polity under colonial dispensation.

It signals the need for an alternative approach to development steering past the self-enclosed cosmos of modernism. This approach is a combination of the theoretical framework of *Swaraj* and the practical tenets of a non-violent, self-contained village society. The organising mechanism of this village society within the coordinates of *Swaraj* unravels the principles of governance that can be legitimately termed as Gandhian ideals of development. Here we discuss some of the principal issues of development as recounted in *Hind Swaraj*. Simultaneously we also take recourse to the other Gandhian literature for empirical-analytic purposes. Anthony J. Parel writes: "Modern civilisation forms the broad historical context of *Hind Swaraj*. Its critique of that civilisation is one of its main contributions to modern political thought. In historical terms, it is Gandhi's apprehensions about certain tendencies in modern civilisation that made him the thinker and the political innovator that he is" ('Introduction' in *Hind Swaraj and other Writings*, first South Asian Edition, New Delhi, 1997, xvii).

The views on development as given in *Hind Swaraj* may be outlined briefly as follows. The priority in development work should be given to villages and village industries. Since villages were the sheet anchor of democracy in India, the work of development should begin from there. A different focus, namely on heavy industries and on speedy modernisation of Indian state was fraught with grave and adverse consequences. Since heavy industry was destined to alienate people from their immediate social contexts, a development based on them was more likely to benefit those who possessed wealth and resources ever most unlikely to either part with it or share it with the majority. Gandhi's disapproval of 'modern' and by consequence modern state is nicely explained by Parel thus: "The Reader believes that the adoption of the modern state is sufficient for achieving self-government. Gandhi disputes this. He believes that the modern state without swaraj as self-rule would only replace the British Raj with an Indian Raj. In *Hind Swaraj*'s striking phrase, such a rule would produce *Englistan* not Hindustan, 'English rule without the Englishman', 'the tiger's nature, but not the tiger' (ch.iv). The tiger is Gandhi's metaphor for the modern state: all tigers seek their prey, and it makes no difference whether the tiger is British or Indian. *Hind Swaraj* offers a greater challenge to the Indian elite aspiring to be the new rulers of India than its does to the old British elite actually ruling India. The point of this greater challenge is one of the lasting lessons of the book" (*Ibid*).

In his editorial in *Harijan* (dated 2.11.1934) Gandhi wrote: "I would categorically state my conviction that the mania for mass-production is responsible for the world crisis. Granting for the moment that machinery may supply all the needs of humanity, still, it would concentrate production in particular areas, so that you would have to go about in a roundabout way to regulate distribution; whereas, if there is production and distribution both in the respective areas where things are required, it is automatically regulated, and there is less chance for fraud, none for speculation.

"You see that these nations (Europe and America) are able to exploit the so-called weaker or unorganised races of the world. Once these races gain an elementary knowledge and decide that they are no more going to be exploited, they will simply be satisfied with what they can provide themselves. Mass-production, then at least where the vital necessities are concerned, will disappear.

"When production and consumption both become localised, the temptation to speed up production, in-definitely and at any price, disappears. All the endless difficulties and problems that our present-day economic system presents, too, would then come to an end".

In Parel's view, "The attitude that *Hind Swaraj* exhibits towards 'machinery' is controversial, to say the least. In the course of time, Gandhi moderated his stand. But even in *Hind Swaraj*, as a close study of the similes he uses for 'machinery' would suggest, his stand is not at all one-sided. True, similes such as 'Upas tree', 'snake-hole', 'whirlwind', 'drift-net' and 'craze' point to the harmful potential of modern technology. But these are not the decisive similes of the book: the decisive simile is 'curable disease'. 'Machinery' no doubt tends to produce cultural diseases; but such diseases need not be fatal, provided a competent doctor (Gandhi himself, presumably) can be found in good time" (*Ibid*).

The doctor in Gandhi was clearly conscious of the disease. As if by way of a prescription he wrote in the *Harijan* (dated 1.9.1946) "I do not believe that industrialization is necessary in any case for any country. It is much less so for India. Indeed, I believe that Independent India can only discharge her duty towards a groaning world by adopting a simple but ennobled life by developing her thousands of cottages and living at peace with the world. High thinking is inconsistent with complicated material life based on high speed imposed on us by Mammon worship. All the graces of life are possible only when we learn the art of living nobly.

“There may be sensation in living dangerously. We must draw the distinction between living in the face of danger and loving dangerously. A man who dares to live alone in a forest infested by wild beasts and wilder men without a gun and with God as his only Help, lives in the face of danger. A man who lives perpetually in mid-air and dives to the earth below to the admiration of a gaping world lives dangerously. One is purposeful, the other a purposeless life.

“Whether such plain living is possible for an isolated nation, however large geographically and numerically in the face of a world, armed to the teeth, and in the midst of pomp and circumstances, is a question open to the doubt of a sceptic. The answer is straight and simple. If plain life is worth living, then the attempt is worth making, even though only an individual or a group makes the effort.

“At the same time I believe that some key industries are necessary. I do not believe in armchair or armed socialism. I believe in action according to my belief, without waiting for wholesale conversion. Hence, without having to enumerate key industries, I would have State ownership, where a large number of people have to work together. The ownership of the products of their labour, whether skilled or unskilled, will vest in them through the State. But as I can conceive such a State only based on non-violence, I would not dispossess moneyed men by force but would invite their co-operation in the process of conversion to State ownership. There are no *pariahs* of society, whether they are millionaires or paupers. The two are sores of the same disease. And all are men ‘for a’ that’. And I avow this belief in the face of the inhumanities we have witnessed and may still have to witness in India as elsewhere. Let us live in the face of danger”. The alternative to techno-modern development could not be stated better.

HIND SWARAJ

OR

INDIAN HOME RULE

CHAPTER XIX

MACHINERY

Reader: When you speak of driving out Western civilisation, I suppose you will also say that we want no machinery.

Editor: By raising this question, you have opened the wound I have received. When I read Mr. Dutt’s Economic History of India, I wept; and as I think of it again my heart sickens. It is machinery that has impoverished India. It is difficult to measure the harm that Manchester has done to us. It is due to Manchester that Indian handicraft has all but disappeared.

But I make a mistake. How can Manchester be blamed? We wore Manchester cloth and this is why Manchester wove it. I was delighted when I read about the bravery of Bengal. There were no clothmills in that presidency. They were, therefore, able to restore the original hand-weaving occupation. It is true Bengal encourages the mill-industry of Bombay. If Bengal had proclaimed a boycott of *all* machine-made goods, it would have been much better.

Machinery has begun to desolate Europe. Ruination is now knocking at the English gates. Machinery is the chief symbol of modern civilisation; it represents a great sin.

The workers in the mills of Bombay have become slaves. The condition of the women working in the mills is shocking. When there were no mills, these women were not starving. If the machinery craze grows in our country, it will become an unhappy land. It may be considered a heresy, but I am bound to say that it were better for us to send money to Manchester and to use flimsy Manchester cloth than to multiply mills in India. By using Manchester cloth we only waste our money; but by reproducing Manchester in India, we shall keep our money at the prince of our blood, because our very moral being will be sapped, and I call in support of my statement the very mill-hands as witnesses. And those who have amassed wealth out of factories are not likely to be better than rich men. It would be folly to assume that an Indian Rockefeller would be better than the American Rockefeller. Impoverished India can become free, but it will be hard for any India made rich through immorality to regain its freedom. I fear we shall have to admit that moneyed men support British rule; their interest is bound up with its stability. Money renders a man helpless. The other thing which is equally harmful is sexual vice. Both are poison. A snake-bite is a lesser poison than these two, because the former merely destroys the body but the latter destroy body, mind and soul. We need not, therefore, be pleased with the prospect of the growth of the mill-industry.

Reader: Are the mills, then, to be closed down?

Editor: That is difficult. It is no easy task to do away with a thing that is established. We, therefore, say that the non-beginning of a thing is supreme wisdom. We cannot condemn mill-owners; we can but pity them. It would be too much to expect them to give up their mills, but we may implore them not to increase them. If they would be good they would gradually contract their business. They can establish in thousands of households the ancient and sacred handlooms and they can buy out the cloth that may be thus woven. Whether the mill-owners do this or not, people can cease to use machine-made goods.

Reader: You have so far spoken about machine-made cloth, but there are innumerable machine-made things. We have either to import them or to introduce machinery into our country.

Editor: Indeed, our gods even are made in Germany. What need, then, to speak of matches, pins and glassware? My answer can be only one. What did India do before these articles were introduced? Precisely the same should be done today. As long as we cannot make pins without machinery so long will we do without them. The tinsel splendour of glass-ware we will have nothing to do with, and we will make wicks, as of old, with home-grown cotton and use handmade earthen saucers for lamps. So doing, we shall save our eyes and money and support Swadeshi and so shall we attain Home Rule.

It is not to be conceived that all men will do all these things at one time or that some men will give up all machine-made things at once. But, if the thought is sound, we shall always find out what we can give up and gradually cease to use it. What a few may do, others will copy; and the movement will grow like the cocoanut of the mathematical turn. The matter is neither complicated nor difficult. You and I need not wait until we can carry others with us. Those will be the losers who will not do it, and those who will not do it, although they appreciate the truth, will deserve to be called cowards.

Reader: What, then, of the tram-cars and electricity?

Editor: This question is now too late. It signifies nothing. If we are to do without the railways we shall have to do without the tram-cars. Machinery is like a snake-hole which may contain from one to a hundred snakes. Where there is machinery there are large cities; and where there are large cities, there are tram-cars and railways; and there only does one see electric light. English villages do not boast of any of these things. Honest physicians will tell you that where means of artificial locomotion have increased, the health of the people has suffered. I remember that when in a European town there was a scarcity of money, the receipts of the tramway company, of the lawyers and of the doctors went down and people were less unhealthy. I cannot recall a single good point in connection with machinery. Books can be written to demonstrate its evils.

Reader: Is it a good point or a bad one that all you are saying will be printed through machinery?

Editor: This is one of those instances which demonstrate that sometimes poison is used to kill poison. This, then, will not be a good point regarding machinery. As it expires, the machinery, as it were, says to us: “Beware and avoid me. You will derive no benefits from me and the benefit that may accrue from printing will avail only those who are infected with the machinery-craze.”

Do not, therefore, forget the main thing. It is necessary to realize that machinery is bad. We shall then be able gradually to do away with it. Nature has not provided any way whereby we may reach a desired goal all of a sudden. If, instead of welcoming machinery as a boon, we should look upon it as an evil, it would ultimately go.

25.2 ENVIRONMENTAL CONSERVATION – CHIPKO MOVEMENT

The conservation practices in India have traditionally been offering alternatives to the modern methods of conservation. These alternatives have also come as a result of misdirected priorities of modern methods and sometimes by way of a protest at the inherent mechanisms of exploitation in 'modern' practices. The famous Khejri tree protection movement in Rajasthan about which we have given you information in Unit 16, Block 5 was a movement of the same category. A parallel, if not identical, movement in the same genre has been the Chipko Movement.

The Chipko Movement is often associated with the people of Uttarakhand's struggle launched in 1970s for the protection of the forests of the region. (Uttarakhand was then a part of the state of Uttar Pradesh). The roots of this movement may, however, be traced to an earlier period and may be related to the pernicious provisions in the Forest Acts of the British restricting the hill community from commonly using the forest resources for various daily purposes. The importance of these resources to the people of the hills of Uttarakhand (Kumaon and Garhwal regions of the Himalaya) has been aptly described thus: "Forest resources are the critical ecological elements in the vulnerable Himalayan ecosystem. The natural broad-leaved and mixed forests have been central in maintaining water and soil stability under conditions of heavy seasonal rainfall. They have also provided the most significant input for sustainable agriculture and animal husbandry in the hills. Undoubtedly, forests provide the material basis for the whole agri-pastoral economy of the hill villages. Green leaves and grass satisfy the fodder requirement of the farm animals whose dung provides the only source of nutrients for food crops. Dry twigs and branches are likewise, the only source of domestic cooking fuel. Agricultural implements and house frames require forest timber. Forests also provide large amounts of fruit, edible nuts, fibres and herbs for local consumption" (Vandana Shiva, Jayanto Bandhyopadhyay, *CHIPKO, India's Civilisational Response to the Forest Crisis*, INTACH, New Delhi, 1986, p.6).

The gensis of the Chipko Movement may be traced to the changes effected in the management and use of forest resources in the Garhwal region by the English settlers and by the rulers of the hill kingdom. The main stages in which the new measures were implemented were as below:

- In 1850 the forests of the Garhwal region (mainly Tehri Garhwal) were taken by the Britishers on a nominal annual rent;
- In 1864 the British took the forests of the region on a lease of 20 years;
- In 1895 the forests were brought under the control of the local kingdom, the Tehri Garhwal rulers.

All the above were aimed at restricting the villagers from using the forests – restrictions even on their livelihood earnings from the forests and on their sustenance on the forest resources. The early signs of people's protest against these measures had become evident towards the close of the nineteenth century. At the beginning of the twentieth century the protests had assumed the form of loosely organised resistance. As reported by Sunderlal Bahuguna, the protest of hill people against the forest policy of the rulers of Tehri Garhwal assumed an organised form in 1907 when Kirti Shah, the ruler of Tehri Garhwal, had to intervene personally to quell the people's anger (cf. 'Bagi Tehri Ki Ek Jhanki' in Bhaktdarshan ed. *Suman Smriti Granth*, Silyara, 1976). However "the contradictions between the people's basic needs and the State's revenue requirements remained unresolved" and, as described by Vandana Shiva and Jayanto Bandhyopadhyay, "in due course, became sharper. In 1930 the people of Garhwal began the non-cooperation movement, mainly around the issue of forest resources. Satyagraha to resist the new oppressive forest laws was most intense in the Rewain region. A massive protest meeting was organised at Tilari. The King of Tehri was in Europe at that time; in his advance, Dewan Chakradhar Jayal crushed the peaceful satyagraha with armed force. A large number of unarmed satyagrahis were killed and wounded, while many others lost their lives in a desperate attempt to cross the rapids of the Yamuna. While the right of access to forest resources remained a burning issue in the Garhwal Kingdom, the anti-imperialist freedom movement in India invigorated the Garhwali people's movement for democracy. The Saklana, Badiyargarh, Karakot, Kirtinagar and other regions revolted against the King's rule in 1947 and declared themselves independent panchayats. Finally on August 1, 1949, the Kingdom of Tehri was liberated from feudal rule and became an integral part of the Union of India and the State of Uttar Pradesh" (*CHIPKO, op.cit*, p.7).

The Chipko Movement of the post-independence period in India thus had a rich legacy of similar forest movements in the region of Garhwal in Himalaya. The immediate event that sparked the Chipko Movement was the stopping of forest felling by a group of peasants in a remote Himalaya village in Gopeshwar. The date generally ascribed to this little incident is 27 March, 1973. The other relevant details of this incident are noted below:

- State forest department, the owner of the area where the incident took place, had auctioned the trees on that area to a sports goods manufacturing concern of Allahabad;

- The peasants of the Mandal village actually embraced the trees physically to prevent their felling. This embrace – Chipko symbolised the union of man with nature. The nature would be defiled only after bringing death to humans who had embraced the trees;

- The term *Chipko* was derived from a poem composed by a folk-poet of the region, Ghan Shyam Taturi. In translation it reads:

Embrace the trees
Save them from being felled;
The property of our hills,
Save them from being looted.

Soon after the successful thwarting of the tree felling in Gopeshwar Sarvodaya Mandal forest, the movement gathered steam. Under the leadership of Sunderlal Bahnguna, who had left his job in a transport company (of that of a booking clerk), a march was organised in the district of Chamoli (the village Gopeshwar was located in the jurisdiction of this district). The movement quickly spread to Uttarkashi and then in the rest of the hilly region.

The Ecological Foundation of Chipko

Both the earlier forest satyagrahas and their contemporary form, the Chipko Movement, have arisen from conflicts over forest resources, and are similar cultural response to forest destruction. What differentiates Chipko from the earlier struggle is its ecological basis. The new concern to save and protect forests through Chipko satyagraha did not arise from a resentment against further encroachment on the people's access to forest resources. It arose from the alarming signals of rapid ecological destabilisation in the hills. Villages that were self-sufficient in food has to resort to food imports as a result of declining food productivity. This in turn was related to the reduction of soil fertility in the forests. Water resources began to dry up as the forests disappeared. The so-called "natural disasters", such as floods and landslides, began to occur in river systems which had hitherto been stable. The Alakananda disaster of July 1970 inundated 1,000 sq.km. of land in the hills and washed away many bridges and roads. In 1977 the Tawaghat tragedy took an even heavier toll. In 1978 the Bhagirathi blockade resulting from a big landslide above Uttarkashi caused massive flood across the entire valley.

The over-exploitation of forest resources and the resulting threat to communities living in the forests have evolved from concerns for distribution of material benefits to concerns for distribution of ecologically-generated material costs. At the first stage, the growth of commercial interests resulted in efforts to exclude competing demands. The beginning of large scale commercial exploitation of India's forest resources created the need for a forest legislation which denied village communities access to forest resources. The forest satyagrahas of the 1930s were a result of the Forest Act of 1927 which denied the people access to biomass for survival while increasing biomass production for industrial and commercial growth. The growth imperative, however, drove production for commercial purposes into the second stage of conflict which is at the ecological level. Scientific and technical knowledge of forestry generated in the existing model of forest management is limited to viewing forests only as sources of commercial timber. This gives rise to prescriptions for forest management which are manipulations to maximise immediate growth of commercial wood. This is achieved initially by the destruction of other biomass forms that have lower commercial value but may be very important to the people, or have great ecological significance. The silvicultural system of modern forestry embraces prescriptions for destruction of non-commercial biomass forms to ensure the increased production of commercial biomass forms. The encouragement given to replacement of ecological valuable oak forests by commercially valuable conifers is an indicator of this shift. Ultimately, this increase in production may be described as mining of the ecological capital of the forest ecosystem which have evolved over thousands of years.

The contemporary Chipko Movement, which has become a national campaign, is the result of these multidimensional conflicts over forest resources at the scientific, technical, economic, and especially the ecological levels. It is not a limited conflict over the local or non-local distribution of forest resources, such as timber and resin. The Chipko demand at one stage was for a bigger share for the local people in the immediate commercial benefits of an ecologically destructive pattern of forest resource exploitation. It has now evolved to the demand for ecological rehabilitation. Since the Chipko Movement is based upon a perception of forests in their ecological context, it exposes the social and ecological costs of short term growth-oriented forest management. This is clearly seen in the slogan of the Chipko Movement which claims that the main products of the forests are not timber or resin, but soil, water and oxygen. With appropriate social control, the basic biomass needs of food, fuel, fodder, small timber and fertilizer can, in the Chipko vision and the Garhwal practice, be satisfied as positive externalities of biomass production, aimed primarily at soil and water conservation to stablise the local agri-pastoral economy.

The Chipko Movement has been successful in forcing a ban on commercial green felling in the hills of Uttar Pradesh at altitudes above 1000 metres, in stopping clear-felling in the Western ghats and the Vindhyas, and in generating pressure for a national forest policy which is more sensitive to the people’s needs and to the ecological development of the country. Unfortunately, the Chipko Movement has often been naively presented by vested interests as a reflection of a conflict between “development” and “ecological concern”, implying that “development” relates to the material and objective bases of life while “ecology” is concerned with non-material and subjective factors such as scenic beauty. The deliberate introduction of this false and dangerous dichotomy between “development” and “ecology” disguises the real dichotomy between ecologically sound development and unsustainable and ecologically destructive economic growth. The latter is always achieved through destruction of life-support systems and material deprivation of marginal communities. Genuine development can only be based on ecological stability which ensures sustainable supplies of vital resources. Gandhi and later his disciples, Mira Behn and Sarala Behn, clearly described how and why development is not necessarily contradictory to ecological stability. Conflict between exploitative economic growth and ecological movements like Chipko are never an obstacle to the process of development. On the contrary, by constantly keeping ecological stability in focus, they provide the best guarantee for ensuring a stable material basis for life for all.

(Vandana Shiva, Jayanto Bandhyopadhyay, *CHIPKO, India's Civilisational Response to the Forest Crisis*, INTACH, New Delhi, 1986).

"Chipko was representative of a wide spectrum of natural-resource conflicts", as described by Ramchandra Guha, "that erupted in different parts of India in the 1970s and 1980s: conflicts over access to forests, fish and grazing resources; conflicts over the effects of industrial pollution and mining; and conflicts over the siting of large dams. One can understand each of these conflicts sequentially, as an unfolding of the processes of *Degradation – Shortages – Protest – Controversy (local)– Controversy (national)*. Applying this scheme to Chipko, for instance, we note that deforestation in the hills led on the one hand to shortages of fuel, fodder and small timber for local communities and on the other to shortages of raw material for wood-based industry (with Himalayan timber being especially prized as the only source of softwood in India). When the state inclined markedly in favor of one party to the conflict, namely industry, the other party, i.e. peasants, responded through collective action. Picked up by a press that is amongst the most voluble in the world, the protests then gave shape to a debate on how best the Himalayan forests should be managed – by communities, the state, or private capital; on what species should be planted and protected – conifers, broad-leaved, or exotics; and on what should constitute the forest's primary product– wood for industry, biomass for villagers, or soil, water and clean air for the community at large. Finally, this region-specific debate led in turn to a national debate on the direction of forest policy in the country as a whole" (*Environmentalism: A Global History*, New Delhi, 2000, p.166).

The great significance of Chipko Movement lies in its being an alternative, people's initiative. The devastation heaped on the community of hill region by the development agencies alien to the region engendered in the people a sense of indignation the outward manifestation of which was a form of *satyagraha* quite akin to the Gandhian mode of non-violent resistance. As stated by Vandana Shiva and Jayanto Bandhyopadhyay "The Chipko Movement is historically, philosophically and organizationally, an extension of traditional Gandhian satyagrahas. Its special significance is that it is taking place in post-Independence India" (*CHIPKO*, *op.cit*., pp.7-8).

25.3 SUMMARY

We have noted the Gandhian model of development and Chipko Movement as two illustrative cases providing alternatives to the so-called mainstream course of development, progress and conservation practices. The alternative from Gandhi was described by him at length in *Hind Swaraj*. It was mainly concerned with the underlying reality of an otherwise dazzling array of triumphs heralded by the machine age. The reality was that industrial model of development had resulted in a lopsided concentration of wealth, in the hands of a few and depriving a large multitude that actually would need it. Gandhi's emphasis on villages as the nodal points of development was in stark contrast to the town-centric industrialis`ation of the modern paradigm of development. Likewise Chipko Movement was also seen as an extension of Gandhian mode of struggle against the unjust and oppressive regimes that were in reality exploitative in character though outwardly professed commitment to environmental conservation. Chipko Movement's success was in fact the triumph of the people oriented initiatives that provided viable alternatives to the modern development practices.

25.4 EXERCISES

1) Discuss the characteristics of Gandhi's non-industrial model of development.
2) Describe the genesis and character of Chipko Movement.
3) Write notes on the following:
   i) *Hind Swaraj's* critique of machinery.
   ii) *Chipko* and its ecological foundation.

25.5 SUGGESTED READING

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